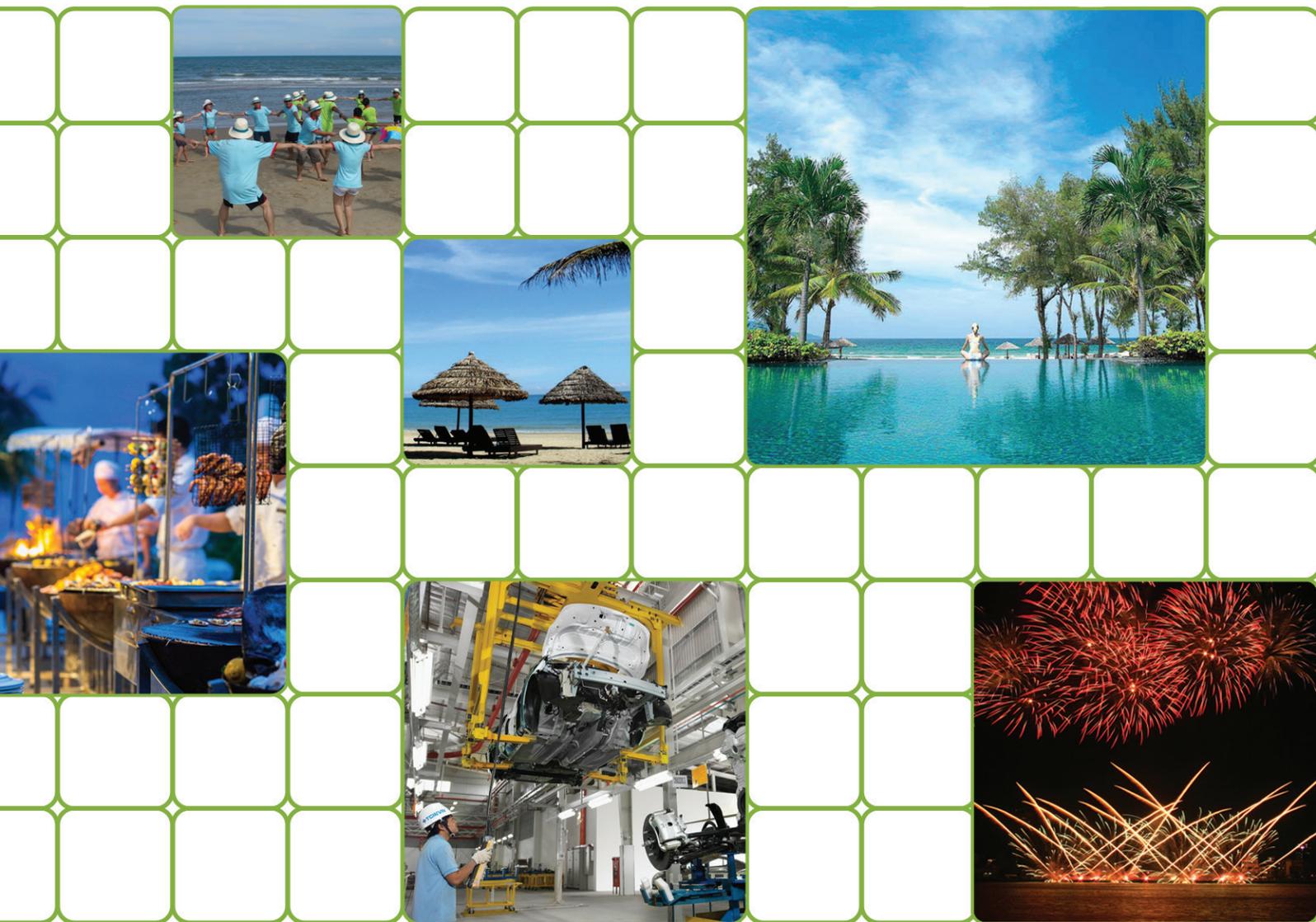


# Green Growth City Development Strategy for Da Nang



## DISCLAIMER

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or regarding its economic system or degree of development. The analysis, conclusions, recommendations and views expressed in this publication do not necessarily reflect those of the United Nations Human Settlements Programme, the United Nations, or its Member States. Information contained in this publication is provided without warranty of any kind, either express or implied, including, without limitation, warranties of merchantability, fitness for particular purpose and non-infringement.

UN-Habitat specifically does not make any warranties or representations as to the accuracy or completeness of any such data. Under no circumstances shall UN-Habitat be liable for any loss, damage, liability or expense incurred or suffered that is claimed to have resulted from the use of this publication, including, without limitation, any fault, error, omission with respect thereto. The use of this publication is at the user's sole risk. Under no circumstances, including, but not limited to negligence, shall UN-Habitat or its affiliates be liable for any direct, indirect, incidental, special or consequential damages, even if UN-Habitat has been advised of the possibility of such damages. Excerpts may be reproduced without authorization, on condition that the source is indicated.

# Green Growth City Development Strategy for Da Nang

## ACKNOWLEDGEMENT

### DA NANG GREEN GROWTH CITY DEVELOPMENT STRATEGY CORE TEAM

Supervisor: Nguyen Quang, Jooseub Lee, Ho Ky Minh

Team Leader: Juhyun Lee, Juhye Kwak

Task Manager: Do Minh Huyen, Vo Ho Bao Hanh, Bui Thu Hien

Principal Authors: Juhyun Lee and Sohyun Park

Consultant Team: Task Force members of Da Nang Institute of Socio-Economic Development and Ambika Chawla

Publication Coordinator: Nguy Huong Ha

Layout and Editorial Works: Narae Lee

English Editing and Proof Reading: Ambika Chawla

### CONTRIBUTOR

Da Nang Institute of Socio-Economic Development for facilitating whole process of GG-CDS preparation, training, technical meeting, training, and consultations;

Departments of Da Nang City, Da Nang High tech park management board and Peoples' Committees of districts for consolidating data, conducting assessment, being interviewed, and providing technical comments;

International Urban Training Center and Suwon City Government for preparing and conducting "A training for Green Growth City Development Strategy";

Prof. Jeonghee Lee and Prof. Inkwon Park of University of Seoul, for valuable comments and technical advice through the whole process of developing GG-CDS;

Korea Energy Management Corporation, Korea Environment Corporation, Korea Transport Institute, Korea Industrial Complex Corporation, Korea Rural Economic Institute, and G&S innovation for contribution to technical consultation and advice on development of key green growth strategic initiatives;

Prof. Donyun Kim of Sungkyunkwan University for developing an in-depth consultation paper on the conceptual master plan for Da Nang High Tech Park;

Dr. Krishna Shrestha of University of New South Wales, Dr. Bernard Rowan of University of Chicago, Dr. Van Long Hoang, Mr. Manh Trinh Chu of Da Nang University, and Tadashi Matsumoto of the OECD for his valuable comments on the draft Da Nang GG-CDS;

Ashley Hollenbeck for developing a session of integrated water resource management in collaboration with local stakeholders;

Boram Kim for supporting developing a session on social development and green growth;

UN-Habitat and GGGI acknowledge the contribution of all conductors and participants of training and consultative workshops under the framework of project, and also those who were interviewed by the international and national experts

### FINANCIAL SUPPORT

GGGI (Global Green Growth Institute)

### LOGISTICAL SUPPORT

UN-Habitat Office in Vietnam

## TABLE OF CONTENTS

<b>DISCLAIMER</b> .....	i
<b>ACKNOWLEDGEMENT</b> .....	iii
<b>LIST OF FIGURES</b> .....	vi
<b>LIST OF TABLES</b> .....	viii
<b>LIST OF BOXES</b> .....	viii
<b>ACRONYMS</b> .....	ix
<b>I. INTRODUCTION TO DA NANG GREEN GROWTH CITY DEVELOPMENT STRATEGY</b>	
1. BACKGROUND AND PRIMARY OBJECTIVES.....	2
2. APPROACHES AND PROCESSES .....	4
3. RELATION TO OTHER PLANS .....	7
<b>II. DA NANG CITY DEVELOPMENT AND GREEN GROWTH</b>	
1. DA NANG AND OVERALL DEVELOPMENT ISSUES .....	10
1.1 Context for Development of Da Nang .....	10
1.2 Key Challenges and Opportunities for Da Nang Development .....	11
2. GREEN GROWTH OPPORTUNITIES AND GAP ANALYSIS OF DA NANG .....	15
2.1 Sustainable Urban Service and Infrastructure .....	15
2.1.1 Material Management .....	16
2.1.2 Access & Mobility Management .....	22
2.1.3 Green Space and Construction .....	29
2.1.4 Green Industrial Development and Management .....	35
2.2 Natural Resource Based Development and Management .....	39
2.2.1 Agriculture and Rural Development .....	39
2.2.2 Integrated Water Resource Management .....	43
2.2.3 Eco-system based Tourism Development .....	47
2.3 Social Development and Green Growth .....	50
2.3.1 Health and Labor for green growth .....	50
2.3.2 Livelihood Resilience to Natural Disaster and Climate Change .....	54
2.3.3 Governance for Inclusive Growth .....	55
3. GREEN GROWTH SWOT ANALYSIS OF DA NANG .....	58

### III. GREEN GROWTH STRATEGIC INITIATIVES OF DA NANG

1. OVERVIEW .....	64
2. KEY STRATEGIC INITIATIVES AND PROGRAMS .....	66
2.1 Strategic Initiative 1: Sustainable Material Management for Local Economic Development .....	66
2.2 Strategic Initiative 2: Green and Public Transportation for Sustainable City .....	80
2.3 Strategic Initiative 3: Green Industrialization Master Plan and Eco Industrial Development .....	88
2.4 Strategic Initiative 4: Integrated Water Resource Management (IWRM) for Green Growth .....	107
2.5 Strategic Initiative 5: Green Agricultural Village linked with Green Production and Ecotourism .....	112
<b>CONCLUSION</b> .....	119
<b>END NOTES</b> .....	120
<b>APPENDIXES (Part 2)</b>	
1. Green Growth for Sustainable Urbanization of Vietnam - Key issues and innovative approaches .....	3
2. Green Growth indicators examples and indicators Da Nang .....	30
3. Indicators for Da Nang Green Growth Opportunity .....	38
4. Report on the Survey Results for Da Nang Green Growth City Development Strategy (GG-CDS) .....	41
5. Danang City Development Strategy policy discussion paper .....	65
6. Best practices from other cities/countries and Pilot projects ideas .....	117
7. PROPOSAL of Building scientific framework for the Vu Gia - Thu Bon River Basin Coordination Organization (RBCO) establishment .....	128
8. Da Nang High -Tech Park (DHTP) Consulting Report .....	142
9. Reference for calculating potential Economic Benefits of Strategic Initiatives .....	163

## LIST OF FIGURES

Figure 1. CDS strategic approaches to strength SEDP, Master plan and Eco-city plan	3
Figure 2. Green Growth Criteria of Da Nang GG-CDS	4
Figure 3. Analytical structure of Green Growth Orientation for Da Nang Development	5
Figure 4. Map of Vietnam	10
Figure 5. GDP comparison between Da Nang and overall Vietnam (unit: USD): 1997 - 2011 (left)	11
Figure 6. Economy structures of Da Nang: 2000 - 2011 (right)	11
Figure 7. Urban spatial development planning for Da Nang by 2030	14
Figure 8. Green Growth Performance Areas and Da Nang City	15
Figure 9. Green Growth Opportunities for Resource and Solid Waste Management in Da Nang City	16
Figure 10. Collected solid waste in Da Nang City	17
Figure 11. Waste composition in Da Nang City (2011)	17
Figure 12. A concept of economic incentive systems based on waste management hierarchy	21
Figure 13. Green Growth Opportunities of Access and Mobility Management in Da Nang City	22
Figure 14. Transport network in Da Nang City	23
Figure 15. Potential BRT corridors in Da Nang City	25
Figure 16. Creation of market value for public transportation in Da Nang City	25
Figure 17. Integration effects of public transportation and land use planning	26
Figure 18. Traffic accidents in Da Nang City	26
Figure 19. Green Growth Opportunities of Green Space and Construction in Da Nang City	29
Figure 20. Densification opportunities for Da Nang (referring to Cape Town)	31
Figure 21. Patches and corridors of Habitat Cores for Da Nang City	34
Figure 22. Green Growth Opportunities of Green Industrial Development & Management in Da Nang City	35
Figure 23. Industrial parks in Da Nang City	37
Figure 24. Green Growth Opportunities of Agriculture and Rural Development in Da Nang City	39
Figure 25. Forest coverage rate in Da Nang City	41
Figure 26. The Quang Hue Cross Connection: Da Nang City's Water Intake System	42
Figure 27. Green Growth Opportunities for Integrated Water Resource Management in Da Nang City	43
Figure 28. Quang Nam Province Hydropower System & DakMi4 Inter-Basin Diversion Project	45
Figure 29. Green Growth Opportunities of Eco-system Based Tourism Development in Da Nang	47
Figure 30. Green Growth Opportunities of Health and Labor in Da Nang City	51
Figure 31. Comparison between conventional centralized infrastructure facilities for wastewater and solid waste	53
Figure 32. Semi-centralized supply and treatment center at district and neighborhood level that combines infrastructural functions and generates multiple useful services	53
Figure 33. Green Growth Opportunities of Governance for Inclusive Growth in Da Nang City	56
Figure 34. Overview of strategic initiatives of Green Growth Orientation for Da Nang Development	64
Figure 35. Waste solution though IRRC mechanism	68
Figure 36. Main principles and expected outcomes of IRRC	69
Figure 37. Indication system for separation of recyclables: example of Korea	70
Figure 38. Financing component and financial flows in the IRRC program for Da Nang City	72
Figure 39. Role design for promoting the IRRC system in Da Nang City	73
Figure 40. Concept: Biomass to Electricity	75
Figure 41. Financing component and financial flows in the Biomass Power Plant program for Da Nang City	77

Figure 42. Role design for promoting the Biomass Power Plant in Da Nang City	78
Figure 43. Methods of densification in integrated land use and transport planning	82
Figure 44. Sustainable transportation system: main principles and expected outcomes	83
Figure 45. Investments in road infrastructure for non-motorized transport	84
Figure 46. Role design for promoting the sustainable transportation system in Da Nang City	86
Figure 47. Industrial Energy Audit: main principles and expected outcomes	90
Figure 48. Operation mode and contract arrangement for shared savings in utilizing ESCO system	92
Figure 49. Role design for promoting Industrial Energy Audit in Da Nang City	93
Figure 50. Comparison between existing industrial complex and EIP	95
Figure 51. Relevant activities for transformation process of the existing industrial complex to an Eco Industrial Park (EIP)	95
Figure 52. Resource recovery in an Eco Industrial Park (EIP)	96
Figure 53. Eco Industrial Park (EIP): main principles and expected outcome	97
Figure 54. Financing component and financial flows in the Eco Industrial Park (EIP) program for Da Nang	98
Figure 55. Role design for promoting the Eco Industrial Park (EIP) in Da Nang City	99
Figure 56. Digital Media City (DMC) case of Seoul (1)	102
Figure 57. Digital Media City (DMC) case of Seoul (2)	103
Figure 58. Example of the application of land use principles	103
Figure 59. Role design for promoting DHTP (Da Nang High-Tech Park)	105
Figure 60. Multilateral governance structure for IWRM	108
Figure 61. Proposed organizational structure for VGTB Research Center	109
Figure 62. Comparison between CSA system and retail farms	111
Figure 63. Green Village Development role design and collaboration mechanism	114
Figure 64. Financial flows of Green Village Development in Da Nang City	115
Figure 65. Inclusiveness of various sources and mechanisms of financing for smallholders	116

## LIST OF TABLES

Table 1.	Key Multi-Sectoral Issues and Questions for Da Nang City to become a competitive & livable city	12
Table 2.	Operation of the Bus System in Da Nang City	24
Table 3.	Key Projects for the Development of Trees and Parks	33
Table 4.	Current and Projected Water Use in Da Nang City	43
Table 5.	Number of tourists to Da Nang during the fireworks festival (DIFC)	48
Table 6.	Total budget for developing tourism in the period 2011 - 2015 (unit: million VND)	49
Table 7.	Summary of SWOT	61
Table 8.	Comparison between urban infrastructure and science city infrastructure	104

## LIST OF BOXES

Box 1.	International examples of innovative solid waste management initiatives	19
Box 2.	Zero Waste Alliance: Public-Private Partnerships for Zero Waste	19
Box 3.	Public-Private Partnership (PPP)	28
Box 4.	Vietnam Green Building Council	32
Box 5.	Viewpoints of the Green Growth Orientation of Da Nang City	65
Box 6.	Best Practices (Korea and Sri Lanka) related to IRRC	74
Box 7.	Site Requirements for Biomass Power Plants	76
Box 8.	Best Practice: The Biomass Plants of Güssing, Austria	79
Box 9.	Best Practice: Innovative land use planning integrated with transportation planning in Curitiba, Brazil	87
Box 10.	Best Practice: Industrial Energy Audit Program in Korea	94
Box 11.	Best Practices: Kalundborg City (Denmark) and Ulsan City (Korea)	100
Box 12.	Best Practices	106
Box 13.	Community Supported Agriculture (CSA)	111
Box 14.	Innovative financing for green agricultural development	116

## ACRONYMS

<b>BOT</b>	Build Operate Transfer
<b>BRT</b>	Bus Rapid Transit
<b>CBO</b>	Community Based Organization
<b>CIF</b>	Climate Investment Fund
<b>CSA</b>	Community Supported Agriculture
<b>CTF</b>	Clean Technology Fund
<b>DARD</b>	Department of Agriculture and Rural Development
<b>DISED</b>	Da Nang Institute of Socio-Economic Development
<b>DOC</b>	Department of Construction
<b>DOIT</b>	Department of Industry and Trade
<b>DONRE</b>	Department of Natural Resources and Environment
<b>DOCST</b>	Department of Culture, Sports and Tourism
<b>DOLISA</b>	Department of Labor, Invalids and Social Affair
<b>DOST</b>	Department of Science and Technology
<b>DOT</b>	Department of Transportation
<b>EA</b>	Energy Auditing
<b>EE</b>	Energy Efficiency
<b>EIA</b>	Environmental Impact Assessment
<b>EIP</b>	Eco Industrial Park
<b>EMO</b>	Energy Management Opportunities
<b>ESCO</b>	Energy Service Company
<b>GGGI</b>	Global Green Growth Institute
<b>HTP</b>	High-tech Park
<b>ICZM</b>	Integrated Coastal Zone Management
<b>IPC</b>	Investment Promotion Center
<b>IRRC</b>	Integrated Resource Recovery Center
<b>NGO</b>	Non Governmental Organization
<b>NWRC</b>	National Water Resource Council
<b>ODA</b>	Official Development Assistance
<b>PAPI</b>	Public Administration Performance Index
<b>PC</b>	People's Committee
<b>PPP</b>	Public-Private Partnership
<b>RBCO</b>	River Basin Coordinating Organization
<b>SEA</b>	Strategic Environmental Assessment
<b>SEDP</b>	Socio-Economic Development Plan
<b>SME</b>	Small and Medium Enterprises
<b>SWM</b>	Solid Waste Management
<b>SUDEEP</b>	Sustainable Urban Energy and Emission Planning
<b>UNEP</b>	United Nation Environmental Program
<b>UNESCAP</b>	United Nation Economic Social Commission for Asia and the Pacific
<b>URENCO</b>	Urban Environment Company
<b>VGGS</b>	Vietnam Green Growth Strategy
<b>VietGAP</b>	Vietnam Good Agricultural Practice



Overview of Da Nang © Vuong Kha Vinh

# INTRODUCTION TO DA NANG GREEN GROWTH CITY DEVELOPMENT STRATEGY



CHAPTER **1**

# 1.

## BACKGROUND AND PRIMARY OBJECTIVES

*Da Nang City aims to become an important domestic and international transportation and transit hub, as well as a telecommunications, post, and banking hub.*

Da Nang City, a major harbor city and the largest urban center in central Vietnam, has played an important, strategic role in the socio-economic development of the region and Vietnam. The orientation of the Socio-Economic Development Plan (SEDP) of Da Nang City towards 2025 is for the city to become a major socio-economic center in central Vietnam. Da Nang City aims to become an important domestic and international transportation and transit hub, as well as a telecommunications, post, and banking hub. In addition, the city aims to become a national center for culture, sports, education, science and technology. In order to achieve targeted economic restructuring as required under the SEDP, the city of Da Nang also needs to improve low-value added industrial development while strengthening its services sector. The expectation is that due to its strategic location, Da Nang City will become a driving force for economic development in central Vietnam.

The urbanization, industrialization and modernization of Da Nang have brought the city considerable achievements in terms of economic development.

However, environmental degradation and the depletion of natural resources have accompanied Da Nang's rapid economic development. In order to balance the city's need for economic growth with its goals to protect the natural environment, Da Nang City has developed an Environmental City Plan.

For sustainable urban development to take place in Da Nang, the city needs to develop an integrated approach to replace current sectoral plans and programs. More importantly, Da Nang needs to strengthen leadership among local government leaders in order to institutionalize the city's strategic initiatives and to improve collaboration with the private sector. In particular, an innovative financing mechanism, known as Multi Sectoral Investment Planning, is needed to make practical contributions towards environmentally sustainable urban development in Da Nang City.

Recently, major cities in Vietnam are required to localize the initiatives of Vietnam's national Green Growth Strategy (VGGS) (decision 1393/QĐ-TTĐ). The Vietnam Green Growth Strategy aims to ensure fast, efficient and sustainable economic growth in Vietnam while making significant contributions towards implementing the country's national climate change strategy. The VGGS is expected to contribute to increasing investments in conservation, development, and the efficient use of natural capital, while stimulating economic growth and job creation in Vietnam (overall principles and concepts of Green Growth and details of the VGGS can be found in Appendix 1). Recognizing green growth as a tool to restructure and green local economies, Da Nang City recently decided to adopt key green growth principles and approaches to be integrated in the city's urban planning frameworks. In particular, Da Nang City leaders identified the need to focus on high-tech driven economic growth, the efficient use of natural resources, social equity, cleaner industrialization, the sustainable use of natural resources, and the strengthening of urban-rural linkages.

With the aim to develop a strategic planning framework for mainstreaming green growth into Da Nang City's overall urban development plan, UN-Habitat and the Global Green Growth Institute (GGGI) have been requested to develop a Green Growth City Development Strategy (GG-CDS) in cooperation with the city government of Da Nang. Already, UN-Habitat has been working extensively on developing strategies for green growth and climate resilient cities in collaboration with local governments such as the Da Nang City People's Committee and the Ho Chi Minh City People's Committee. The Global Green Growth Institute (GGGI), has been dedicated to pioneering and diffusing a new model of economic growth in Vietnam. This innovative model of economic growth aims for poverty reduction, job creation, social inclusion, environmental sustainability,

while building resilience to climate change in Vietnam.

In 2012 to early 2013, GGGI and UN-Habitat coordinated a series of Green Growth City Development Strategy leadership and technical training workshops<sup>1</sup> before developing the GG-CDS to increase ownership of the development of the CDS by Da Nang’s diverse urban community. The GG-CDS aims to strengthen urban management in the city and institutional frameworks which deal with infrastructure, the services sector, and natural resource management. The GG-CDS is primarily aimed at identifying integrated green growth opportunities and gaps with green growth criteria aligned with key

programs under the SEDP and the eco-city development plan. More importantly, prioritized strategic initiatives and pilot project ideas were identified, as well as potential mechanisms to mobilize necessary resources were discussed with relevant multi-sectoral partners. The ultimate goal is that Da Nang City will be recognized as the first city in Vietnam to mainstream green growth principles and approaches into its overall development orientation. Internationally, Da Nang City will be rebranded as a vibrant, green growth urban center in the Asia-Pacific region characterized by high-tech industries, a healthy economic growth rate, and a high quality of life for its city residents.

**Figure 1.** CDS strategic approaches to strength SEDP, Master plan and Eco-city plan

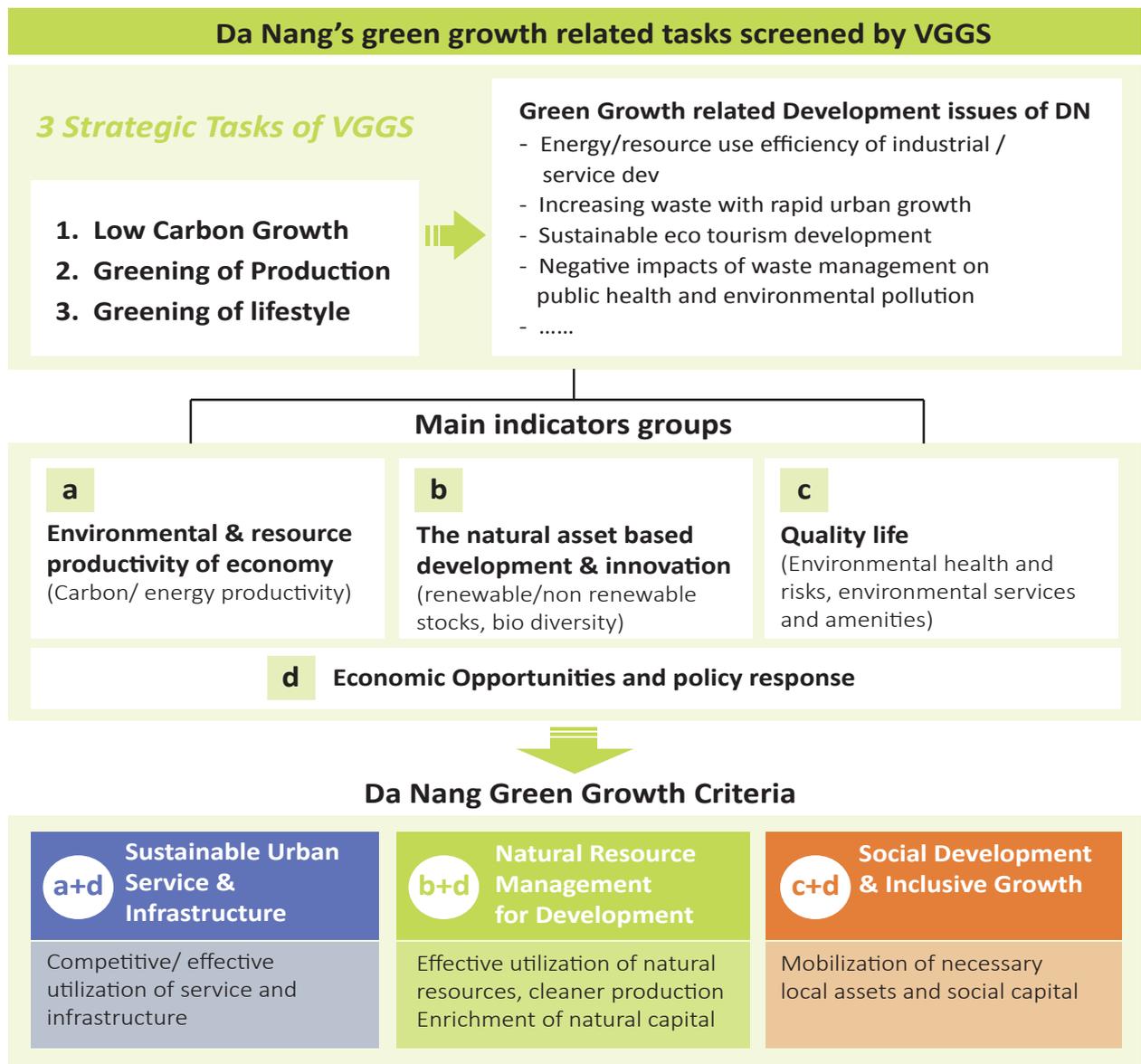


# 2. APPROACHES AND PROCESSES

The GG-CDS for Da Nang City applies innovative approaches to the City Development Strategy (CDS) model which has been used as a part of the sustainable urban development programs of the Cities Alliance,

UN-Habitat, and other international organizations. The GG-CDS was developed to practice strategic planning and innovative resource mobilization in a market-oriented economy with a focus on building stakeholder coalitions and public-private partnerships. The GG-CDS focuses on the effective use of local assets, adaptive capacity, and community resilience in order to maximize green growth impacts while improving the quality of life of urban residents. By effectively using local resources, the GG-CDS provides opportunities to make the best use of local resources and social capital, thereby creating high value added development in Da Nang City. The GG-CDS aims to combine “green growth” with “city development strategies” by applying integrated and multi-sectoral planning approaches to make direct contributions towards the realization of green growth.

**Figure 2.** Green Growth Criteria of Da Nang GG-CDS



**Green Growth Criteria for the GG-CDS**

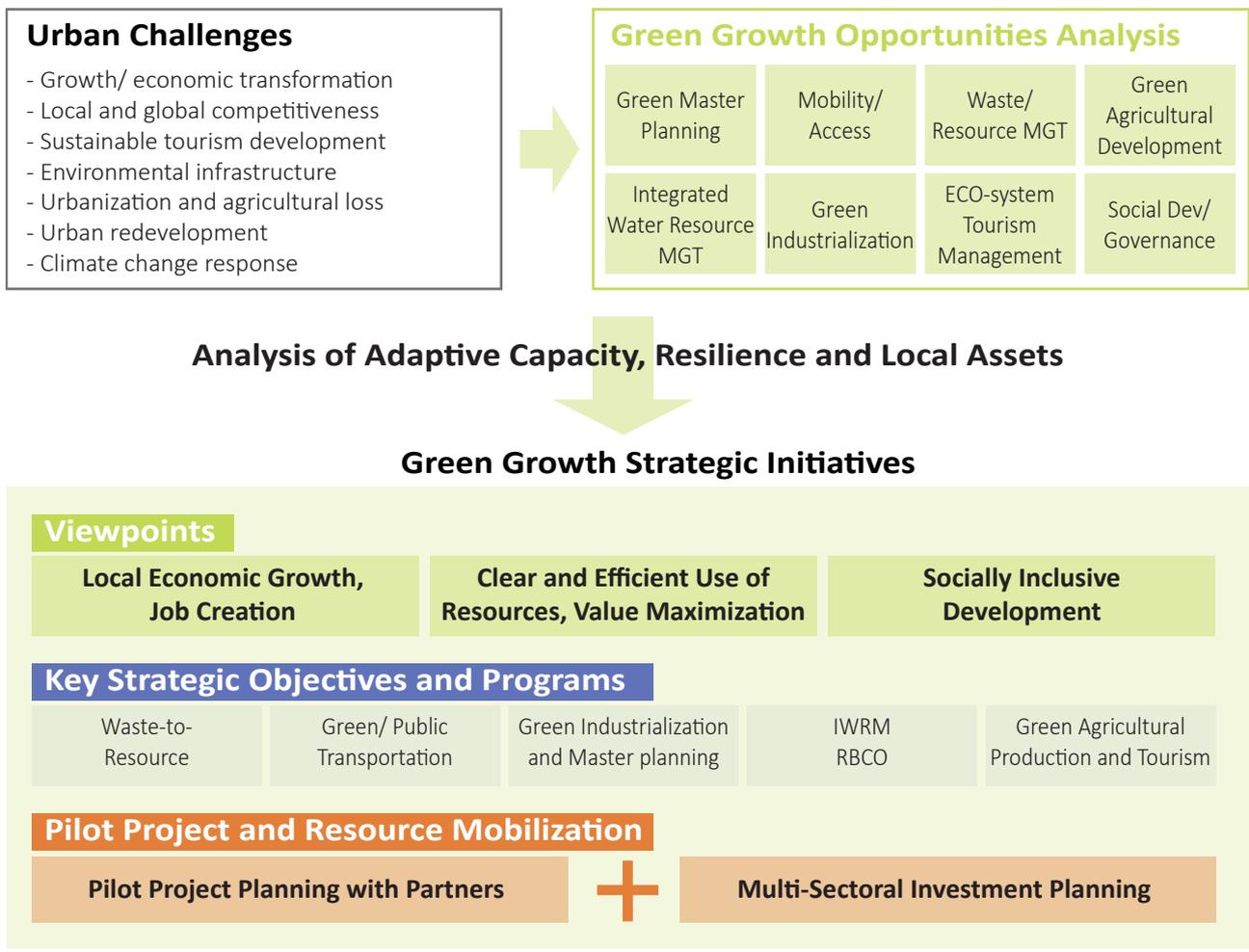
The criteria for analyzing green growth opportunities for Da Nang City have been developed based on the three strategic tasks of VGGs as well as green growth indicators recognized by international organizations such as the Organization for Economic Cooperation and Development OECD (Green Growth indicators examples to be found in Appendix 2). First, the three strategic tasks of the VGGs, namely the need to move towards low carbon growth, the greening of production, and the greening of lifestyles, have been referred to in order to screen Da Nang City’s green growth related development issues. In addition, the results of the leadership training and technical capacity building workshops have also been referred to for selecting the key development issues for the city. Second, in line with the local issues related to green growth, a number of key indicator groups have been developed which refer to relevant international green growth indicators (i.e. OECD, Korea Green Growth indicators, UNEP and UNESCAP). These indicators can be divided into four groups: 1) Environmental and

Resource Productivity of the Economy, 2) Natural Asset based Development and Innovation, 3) Quality of Life, and 4) Economic Opportunities and Policy Responses.

The group “Environmental and Resource Productivity of the Economy” concerns carbon, resource and energy productivity. “Natural Asset based Development and Innovation” deals with the sustainable use of natural resources and value added development of renewable and non-renewable stocks. “Quality of Life” is concerned with improving the quality of life of urban citizens. The group “Economic Opportunities and Policy Responses” is a cross cutting indicator group which is concerned with appropriate policy frameworks and economic development opportunities for all other green growth issues (Indicators and corresponding data examples can be found in Appendix 3).

The green growth criteria for Da Nang’s GG-CDS were formulated by combining a, b, c with d as seen in the following diagram, each of which is particularly concerned with institutional settings and local capacity

**Figure 3. Analytical structure of Green Growth Orientation for Da Nang Development**



development in order to realize green growth (i.e. economic incentives, regulatory framework, governance and institutional mechanism, local practices, financing, and public awareness). These criteria groups are the basis for green growth opportunities and gap analysis, as well as for the key strategic development of the GG-CDS.

### **Analytical Structure of the GG-CDS**

The first section describes the rationale for applying green growth into the overall development orientation of Da Nang City. By supporting Da Nang City's SEDP and other key development plans, the GG-CDS identifies ways to contribute to the competitiveness of the city by adopting green growth principles and by providing solutions to sort out identified multi sectoral development issues.

Second, green growth criteria were developed for Da Nang City and green growth related challenges, opportunities, and gaps to achieve development targets were analyzed. Three green growth criteria groups, namely 1) sustainable urban service and infrastructure development, 2) natural resource management, and 3) social development and governance are used for a more in-depth analysis of green growth opportunities and gaps in relation to the specific development issues of Da Nang City. Moreover, the adaptive capacity of communities and their local assets to deal with identified challenges were analyzed so that the city can use local resources more effectively. By applying green growth to local practices, Da Nang City can better formulate the rationale for strategies and programs. This analysis is followed by a SWOT analysis which bridges green growth opportunities with key parts of the strategic initiatives.

The third part is focused on formulating green growth strategic initiatives, which includes cross-cutting and integrated green growth related strategic objectives and programs with pilot ideas. Each strategic initiative introduced objectives and monitoring indicators with a strong rationale and outcome. Key programs were designed with innovative concepts which identified management structure, process, key stakeholders collaboration, financing mechanisms, and the necessary resources required to bring these programs to life. Experts and practitioners who were involved in identifying best practices were consulted to build these programs and to support project pilot ideas. Ultimately, these pilot ideas aim to attract potential business partners and international development organizations who are interested in investing in sustainable and cost effective solutions with high and long-term impacts for Da Nang City.

### **Key Process**

Most importantly, as a prerequisite of developing the GG-CDS, leadership training and technical consultative meetings were conducted to identify the key areas to mainstream

green growth, identifying the basis for the green growth criteria. This was critical process to increase ownership and leadership of Da Nang City in planning and implement the GG-CDS in the end. With the leaders and the officials of Da Nang City who actively led these initiatives, during the training sessions, the areas of sustainable local economic development, sustainable infrastructure development and urban planning, the sustainable use of natural resources, social equity, and regional cooperation were focused on and relevant green growth solutions were identified. In addition, the roles of different stakeholders were discussed. The motivation for adopting green growth was strengthened among key stakeholders while international best practices and innovative ideas were studied and application points were discussed.

Upon receiving feedback from local leaders and other stakeholders, the GG-CDS was developed by GGGI and UN-Habitat in cooperation with the Da Nang City government. It is based on multi-sectoral stakeholder interviews. Notably, an in-depth multi-stakeholders survey<sup>2</sup> was conducted to identify the perceptions of various sectors regarding opportunities and challenges towards green growth oriented development (Appendix 4). The survey helped understand awareness and readiness, and capacity to adopt green growth as a main urban planning and development practice into current development direction. Furthermore, trainings to learn the successful implementation of green growth initiatives in other regions, such as green growth in Korea, and multi stakeholders' consultation with experts and the local government provided critical opportunities to build key programs and pilot project ideas.

Pilot project ideas were discussed with potential partners interested in green growth planning and the implementation of projects in Da Nang. A final workshop and technical meetings were organized which involved discussions among key stakeholders on the institutionalization of the GG-CDS and ways to finance strategic initiatives .

# 3.

## RELATION TO OTHER PLANS

The GG-CDS has an important role to play in terms of strengthening links among different urban development plans such as the eco-city plan, the construction master plan, and the Socio-economic Development Plan (SEDP) (2010 - 2030). The GG-CDS is designed to complement the SEDP of Da Nang City by developing key green growth programs and projects which are strongly linked with and which will strengthen key programs and projects under the SEDP.

The GG-CDS aims to achieve the identified targets and objectives of SEDP to make Da Nang a more environmentally and socially sustainable city by improving key programs. The GG-CDS promotes the greening of production processes and aims to reduce economic losses from climate change impacts while fostering new markets based upon the innovative use of natural resources. It identifies opportunities for public-private partnerships to mobilize resources to implement those key programs.

Next, the GG-CDS provides an integrated approach to environmental city planning by contributing to the implementation of the plan “Developing Da Nang - The Environmental City(2008)”. The environmental city plan was based on sectoral approaches to environmental planning and is mainly concerned with waste management and the mitigation of pollution rather than integrated

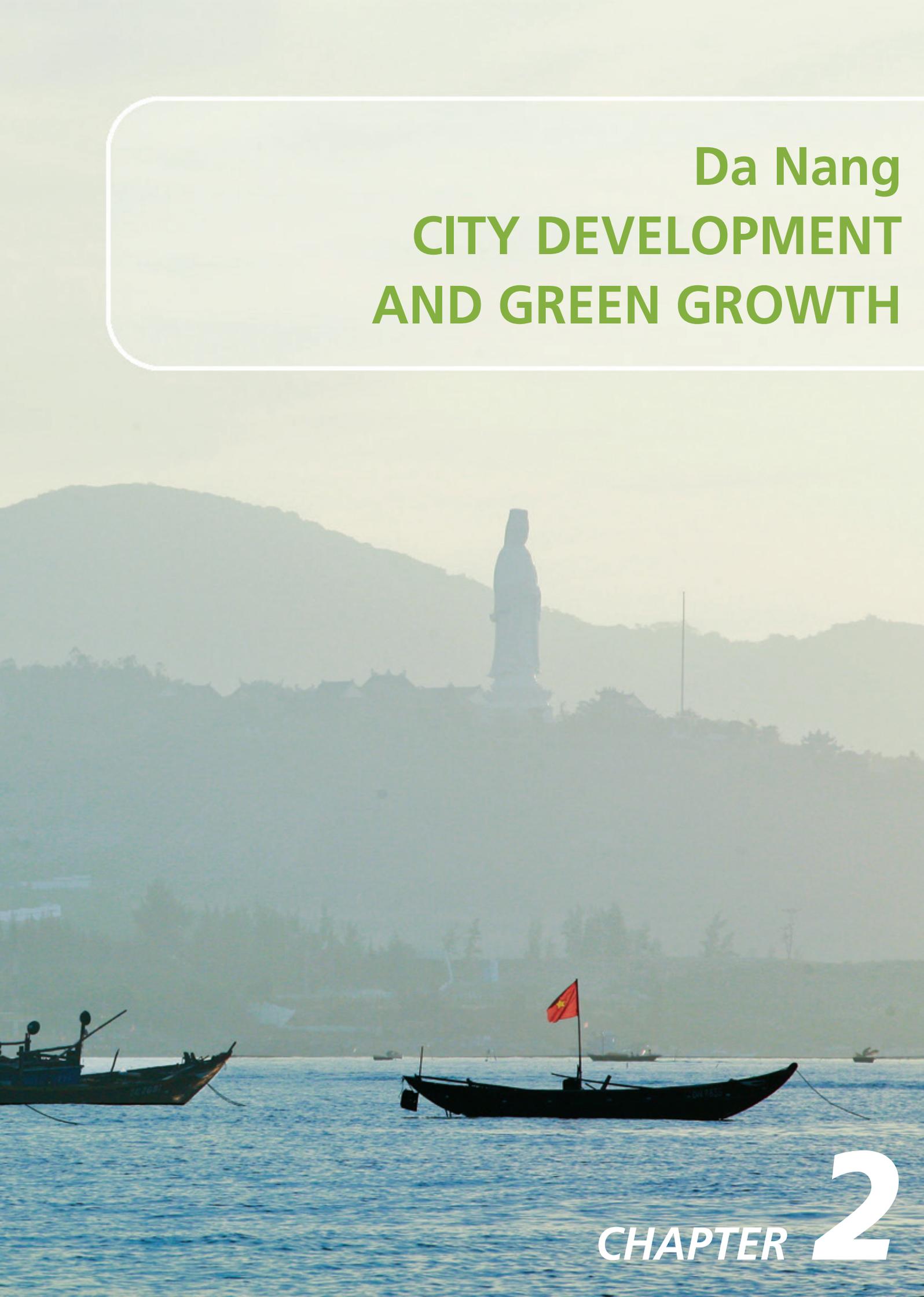
approaches towards natural resources based development. The cross-cutting and multi-sectoral analysis and strategies of the GG-CDS aim not only at environmental management but also at high-value added development while increasing economic competitiveness for Da Nang City. The strategic initiatives of the Da Nang GG-CDS are expected to bring civil society, business, and government together to formulate innovative programs and create business opportunities dealing with interlinked urbanization issues with synergy effects for green growth.

The GG-CDS focuses on strengthening policy implementation by identifying multi-sectoral financing mechanisms for existing key sustainable urban development programs and projects. Pilot project ideas such as creating new markets for green enterprises, such as bio-mass businesses, initiatives for increasing energy efficiency, the up-scaling of green agricultural production and rural development, and institutionalizing integrated water resource management would be discussed with identified potential partners. They would be referred to as applicable best practices, right after formulation of the GG-CDS. It will be critical to communicate with and involve potential partners and investors interested in participating in project development and implementation through the various stages of the development of the GG-CDS.

Finally, the GG-CDS is expected to localize the VGGS based on the three strategic tasks of: 1) greening existing production processes, 2) promoting the use of clean and renewable energy which reduces the intensity of carbon emissions of the economy per unit of GDP, and 3) promoting environmentally sustainable lifestyle behaviors and patterns. The GG-CDS is designed to develop key initiatives directly linked with these three strategic tasks. The hope is that the GG-CDS will transform the socio-economic development orientation of Vietnam by focusing on strategic breakthroughs in economic restructuring and by changing the country’s model of economic growth.



*View to Son Tra Peninsula © Le Thang*



# Da Nang CITY DEVELOPMENT AND GREEN GROWTH

CHAPTER **2**

# 1.

## DA NANG CITY AND OVERALL DEVELOPMENT ISSUES

### 1.1 CONTEXT FOR DEVELOPMENT IN DA NANG CITY

During the period of 1997 - 2009, Da Nang's urban population grew by 20% and the city is expected to more than double from current levels to reach 1.5 million people by 2025<sup>3</sup>. Da Nang City has an average annual urban population growth rate of 3.5%<sup>4</sup>. As Vietnam's fifth largest city, Da Nang City is one of three key urban centers in Vietnam and one of the main regional centers in Southeast Asia. Da Nang's urban landscape has seen a rapid transformation, especially in terms of growth in infrastructure projects, real-estate development, and the expansion of the service sectors.

Figure 4. Map of Vietnam



Da Nang City is a vibrant port city characterized by its scenic, natural surroundings. The city is ringed by mountains on one side and the East Sea on the other. Da Nang is known for its cultural richness as it lies in close proximity to several UNESCO World Heritage Sites, such as the Imperial City of Hue and the My Son archaeological ruins. Other tourist attractions in and around the city include the Ba Na Tourist Resort, which offers tourists a panoramic view of the spectacular Ba Na Mountains, and the Ngu Hanh Son mountains, better known as the marble mountains. The marble mountains are named after the five earthly elements (metal, water, wood, fire, and earth).

Da Nang City has the fourth largest seaport in the country and is also an important gateway to the Central Highlands of Vietnam, the Lao People's Democratic Republic, Cambodia, Thailand, and Myanmar. Since being designated as a Class I city in 1997, Da Nang City, as with the rest of Vietnam, has experienced significant socio-economic changes. Economic liberalization has increased the opportunities for investment and has promoted economic development. The economic structure of Da Nang City continues to shift towards the industries of services and agriculture. The proportion of GDP in the services sector reached 50.5% in 2009, industry construction reached 46.5%, and agriculture 3%<sup>5</sup>.

In addition, the free trade agreements of the Association of Southeast Asian Nations (ASEAN) have contributed to promoting the commercial development of the central region. Furthermore, the East-West economic corridor is expected to play its role in increasing economic development opportunities and strategic cooperation in the region.

Notably, one of key development focuses for Da Nang City is to initiate a competitive high-tech industrial park and an information technology park in order to accelerate a process to develop Da Nang City into a hub for information technology in the central region. The city has been encouraging foreign investors to be involved in developing the infrastructure for a high-tech park (1,129.76ha) and an IT park (341ha). The parks will link training, scientific research and technology development with production, commerce and services.

#### Focus of development orientation of Da Nang

In Da Nang City's Socio-Economic Development Plan (SEDP) for 2010 - 2020, and other plans such as the Construction Plan, it is clear that Da Nang City aims to become a centre for industrialization and modernization in the region and in the country. In particular, Da Nang City's development orientation emphasizes that socio-economic development be linked with urban upgrading as well as urban spatial expansion. It also aims for improvements in

the areas of health, culture and education. with the aim to enhance the quality of people’s lives.

Changes in land use, environmental degradation, and the depletion of natural resources have accompanied Da Nang City’s rapid, urban development. Concerns about the environmental repercussions of economic growth resulted in the city government taking the lead to develop the plan *Developing Da Nang - an Environmental City* (Decision no: 41/ 2008/ QĐ- UBND). The Plan focuses on developing a sustainable city by relocating polluting industries, controlling the development of industrial sectors, creating protected areas such as the Ba Na forest zone, and promoting low carbon public transportation systems. In addition, the plan aims to improve environmental management in the areas of solid waste, water supply, and wastewater.

The implementation of the Vietnam National Green Growth Strategy at the municipal level has been requested and an action plan will be developed. Da Nang City has already developed a few programs which capitalize on the advantages of green growth, which in turn contribute to the restructuring of the national and regional economy. Programs such as the Sustainable Urban Energy and Emissions Planning (SUDEEP) focus on identifying opportunities that can maximize energy efficiency (EE) outcomes while taking into account the need for the reduction of greenhouse gas (GHG) emissions. In addition, projects for climate resilient urban development supported the integration of climate change agendas in the master planning process.

Notably, one of the key focuses is for developing into Da Nang City into a leading ASEAN city. The city aims

to develop high-tech industries that will significantly contribute to the enhancement of economic efficiency and competitiveness in Da Nang. The city has been encouraging foreign investors to be involved in developing the infrastructure for a high-tech park and an IT park. The parks will link training, scientific research and technology development with production, commerce and services.

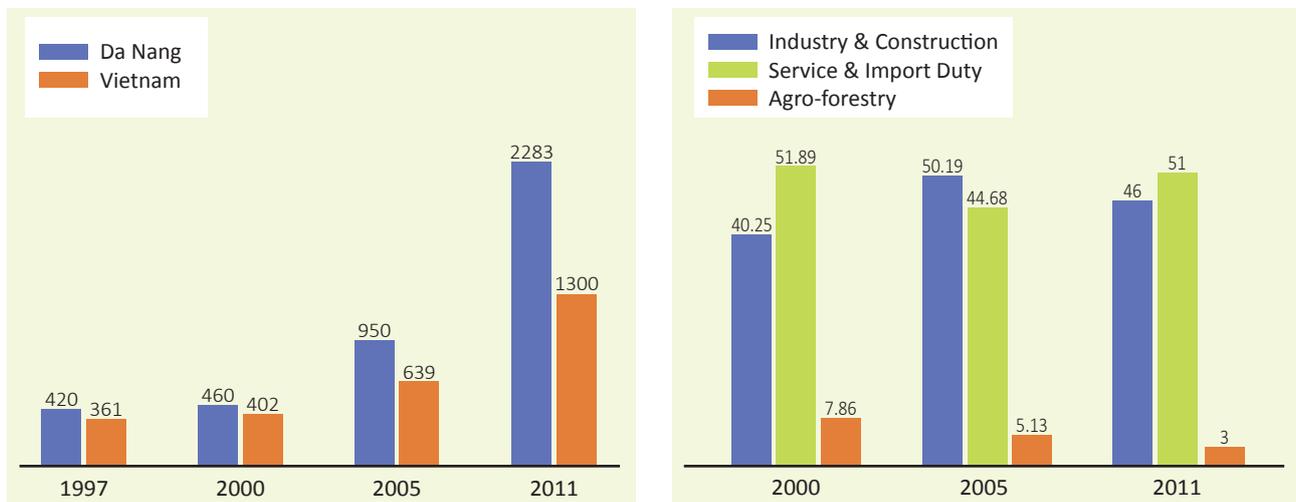
## 1.2 KEY CHALLENGES AND OPPORTUNITIES FOR DEVELOPMENT IN DA NANG CITY

In order to implement key development orientations to achieve sustainable development in Da Nang, the city needs to implement tasks to develop a new economic growth engine while protecting the environment and the local assets of community groups. In order to realize these tasks, city officials in Da Nang developed a number of multi-sectoral questions for key stakeholders in the city. The questions are described briefly as follows (a full text of the consulting paper to be found in Appendix 5)<sup>6</sup>.

### Spatial Planning to Support Sustainable Urbanization in Da Nang City

It is critical that these multi-sectoral development issues be linked with the spatial development of Da Nang City. In order to support sustainable urbanization in Da Nang, spatial planning and development should lend to a livable and economically competitive environment which includes good access to public transportation, affordable housing and convenient services, as well as green industrial development. In addition, spatial planning can introduce

**Figure 5.** GDP comparison between Da Nang and overall Vietnam (unit: USD): 1997 - 2011 (left)  
**Figure 6.** Economy structures of Da Nang: 2000 - 2011 (right)



Source: Investment Promotion Center Da Nang, 2013

**Table 1.** Key Multi-Sectoral Issues and Questions for Da Nang City to become a competitive & livable city

Key Multi-Sectoral Issues	Questions
Growth and Economic Transformation	What growth is desirable? What are the consequences of rapid growth? How to realize economic transformation with limited available instruments to impact growth? How to develop a good governance and pro-business model?
Competitiveness	How effective is competitiveness in generating growth and investment, with a focus on environmental quality, quality of life, land and labor cost, quality and cost of housing, and the cost of living?
Sustainable Tourism	How to make high value added tourism, contributing to local economic development? How to be re-branded as the pearl of the Asia-Pacific region, to attract tourists from around the world? What is competitive tourism development when growth cannot be extrapolated from current take-off pace?
Urban Mobility and Infrastructure	Is rapid behavior modification possible with a limited traffic management system, incentives/ penalties, and social impact assessment? How to coordinate between planners for BRT and the Construction Master Plan?
Environmental City Policy Implementation Gap	Da Nang City is more than just a scenic city of natural beauty - it is a city with identity and charm. How to implement policies for multi-sectoral cooperation?
Urbanization and Agricultural Land Loss	Is urban policy encouraging land loss? How to deal with urban sprawl, land vacancy, poverty reduction, to ensure a healthy local food supply and plentiful green spaces?
Construction Master Plan	How can the plan integrate the urban development direction with effective use of land? How can the current plan be adapted and adjusted to changing needs? How to plan for markets rather than public implementation?
Urban Re-Development and Social Development	Rapid urban growth requires major adjustments in the urban fabric of a city: What is the best mix of large scale urban renewal and incremental redevelopment? How to increase social equality through redevelopment?
Climate Change Resilience to Increase Competitiveness	How to improve resilience to climate change and urban adaptive capacity to climate change? How to mitigate negative socio-economic impacts for the people around river and coastal areas? How to develop integrated water management and how to build resilience in the urban water sector? How to reduce pollution and salinization? How to improve planning processes and urbanization, which replaced areas of vegetation by impermeable concrete and decrease the city's ability to absorb rainwater?
Municipal Finance	How to improve the sustainability of financial resources? (tariff, betterment fee, development impact fee, Public Private Partnership, property tax collection, capital markets?)
Sustainable Economic Development + Input Resource Management	How to measure adequate quantity and quality of water supply to support current and future economic activities of Da Nang, especially newly developed industrial parks? How to improve the local competitive advantage in the agricultural products?
Eco-system based Development	How to conserve the natural environment and the biodiversity of eco-systems to create high value added development to increase the competitiveness of Da Nang City?
Rapid Urbanization and the Impact of Pollution	With urban effluents, mixed together with industrial effluents, and pollution, how to mitigate impacts on rivers, urban lakes, and coastal zones (in particular Da Nang Bay) and maintain quality of life and environmental city image?
Rural Development and Competitive Agricultural Development	How to reduce many environmental challenges which impact on competitive agricultural development? What is investment priority for competitive rural areas and better quality of life of local communities? How to re-think water management in rural areas?
<b><i>Cross-Cutting Challenges</i></b>	
<ul style="list-style-type: none"> <li>• How to innovate and develop a capacity to improve?</li> <li>• How to build a secure and sustainable knowledge base?</li> <li>• How to cooperate and coordinate across sectors?</li> <li>• How to change people's behavior, what instruments to use?</li> <li>• How to plan usefully in a market economy with a social focus?</li> <li>• How to transform plans into action, how to implement?</li> <li>• How to pay for it all and how not to send the wrong signals?</li> <li>• How to institutionalize multi-sectoral investment planning?</li> </ul>	

activities which minimize negative socio-environmental impacts related to climate change. Thus, measures for climate adaptation must be integrated into spatial planning systems if Da Nang City is to successfully manage climate hazards and disasters. Examples of spatial planning activities which can strengthen the adaptive capacity of Da Nang City to climate change include controlling the development of areas at risk to flooding, developing new guidelines for climate resilient urban design and construction, creating areas for water storage, and developing laws to reduce the vulnerability of urban areas to climate impacts. For Da Nang's coastal areas, spatial planners can introduce the design and construction of waterproof buildings, mangrove reforestation programmes, and the construction of sea walls.

Da Nang faces a number of urbanization challenges. First, the excessive development of high-rise buildings for commercial and residential purposes will promote the further densification of the city center and will lead to an increase in car traffic which may worsen traffic congestion. High-density development should be combined with effective public transport systems. Furthermore, the development of high-rise buildings, without proper planning, can spoil the urban landscape of the city center and can lead to negative impacts for sustainable tourism development. Poorly managed urban planning can also negatively affect the operation of the nearby airport which is becoming increasingly important for the urban development of the city.

Expansion of the urban area towards outer areas contributes to urban sprawl and will likely lead to ineffective and low density land-use. This type of development will require higher costs for providing necessary infrastructure, reduce accessibility to necessary services, consume more energy and generate more pollution and carbon emissions. It also makes it difficult to provide effective public transport services. It is necessary to guide this type of urban development in a way that can enhance the convenience of various urban activities, reduce costs for necessary infrastructure provisions, mitigate negative impacts on the environment, and strengthen disaster preparedness. Ultimately, controlled urban development and the preservation of forests, mountainous areas, and precious flora and fauna are important for Da Nang City to mitigate natural disasters. In addition, it is important to integrate rural and mountainous areas with urban areas to improve access and the provision of necessary urban services in those areas, and to encourage environmental friendly development such as eco-tourism.

Green growth opportunities and strategic initiatives are needed to identify innovative ways to deal with these multi-dimensional development and cross cutting challenges.

Figure 7. Urban Spatial Development Planning for Da Nang by 2030



# 2. GREEN GROWTH OPPORTUNITIES AND GAP ANALYSIS OF DA NANG CITY

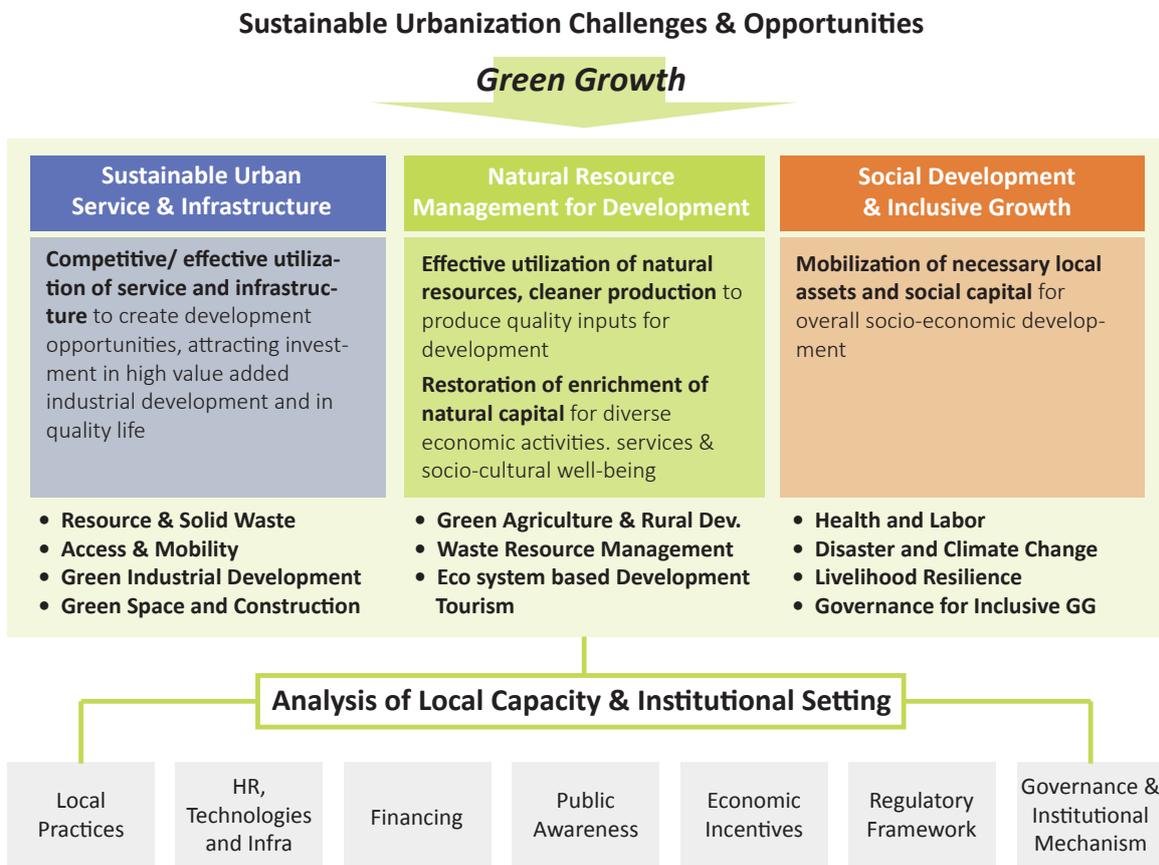
As described above, three green growth criteria areas of the GG-CDS have been formulated to identify green growth opportunities: 1) sustainable urban service and infrastructure, 2) natural resource management for development, and 3) social development and inclusive growth. Under each of the three criteria areas, three to five green growth opportunities have been selected

which directly contribute to job creation, environmental protection, and industrial development, thereby creating better accessibility to urban services. Gaps of green growth implementation capacity and institutional frameworks are also analyzed so that the GG-CDS can focus on strategic initiatives rather than try to cover all issues with limited financial resources.

## 2.1 SUSTAINABLE URBAN SERVICES AND INFRASTRUCTURE

The quality of citizen’s lives in Da Nang City depends significantly on the quality of urban infrastructure, which encompasses both the physical infrastructure as well as the ability to provide key social services for the public. It is crucial to maintain urban infrastructure in an environmentally sustainable manner. This is also directly related to achieving socio-economic development goals while increasing the competitiveness of the city. Effective and sustainable urban infrastructure along with speedy services for investors are critical factors for investment promotion, especially in case of high-value added industries, high-tech businesses and the development of the tourism industry. Local community groups and Small

**Figure 8. Green Growth Performance Areas and Da Nang City**



and Medium Sized Enterprises (SMEs) should also be engaged in innovative infrastructure management and development.

Urban services and infrastructure can create different green growth opportunities for Da Nang City. Different political and socio-economic conditions require different solutions and these solutions need to be linked with each other through comprehensive and coordinated approaches. Da Nang City faces challenges associated with rapid urbanization just like other cities in Vietnam. The three most urgent challenges associated with rapid, urban development in Da Nang City include the following: 1) unsustainable waste management, 2) unsustainable transportation, and 3) the need for effective spatial management. Hence, in order to tackle these key challenges, the following four areas have been identified: 1) resource and solid waste management, 2) access and mobility management, 3) green space and construction, and 4) green industrial development and management. They are all linked with each other in terms of supporting sustainable “green growth” city development.

### 2.1.1 Material Management

#### 2.1.1.1 Green Growth Opportunities and Gap Analysis

Rapid urban development in Da Nang City requires strengthened solid waste management due to the increase in solid waste generated by various types of waste, such as residential, industrial, medical, and rural waste. Solid waste management is required to reduce pressure on land use for waste treatment and to decrease management cost fees.

Waste-to-resource initiatives can contribute directly to the effective use of limited resources and lead to solid waste related industries and a market, thereby providing revenue for local communities and SMEs. In addition, waste to resources can lead to reduced economic costs for solid waste management as well as improved social benefits, such as positive effects for public health. In order to manage solid waste in more efficient and effective ways, the following themes should be taken into account: a) control of increasing waste accompanying urban growth; b) waste collection and treatment for waste-to-resource initiatives; c) and industrial and hazardous waste management.

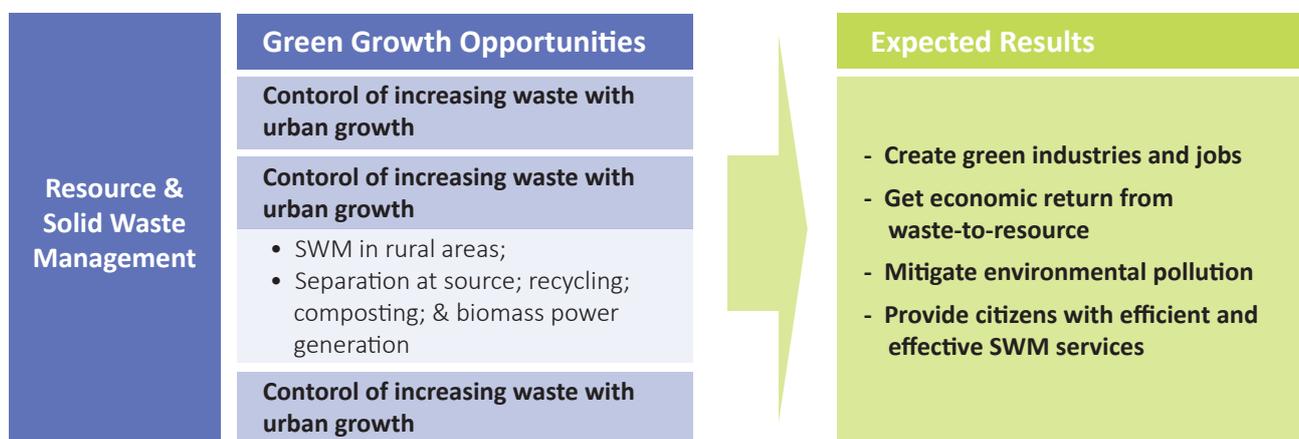
#### a. The Control of Increasing Waste Accompanying Rapid Urban Growth

With rapid urbanization in Da Nang City, more land, human resources, and financial resources have been required to treat the increasing amount of solid waste generated in the city. The current situation for solid waste management in Da Nang City is non-separation at source with inappropriate treatment. There are limited funds and technologies for waste. Disposing waste economically and safely is essential in order to reduce the demand for more landfill areas and for preserving land. In addition, waste segregation can improve recycling in practice, resulting in economic gains through related industrial development and job creation. Furthermore, the innovative management of solid waste can help landfills increase their carrying capacity.

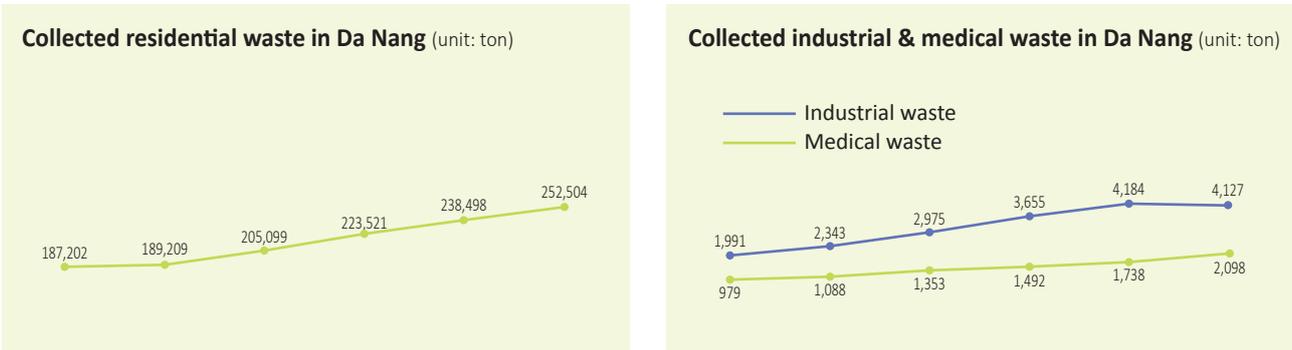
#### b. Waste Collection and Treatment for Waste-to-Resource

The city needs to expand overall waste management in rural areas in order to provide all residents with basic waste services such as collection and treatment. These

**Figure 9.** Green Growth Opportunities for Resource and Solid Waste Management in Da Nang City

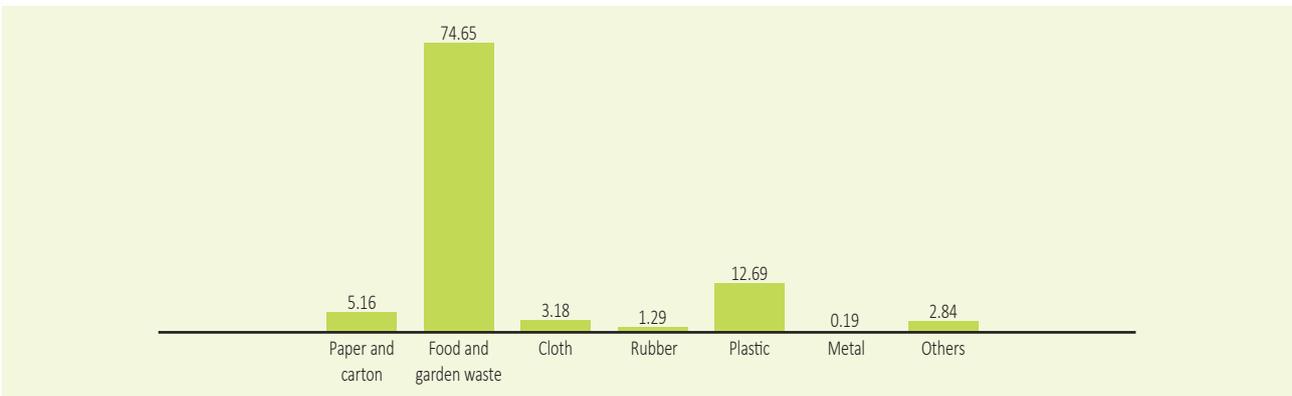


**Figure 10. Collected solid waste in Da Nang City**



Source: Da Nang Urban Environment Company (URENCO), 2013

**Figure 11. Waste composition in Da Nang (2011)**



Source: Da Nang Urban Environment Company (URENCO)

efforts can reduce land/ water pollution, which can lead to better quality of lives for those living in rural areas. It can also contribute to more economic and eco-friendly treatment of rural by-products and bio-degradable waste including grass, crops, and manure. For example, the production of biomass, biogas, and bio-fuels can lead to the creation of related businesses and jobs.

**Separation at Source**

Apart from waste pilot projects in Nam Duong ward and Hai Chau District (2006), most solid waste in Da Nang City is not separated at source. Indeed, separation at source is critical for reducing the total amount of garbage sent to landfills and for saving valuable resources by increasing waste-to-resource through recycling and composting. It can also create solid waste management (SWM) related jobs, lead to poverty reduction, while mitigating environmental pollution driven by waste. As an important opportunity for developing an eco-city, waste has to be segregated into recyclables, bio-degradable (food/organic waste), hazardous, and domestic waste

before being sent to landfills. In particular, recyclables and bio-degradable waste should be separately collected for recycling, composting and biogas/mass power generation. Waste separation at source can also mitigate environmental pollution from landfills caused by uncontrolled waste. In this way, it can also reduce social costs required to improve public health.

**Recycling for Waste-to-Resource: Pursuing Urban Mining**

Currently, on a daily basis the percentage of recycled waste in Da Nang City is about 5 - 7% of generated waste. The city has some related programs to promote and support the implementation of projects focused on the recycle and reuse of waste. Nevertheless, they have not attained any noticeable results due to limited financial, technical, and institutional support. Moreover, most recycling projects are small sized private enterprises with poor facilities and low productivity. In addition, they are characterized by unhygienic working conditions with negative implications for workers' health. They can also worsen environmental pollution in surrounding areas.

Measures are needed to contribute to the reduction in overall waste as well as the recovery of the resource potential of waste. Waste to resources will contribute to a sustainable urban economy for Da Nang City on the basis of closed-loop production, which can minimize the consumption of virgin materials while promoting recycling industries as a competitive business opportunity which can lead to job creation.

Towards this end, Da Nang City should consider “Urban Mining” for waste management. Urban Mining is defined as a process of reclaiming raw materials from products, buildings and waste from areas<sup>7</sup>. The goal of Urban Mining is to monetize urban waste streams including the construction & demolition of material (C&D), municipal solid waste (MSW), electronic waste (appliances, computers/peripherals, and other electronic items) and tires (car, truck and rubber products). Thus, the city needs to implement urban mining in order to achieve the following: 1) recover (waste-to-materials) or convert (waste-to-energy) from waste streams, 2) reduce landfills and the export of raw materials, and 3) create new businesses.

**Bio-degradable Waste-to-Resource (energy):  
Composting and Bio-gas/ mass**

The city needs to implement initiatives for composting. There are many benefits related to composting, such as the following: 1) composting can reduce the absolute amount of organic waste to landfill sites from the agricultural sector and food industry; 2) it also contributes to reducing the amount of gases that contribute to climate change; and 3) composting can replicate a natural recycling process that maintains soil nutrients and plant communities, better known as the ‘nutrient cycle’. In nature, composting processes allow nutrients in an eco-system to be used over and over again so as to sustain the eco-system by converting organic waste into a natural rich soil product. Agricultural by-products such as grass, twigs and crops in rural areas can be efficiently utilized to produce electric power and heat for urban areas.

Da Nang City needs develop an effective management system for the composting of organic waste. Such efforts for managing organic waste can also lead to economic profits from the production and selling of natural fertilizers/ feedstuffs, electricity and heat. Moreover, composting and biogas/biomass power plants can generate local employment opportunities and contribute to economic gains by selling resources-biodegradable waste such as agricultural by-products and electricity. These composting plants will also need workers for management and operation processes.

**c. Industrial and Hazardous Waste Management and Treatment**

Due to rapid industrial development in Da Nang City, hazardous industrial waste has proliferated in terms of quantities and types. To date, industrial waste treatment for enterprises has been quite limited even though there are many types of hazardous waste generated from industrial parks. The difficulties related to managing industrial waste are caused firstly by industrial park development, which has not been well planned. There is no appropriate mechanism for overall industrial waste measurement and management, which means there is no strict legal/regulatory system to prohibit enterprises from discharging hazardous, untreated industrial waste into the environment. Second, there are limitations in the awareness of entrepreneurs about environmental pollution, which leads to the lack of attention to the importance of industrial waste treatment. Third, the current demand for treating industrial waste is much higher than the capacity to treat this waste, primarily due to the lack of investment in infrastructure/equipment.

The city should strengthen the punitive system for violations related to industrial waste management. Industrial waste separation at source is one of the most important tasks to prevent illegal discharges of untreated waste. Appropriate economic incentives and disincentives should be linked with regulatory frameworks so as to encourage enterprises to more actively participate in industrial waste management. More importantly, it is essential to increase investments in developing and upgrading related infrastructure such as treatment equipment and facilities. Finally, there is a need for mobilizing and coordinating public-private partnerships not only for financing but also for R&D improvement. These efforts can improve resource/ energy efficiency in industrial production. The recycling of industrial waste also contributes not only to reduced production costs but also to the strengthened competitiveness of industries. The reform of waste management systems can encourage businesses to internalize their negative impacts on the environment, thereby reducing land, water, and air pollution.

## Box 1. International examples of innovative solid waste management initiatives

### Copenhagen's Innovative Waste Management System

The city of Copenhagen has introduced an innovative municipal waste management system as part of wider efforts to become a major “eco-metropolis” by the year 2015. The current waste management system results in less than 2% of waste being sent to landfills, with 60% for recycling, and 38% to energy recovery<sup>8</sup>. According to Copenhagen's Resource and Waste Management Plan for 2018, the city is encouraged to implement a number of forward thinking initiatives for sustainable waste management. For one, efforts will be made to transition from incinerating waste towards recycling, with a target for 45% of households to recycle their waste. The remaining amount of waste should be recovered for

heat and power. Other initiatives include: 1) Separation at source: the city should continue to install a number of waste bins to encourage urban citizens to separate waste at source according to the categories of paper, metals, electronics, glass, and cardboard; 2) Educational campaigns to encourage behavioral changes among urban residents. These campaigns aim to inspire eco-friendly consumption and waste patterns and green shopping habits among city dwellers. Finally, the waste hierarchy system should provide the foundation for the city's waste management system. The waste hierarchy system aims to establish a set of priorities of different waste treatment options, with the higher, better option having the least impact on the environment.

## Box 2. Zero Waste Alliance: Public-Private Partnerships for Zero Waste

The Zero Waste Alliance is a non-profit alliance based in Portland, Oregon which collaborates with industries, municipalities, and communities to identify and overcome barriers to zero waste. Zero Waste is defined as “a goal that is ethical, economical, efficient, and visionary to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use.” The Zero Waste Alliance works on the following core project areas: 1) Market development to support green marketplaces and technologies with the aim to transform unsustainable waste practices; 2) Convene industry, city, and community leaders to identify opportunities and barriers to achieve zero waste; 3) Research and education activities such as the distribution of research reports and ongoing educational events to highlight innovative waste management technologies.

The Zero Waste Alliance has also created the Zero Business Waste Network which aims to engage small, medium, to large businesses in activities which contribute to a zero waste economy. The network encourages businesses around the world to achieve greater efficiency in the use of natural resources, zero waste in production activities (i.e. recycling, reclamation), and the zero use of toxics in industrial processes and products. The network works towards these goals by facilitating networking, identifying market and policy barriers to zero waste, and by cooperating with the business community to secure resources. Industries and organizations active in the network include Noveda Technologies, Hewlett Packard, the US- China Sustainable Development Center, and General Electric.

### 2.1.1.2 Adaptive Capacity and Local Assets to Deal with the Identified GG Opportunities

#### a. Local Assets and Practices

An example of an inspiring locally-driven green growth initiative for solid waste management is that of a women's union in Da Nang City where community members sell their unused bottles to a recycling center and earn profit. Due to the recycling of bottles, neighborhood waste is reduced. In addition, a sustainable funding mechanism to support the community was established, where money is collected, used efficiently, saved, and then invested in local level development projects. The funding mechanism ensures the longterm sustainability of the funds through a transparent and accurate accounting system for managing funds. Through this funding mechanism, neighbors can support one another financially and have access to small loans which can be invested in community improvement projects.

URENCO is a public waste management company operated under the city government which is in charge of the collection and treatment of solid waste. UNRENCO is under the administrative control of the People's Committee of Da Nang, and the specialized control of DONRE (Department of Natural Resources and Environment). Due to limited funding, URENCO has limited capacity for managing the city's solid waste, especially related to industrial hazardous waste, as well as construction waste and sludge. In addition, support is needed to create and regularly update a database on solid waste generation and treatment (data on waste recycling facilities, composition of industrial waste generated from industrial facilities, and hotspots of environmental pollution caused by inappropriate solid waste disposal). The database will serve as the basis for solid waste management planning and decision making. With regard to residential solid waste, it must be treated in order to be buried in the landfills. There should be improved facilities and technologies to meet environmental standards related to leachate<sup>9</sup> from landfills. Regarding recycling, there is a need to develop value-added types of recycling such as urban mining.

Currently, industrial solid waste has been managed both inside and outside of industrial parks. Hazardous waste has been collected and treated by incinerators at the Khanh Son landfill. However, the problem is that there is little separation at source in industrial workplaces, leading to serious pollution. Another method is the solidification treatment method, which is used before burying waste at specific areas of the landfill. Both methods are out-of-date, with shortages in infrastructure based on modern technologies. In this sense, the city has to build up a foundation for industrial hazardous waste management, with a focus on developing related, up-to-date technologies and facilities.

URENCO is responsible for balancing the finance of solid waste management from sanitary fees and its environmental services. To date, citizens do not have strong willingness to pay for improving solid waste is the lowest among public services. Furthermore, fees have been inadequate to provide the services properly, with only about 70% collected. While financial resources are needed for upgrading and improving solid waste management (SWM) systems, the city government is unable and unwilling to invest in large scale budgets for SWM. Currently, the budget for environmental protection accounts for only about 1% of the city budget, most of which is currently utilized for waste collection/treatment and transportation. Thus, it will be critical that private and public partnership at domestic and international scale commit to financial resources for developing both infrastructure and technologies for SWM. To date, investment in SWM has not been considered as an important and urgent task because it has included simple processes -collection and treatment- without economic gains so far<sup>10</sup>.

Even though public awareness about waste management in the city has slightly improved, the overall awareness of environmental protection and the importance for the duty of paying fees for waste management is limited. More activities are needed for raising awareness in the next few years. The SEDP of Da Nang has emphasized awareness campaigns with objectives such as the promotion of source separation, 3Rs (reuse, reduce, recycle), waste management fee payment, and overall environmental education. All kinds of campaigns should be implemented at the community level in cooperation with community based organizations (CBOs) and other civic groups, such as the Women's Union, with the aim to increase civil society participation. In order to develop and implement more effective waste management programs, a KAP survey should be carried out in order to gain insight into the "knowledge, attitudes and practices" of various target groups such as public officials, entrepreneurs, children/students, women, and the poor.

#### b. Institutional Settings and Capacity

Currently, there are few incentives (i.e. supports for infrastructure, land, capital, taxes/charges, and subsidies) related to the recycling and reusing of waste. However, the existing programs for SWM need to be complemented and strengthened with economic incentives. The city should actively combine economic incentives with people's welfare in mind when developing programs for SWM. The city can encourage people to separate discarded waste into recyclable and non-recyclable waste by introducing initiatives similar to the Green Exchange Program of Curitiba, Brazil. In this program, low-income families collect garbage and then bring it to waste recycling centers, exchanging garbage for bus tickets and food. As

part of the program, children can exchange recyclable waste for school supplies, snacks, toys, and show tickets. The city can save on costs for waste collection in rural and slum areas in cities. In addition, the Green Exchange Program contributes to the health and overall well-being of the urban poor.

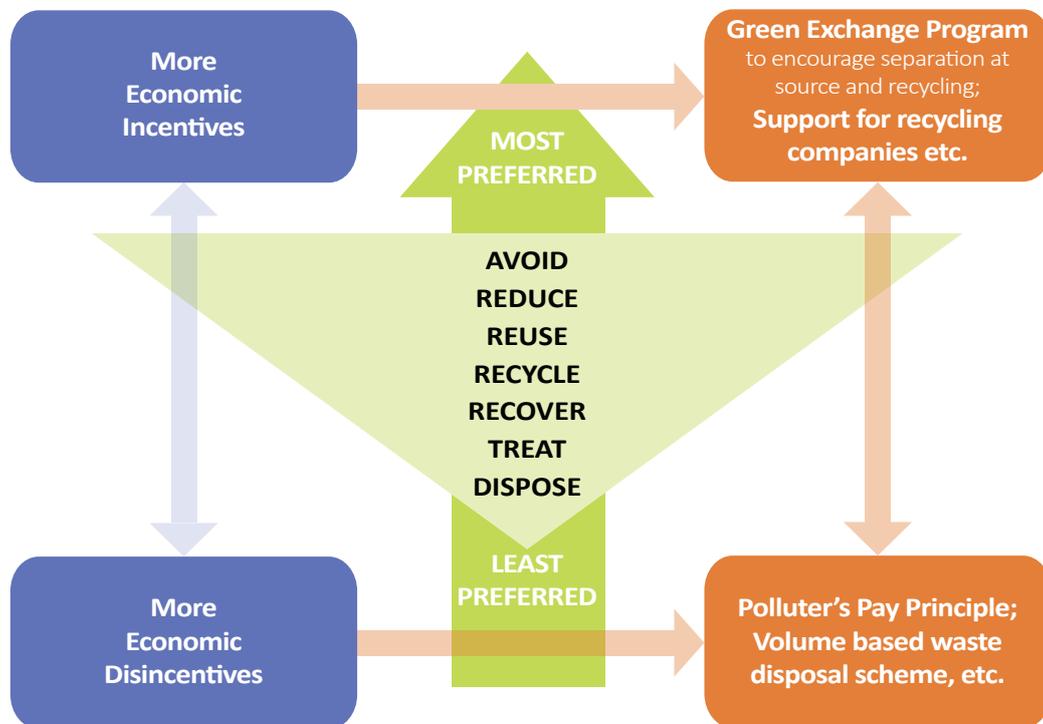
These economic incentives should be closely linked with regulatory frameworks for minimizing waste. The priority should be to reduce and avoid waste altogether. Recycling should be regarded as the second best solution for dealing with waste management. Landfill disposal has to be used as a final step for waste-to-resources.

In recent years, regulations on waste management have improved. They should be complemented by encouraging recycling. The city government can apply regulations by going through a process of ordinance enactment. In addition, support from the central government should be provided in terms of relevant law revision in order to facilitate the managing of recyclables based on classification in an efficient and effective way. Also, there are limitations in regard to the enforcement and compliance of environmental regulations. Policies and laws for environmental protection are not strict nor are

they consistent. Also, they overlap one another, making it difficult for the city to manage and decentralize the implementation of laws. The enforcement of environmental regulations is weak due to a lack of management mechanisms.

The city needs to issue provisions at the local level in accordance with specific economic/social conditions, the current situation for the market for recycling, features of waste, collection/treatment methods, and local management mechanisms. Above all, it will be essential to reduce dependence on the central government when it comes to setting provisions for recycling and waste separation at source in the city. The following measures should be introduced: a) strengthen public awareness about the importance of protecting environment; b) encourage all economic sectors and communities to protect the environment and to participate in waste-to-resource initiatives; c) and attract domestic/ foreign investment and technical support. Also, it will be critical to establish a cooperative mechanism among public agencies, citizens, businesses, and environmental organizations in order to strengthen partnerships among diverse stakeholders in the city.

**Figure 12.** A concept of economic incentive systems based on waste management hierarchy



Source: Revised from the diagram created by Robert Mellor

## 2.1.2. Access & Mobility Management

### 2.1.2.1 Green Growth Opportunities and Gap Analysis

The SEDP 2010 - 2020 of Da Nang City has emphasized some of the key development orientations for transportation. It seeks to build up infrastructure supporting socio-economic development while developing sustainable transport systems in order to limit individual transport, thereby leading to a reduction in traffic congestion. With rapid population growth and urbanization, transportation challenges caused by a high dependence on personal vehicles will require the city to strengthen its public transportation systems, such as the BRT (Bus Rapid Transit). In addition, effective mechanisms for traffic management will be needed not only for improving the quality life of urban residents, but also for developing competitive businesses.

In order to fulfill the Master Plan’s goals for providing better improved mobility access for all citizens, the transport systems and infrastructure of Da Nang City need to be modified in order to give public transport priority in the long term. Below, find the specific green growth opportunities that need to be taken into consideration.

#### a. Transition to Public Transport Systems

With rapid urbanization, Da Nang City has been facing significant challenges in its transport sector. Currently, more than 95% of households Da Nang City own motorbikes with motorbike trips accounting for 78.2% of total transport in the city<sup>11</sup>. This demonstrates a very high dependence on motorized personal vehicles and has resulted in many problems such as traffic congestion, illegal parking, and air pollution.

Green growth oriented transport management aims to transition to public transportation systems to reduce dependence on personal vehicle use. This will contribute to a reduction in the consumption of polluting fuels, and to effective land use planning/management and industrial development.

Moreover, efforts to transition to public transportation can create green jobs, while enhancing access to education and healthcare services through improved accessibility to the city center in the long term. Also, through systematic transport planning and the management of transit networks, the city can develop public transport related industries and jobs in the areas of infrastructure construction, R&D (research & development), M&O (management & operation), and M&E (monitoring & evaluation).

#### Road Network Improvement and Public Transport

In recent years, the city has focused on transport infrastructure development, which includes the development and improvements of urban road networks, waterways, railroads, a seaport and an airport in the city. Regarding the bus system in Da Nang City, there are 9 private companies providing bus services with only 5 routes managed by the Department of Transport. With limited intra-city bus services, people living outside of the bus routes do not have access to public transport. In addition, there is no unified bus fare system. Moreover, the interval of bus service is as long as 20 - 30 minutes, which makes people prefer motorbikes to buses. The intra-city bus services should be expanded to improve citizens’ accessibility and mobility. At the same time, related infrastructure and management mechanisms have to be reinforced to increase the efficiency and effectiveness of the overall public transport system in Da Nang City.

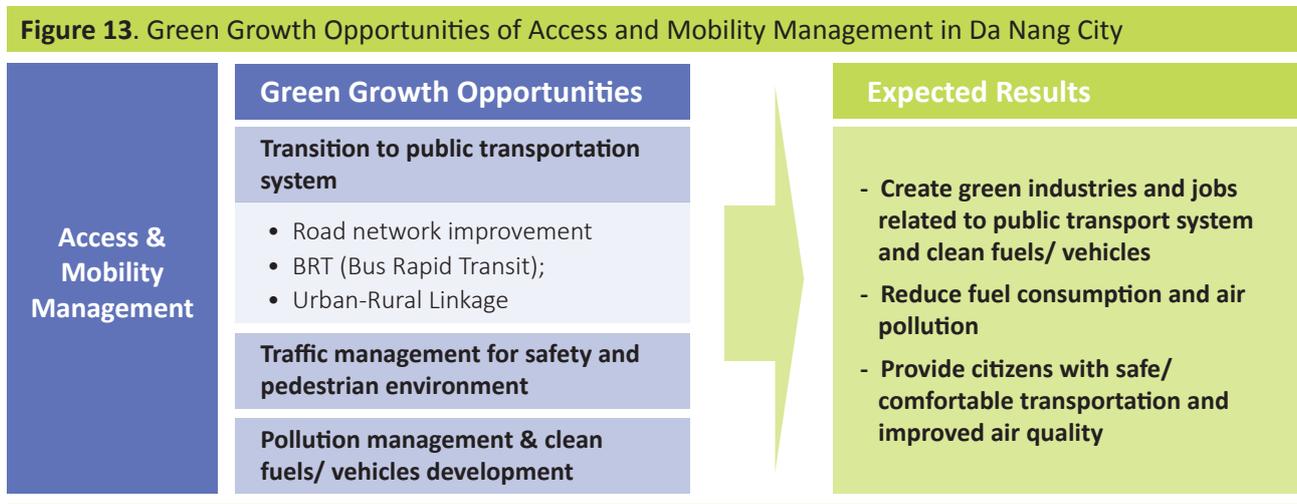
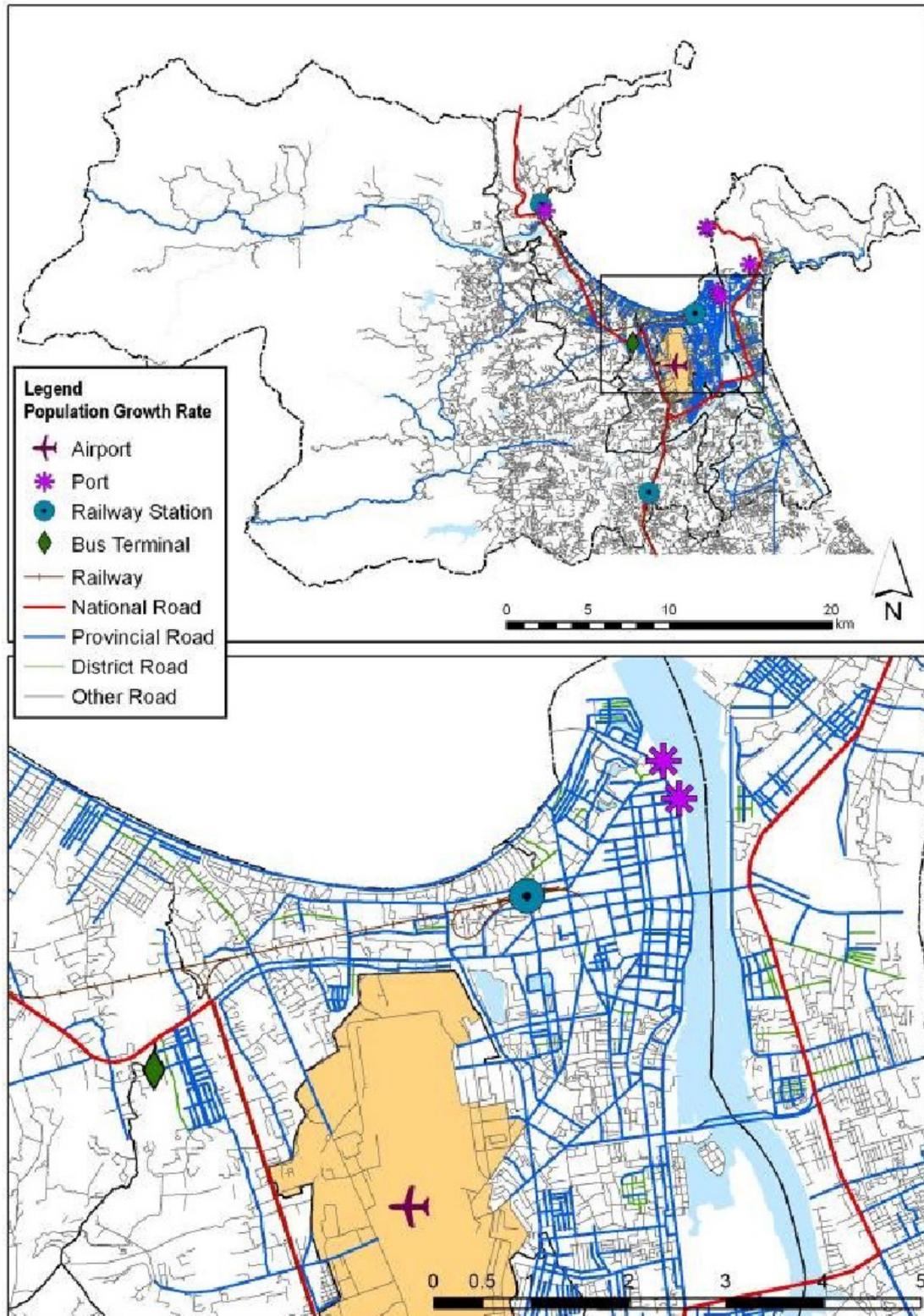


Figure 14. Transport network in Da Nang City



Source: Da Nang General Plan 2020

**Table 2.** Operation of the Bus System in Da Nang City

Route	Bus number	Distance (km)	Number of buses	Schedule (hour)	Allocation interval (minute)
Da Nang bus station ↔ Hoi An bus station	1	32	16	5:30 ~ 17:30	20
Hoa Khanh IP ↔ Han Market	2	14	15	5:30 ~ 18:00	10 ~ 15
Da Nang bus station ↔ Ai Nghia	3	35	9	5:30 ~ 17:00	30
Da Nang ↔ Tam Ky	4	70	35	5:00 ~ 17:30	20
Da Nang bus station ↔ My Son bus station	6	55	16	5:15 ~ 16:45	30

Source: Da Nang Department of Transportation, 2013

### **BRT (Bus Rapid Transit) Oriented Public Transport**

An urban public transportation system should be developed based upon the context of the city, with various options for public transport, such as: taxi, para-transit, bus rapid transit, light and heavy rail based mass transit, and waterborne transport. Each mode has distinctive features in terms of carrying capacity, investment costs, payback period and distances to be covered. Generally, buses can be operated costeffectively and easily mixed with other modes of transport. “Surface subway” systems can be referred to as using buses to get networks up and running, instead of building subway systems with high costs and a long period for construction and payback. These days, the city government has been making specific plans related to institutional frameworks for the introduction of BRT systems, including incentives, regulation, and overall management. Under the BRT system, intra-bus routes have to be enhanced in order to connect all directions in the city, which can lead to improved linkages between residential districts in the periphery areas and the urban center. At the same time, this can lead to a decrease in air pollution from motorized private vehicles.

However, there are some solutions expected to take place in implementing the BRT in Da Nang City. First, there must be human behavior changes in relation to parking, an acceptance of longer work trips, and adjustments in location preferences. This will take time to implement, thus it is essential to make systematic efforts towards appropriate public relations activities and education programs for raising public awareness about the importance of using low carbon transportation. Bus Rapid Transit as public transport should be able to compete with private vehicles. Good quality bus services can attract people in terms of connectivity, speed, affordability, comfort and convenience<sup>12</sup>.

Second, the city has to allocate subsidies to support the BRT fare system. In the initial transition to the BRT, it will be critical to provide bus companies with subsidies

at an optimum level to operate their deficit-ridden bus lines with few passengers. Also, economic incentives should be established to encourage the average motor cyclist to shift modes of transportation. For example, through the flat fare system which provides citizens with subsidies for using bus services. Third, the city needs to coordinate transport planning with urban planning. While transportation has a strong impact on the urban landscape, the city’s Master Plan for Construction has been made before transport planning, thus leading to inconsistent plans between land use and transport use. This is also caused by the limited collaboration and coordination among related departments. It is therefore essential to establish densification through linkages between urban development and public transport corridors to make the city more compact and sustainable in the face of urban sprawl. As shown in the figure below, cities that develop strategies to connect their component parts as quickly as possible create truly useful transit systems and markets.

### **Transportation and the Urban-Rural Linkage**

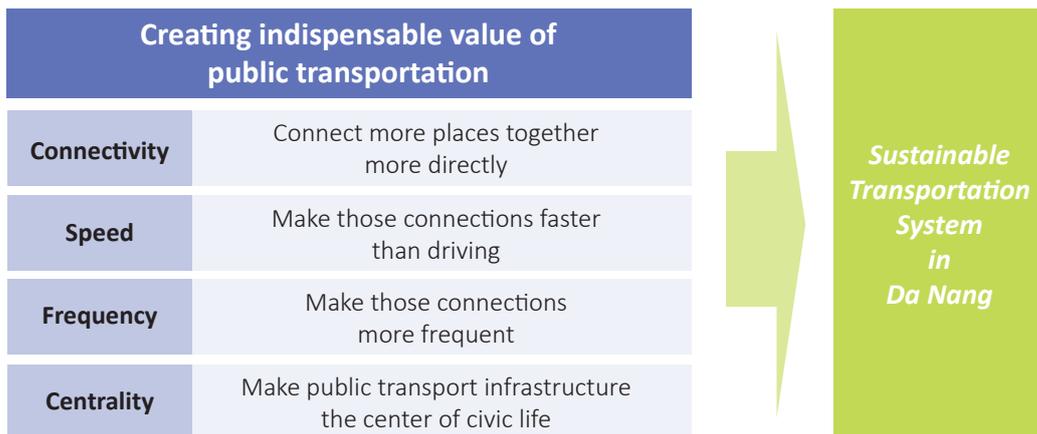
As Da Nang is currently experiencing rapid urbanization, most of the areas in the city are considered to be urban, except for the Hoa Vang sub-district which is considered to be a rural area. The sub-district of Hoa Vang also has forests, hills, and high mountains which account for 70% of the city’s total area. The sub-district is not properly connected to transport networks. Also, road quality in this area is not good and is affected by erosion during the rainy seasons, with negative implications for traffic safety. Hence, Da Nang City will need to develop and upgrade transport systems in outlying rural areas. At present, the city government has developed transport policies and mechanisms for strengthening the socio-economic development of surrounding rural and mountainous areas. Above all, overall transportation networks need to be built in rural areas. Such transport networks can play a critical role in extending local competitive potentials such as green agriculture and eco-tourism, which are valuable local opportunities for green growth<sup>13</sup>.

**Figure 15.** Potential BRT corridors in Da Nang City



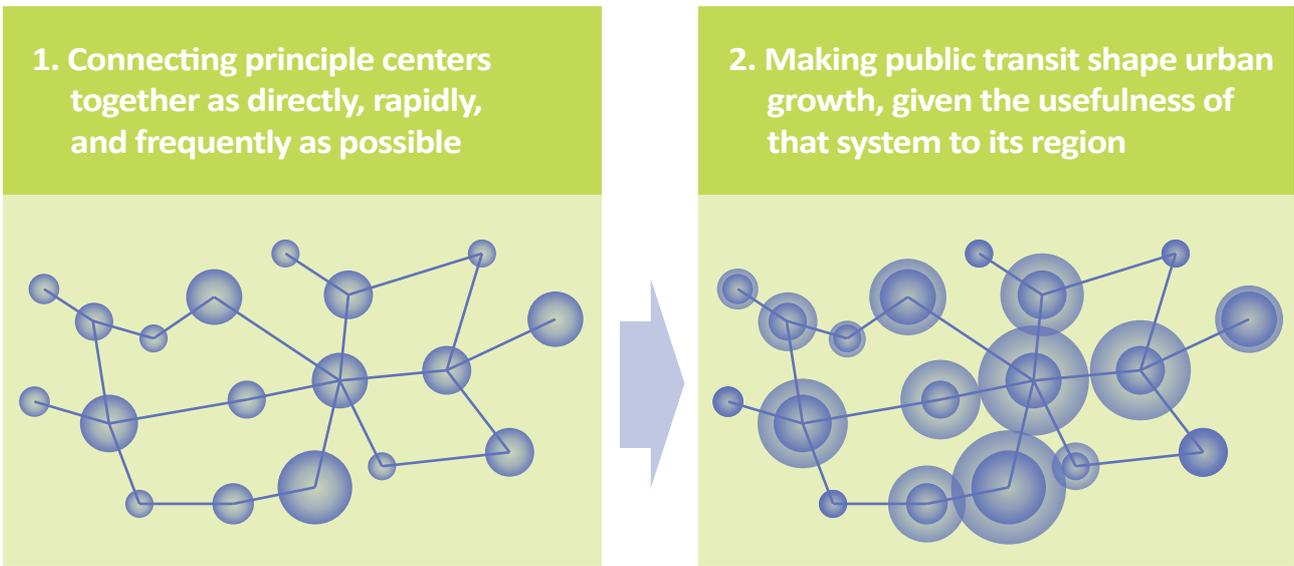
Source: Da Nang Department of Transport, 2013

**Figure 16.** Creation of market value for public transportation in Da Nang City



Source: Revised from Alan Hoffman, Designing Effective Transit, Mission Group, 2002

**Figure 17.** Integration effects of public transportation and land use planning



Source: Alan Hoffman, Designing Effective Transportation, Mission Group, 2002

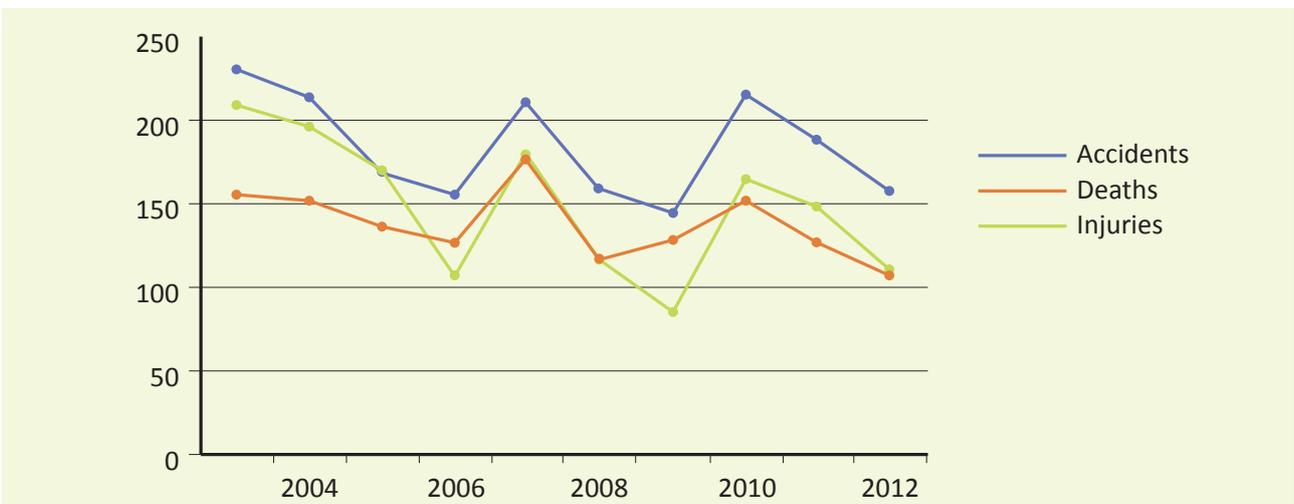
**b. Traffic Management for Safety and Pedestrian Environment**

**Traffic accident and safety challenges**

In recent years, many personnel injuries and related losses have occurred in Da Nang City due to traffic accidents. The main reasons for this are as follows: First, there are many passengers on a motorbike with a high mode share in motorbikes - almost 80% of total traffic. This means that once an accident happens, there is a great likelihood for passengers to run into danger. Child

passengers with no helmets are especially vulnerable to traffic accidents. Second, there is limited understanding about the importance of traffic signals. In back roads, it is easy to find motorbike drivers ignoring traffic signals. Moreover, jaywalking (not using crosswalks and ignoring traffic lights) have become common, leading to increased injuries and to the deaths of pedestrians. Third, various vehicles are usually mixed up especially at rush hour. As there are no exclusive traffic lanes for each transport mode, there is an increase in danger of collision for passengers and drivers.

**Figure 18.** Traffic accidents in Da Nang City



Source: Da Nang Department of Transport, 2013

Thus, measures to reduce the number of traffic accidents must be implemented in Da Nang City. Above all, the city should strengthen traffic regulations for improving citizens' safety. Violations against those who do not wear a helmet, wear a seat belt, or speed should be enforced. In addition, the city should renovate the traffic signal systems, especially for crosswalks to help pedestrians cross roads more safely. Finally, separate lanes for motorbikes and cars/buses should be considered in order to reduce crashes.

### **Improvement of the Pedestrian Environment for Walkability**

Da Nang City must be planned in a way to encourage people to walk. The city should place schools, shopping centers, and public transport networks close to residential areas in order to create an incentive for city dwellers to walk. Besides restricting business activities on the pavement to create sidewalks which are accessible for pedestrians, the city can provide people with enhanced crosswalks in streets with the use of roundabouts, speed humps, curb extensions, raised intersections and narrowing. In addition, Da Nang must develop innovative ideas for providing motorbikes with parking spaces. It will also be necessary to establish park-and-ride lots for motorbikes at the main points of the routes in order to encourage people to use buses freely after parking their motorbikes. If the pedestrian environment in Da Nang City can be improved, more people are likely to walk instead of using motorized private vehicles. This can lead to a reduction in GHG emissions, air and noise pollution, and traffic congestion, all of which contribute to the improved quality of life of city dwellers.

### **c. Pollution Management and Clean Fuels/Vehicles Development**

#### **Air Pollution and Clean Fuels**

The Da Nang City government has decided to control air pollution caused by the transport and commercial sectors for the period of 2011 - 2015. This is to ensure that the city is in line with the national standard Air Pollution Index<sup>14</sup>. However, to date, the city has not been successful in controlling air pollution. Although Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG) contribute very little to overall air pollution in comparison to gasoline and diesel, the application of these clean fuels has not begun in earnest. This is primarily due to the high price of clean fuels driven by limited investment in research/development. Thus, the city will need to mobilize civic participation by raising public awareness about the benefits of using clean fuels. In order to pursue green growth, the city should focus on investing in the development of clean fuel technologies and infrastructure. In addition, experts will be needed to provide advice

on ways to expand markets for clean fuels. Economic incentives are needed to encourage city dwellers to use clean fuels. These incentives can contribute to the development of industries which can in turn create job opportunities related to clean fuels/vehicles (e.g. CNG, LNG, other bio-fuels, and electrical modes of transport). In turn, investing in clean fuels can lead to long term health benefits for city residents.

### **Necessity for Expanding a Market for Electric Motorbikes**

The city needs to expand the market for electric motorbikes and scooters in order to deal with air pollution caused by the extensive use of gasoline dependent motorbikes. For green growth in the city's transport sector, it will be critical to link transport challenges with local industrial development. The city must foster industries for electric motorbikes such as producing related frames, motors and batteries by providing subsidies, tax cuts, and financial support for R&D for electric bike companies. One option is to give consumers small grants to buy electric bikes in order to increase the demand for these bikes. In addition, it will be essential to establish and develop electricity charging stations as part of the city's infrastructure. One of the most important benefits for introducing policies and incentives for electric motorbikes is to develop the city's competitive industries through close linkages with transport and energy. In order for Da Nang City to become a truly "green growth city," existing motorbikes should be replaced with electric motorbikes.

### **2.1.2.2 Adaptive Capacity and Local Assets to Deal with the Identified GG Opportunities**

#### **a. Local assets and practice**

As part of efforts to develop a low carbon, sustainable transport system, Da Nang City will need to introduce various policy options aimed at increasing the quality of public transport in terms of both infrastructure and services. A certain amount of road space must be allocated for public transport to contribute to increased frequency, faster speeds, fewer delays and better reliability of public transport systems. The city needs to design and construct a BRT system as good-quality public transport infrastructure in a way that enables easy access for all users while mobilizing appropriate technologies and management. There are diverse financial sources for transport development in Da Nang City. These include: central budget, city budget, PPP and ODA (Overseas Development Assistance), most of which are from the state budget (central and local).

In the period of 2006 - 2010, total investment for transport infrastructure development was 4,049 billion VND, of which the state budget accounts for 88.6%, ODA makes

up 7.8%, and PPP reaches 3.6%. In order to increase financial sources for transport development in the city, it will be important to mobilize from various sources. These include the following: a) city's central budget reserved for transport development investment; b) PPP models for the projects which are most effective in terms of finance; and c) ODA capital from international sponsors. The city should establish a coordination mechanism for the public budget and private investments based on priorities for transport development. It will be especially critical for the city to establish systematic PPP (Public-Private Partnership) mechanisms for transport development based on the division of roles between both sectors.

To date, efforts for raising public awareness about the benefits of low carbon transport have not been effectively integrated into the education system of Da Nang City. As the citizens of Da Nang have been accustomed to use motorbikes, they have yet to understand the importance and necessity for establishing a sustainable public transportation system. The benefits of using low carbon public transport include the following: financial savings for households, reduced air pollution, and reduced traffic congestion. At present, the dependence on private motorized vehicles has led to the high consumption of unclean fuels and to an increase in air pollution. Thus, prior to the implementation of a Bus Rapid Transit system, the city needs to communicate to the public the importance of traffic safety, public transportation, and the need to transition to clean fuels.

### Box 3. Public-Private Partnership (PPP)

Public-Private Partnerships (PPP) will be critical for attracting private capital investment, often either supplementing public resources or releasing them for other public needs. PPPs can use available resources more effectively by reforming sectors through the reallocation of roles, incentives, and accountability. A strong PPP allocates the tasks, obligations, and risks among public and private partners in an optimal way. The government's contribution to a PPP may take the form of capital for investment (available through tax revenue), a transfer of assets, or other commitments, such as in-kind contributions that support the partnership. The government can also provide principles of social responsibility, environmental awareness, local knowledge, and an ability to mobilize political support. The private

sector's role in the partnership is to make best use of its expertise in commerce, management, operations and innovation in order to more effectively run enterprises. The private sector partner can also contribute to investment capital depending on the form of contract<sup>15</sup>. The structure of the partnership should be designed to allocate risks to the partners who are best able to manage those risks and thus minimize costs while improving performance. Selecting an appropriate option of PPP should be based on a diagnosis of options available, as well as technical constraints and goals of the related sectors. Additional factors include legal and regulatory constraints, institutional issues, commercial, financial and financing requirements, and the interest of the market.

#### b. Institutional Settings and Capacity

Da Nang City will need to develop an economic incentive system to encourage green sustainable transport in the city, such as public transport, low-carbon vehicles, electric bikes, while increasing the dependence on the use of clean fuels. A flat fare system for the BRT as well as tax cuts and subsidies for purchasing clean fuels/ low carbon vehicles need to be considered as effective policy measures for sustainable transport development in Da Nang City. At the same time, in order to utilize effective PPP (Public Private Participation) models, the government needs to provide a capital subsidy in the form of a one-time grant, so as to make the projects more attractive to private investors. In addition, the government needs to support related projects by providing revenue subsidies including tax breaks or by guaranteeing annual revenues for a fixed time period. The city government

should therefore establish effective PPP mechanisms for sustainable transport development in Da Nang City.

The city needs to integrate similar provisions by restructuring and complementing existing regulations for the following areas: transport safety, pollution control, and reducing dependence on private vehicles. In terms of transport safety, violations against traffic rules should be regularly controlled with strict fine imposition. This will contribute to improved safety for city dwellers and will likely reduce accidents and related casualties. As part of efforts to control air pollution, it will be critical to strengthen regulations for smoke and air pollution. A system for the inspection of cars should be established in order to mitigate air pollutants generated from motorized vehicles. At the same time, some measures of private vehicle control need to be mobilized to encourage a transition to a public transport system in the long

term<sup>16</sup>. For sustainable transport development to take place in Da Nang City, it will be essential to ensure horizontal cooperation with different departments within the city government. First, the DOT (Department of Transportation) and DOC (Department of Construction) can enhance collaboration in the transport planning process by designing and implementing the development of infrastructure<sup>17</sup>. Second, the DOIT and DOT can strengthen cooperation with DOST (Department of Science and Technology) through joint research and policy formulation related to clean fuels for traffic vehicles. Third, the city government should establish a partnership with the private sector, which can play an important role in the research/development and financing of low carbon modes of transport. Finally, vertical integration and coordination with the central government is an essential prerequisite for planning and implementing related policy measures and programs/projects in a more efficient and effective way in terms of supporting institutional frameworks.

### 2.1.3 Green Space and Construction

#### 2.1.3.1 Green Growth Opportunities and Gap Analysis

The SEDP to 2020 states that the city should target a technology innovation rate of 25% per year with emphasis on modern and high-technology, while aiming to meet criteria under the environment city plan by the year 2020. These criteria are related to the areas of urban green space development, wastewater treatment, solid waste, water recycling, and the conservation of biodiversity. Along with the SEDP, the city has promulgated Decision 9298 (2012), which approved the action plan to implement

Resolution<sup>18</sup> (Central Communist Party Committee on the Development of Comprehensive Infrastructure Systems), with an emphasis on environmental infrastructure for industrial zones, high-tech and IT parks. The Resolution also emphasizes the need for infrastructure for eco-tourism areas; irrigation infrastructure, as well as climate resilient infrastructure.

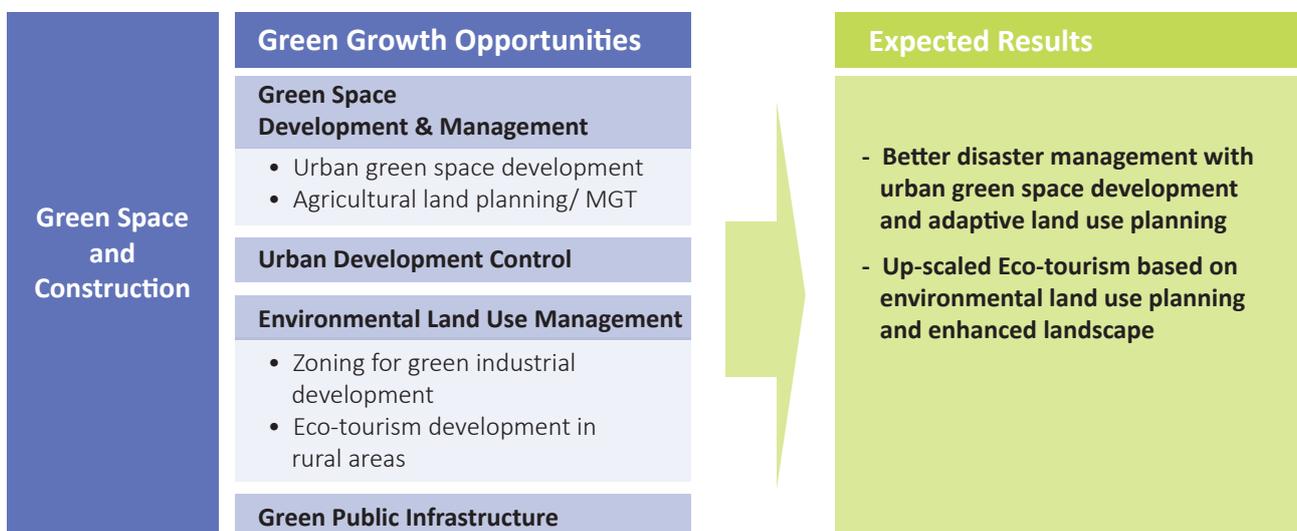
For effective management of construction activities and for the development of green infrastructure which contributes to green growth city development, the following themes should be taken into consideration: a) protect and develop greenery in urban areas; b) land use zoning and the control of development in order to protect the environment from the impacts of construction activities; c) and green public infrastructure and construction.

#### a. Green Space Development and Management

##### Urban Green Space Development

The planting of trees in urban areas can play a key role in building urban resilience to climate change. In addition, urban tree planting can absorb carbon emissions from the transportation sector, industries and households. In particular, planting mangroves is considered to be one of the most effective solutions for dealing with coastal erosion and salinization related to sea level rise. A review of the City Action Plan on Comprehensive Infrastructure Development and the Orientation of the Green Space System Development to 2020 shows that there seems to be more emphasis on planting new trees for the construction of theme parks rather than applying measures to protect existing trees, particularly those along the coast,

**Figure 19.** Green Growth Opportunities of Green Space and Construction in Da Nang City



river banks, and natural areas sensitive to construction activities. Already, a few urban tree planting initiatives have been implemented in Da Nang City. For example, the Daiwa Company and the Department of Agriculture and Rural Development have planted trees along Da Nang City's coastline. However, more efforts are needed to strengthen partnerships between the private sector and community groups for planting trees. In addition, coordination among relevant departments should be strengthened for a more holistic approach towards urban green tree development. The management of theme parks that would serve the needs of local residents and tourists should also respect natural elements and engage the private sector and the local community.

### **Agricultural Land Planning and Management**

The loss of agricultural land in Da Nang City over the period 2005 - 10 was 534 hectares. In the year 2010 to 2011, another 1,330 hectares were lost. The Construction Master Plan to 2030 predicts that thousands of hectares of agricultural land will be converted into construction. Da Nang's land use densities are low and most newly developed areas target high and middle income groups with a low density model. This type of development will require higher costs for providing necessary infrastructure and will reduce accessibility to necessary services. In addition, it will consume more energy, accelerate urban sprawl, and generate more air pollutants. The current development model shows little indication of densification in line with a shift to public transport while the extensive loss of agricultural land limits the potential of ecotourism based on sustainable agricultural production initiatives. This type of development will also have negative implications for job creation. It is likely that the risk of flooding will increase alongside with construction, with direct impacts on agricultural development and the livelihoods of the rural population. Thus, there should be a critical review of the city's land use and construction plan in order to estimate all potential relevant costs and benefits (including opportunity costs) of different land use scenarios.

### **b. Urban Development Control**

#### **Development Control in Conservation Zone, Coastal and Disaster Prone Areas**

Currently, there are no regulations for the construction of resorts along the city's coast line. Accordingly, there should be no development in the perimeter of 50m from the coast line and construction density in coastal areas should be lower than 20%. Many of the resorts constructed more than 5 years ago with high density close to the coastal line are vulnerable to severe storms. Thus, investors should respect these suggested regulations. However, regulations and measures are still needed to

ensure that the local community has access to the beaches. In addition, regulations are needed to mitigate the impacts of resort development on sensitive marine eco-systems. For poor residential areas located along the rivers where there are high risks of erosion, measures for development control (i.e. preventing encroachment on rivers) and disaster risk reduction (i.e. demarcating setback lines for development close to the banks) still need to be strengthened. In order to protect the city's conservation zones and surrounding natural environment, control over construction activities must be done through detailed plans. In such plans, there would be a commitment to restrict density, conserve large green areas and replant trees. Regular monitoring and supervision is required in order to ensure the commitment of investors.

### **Development Controls related to Eco-City Development**

Similar to other cities in Vietnam, control over future industrial and tourism development has been done mainly through the Environmental Impact Assessment (EIA) of specific projects to come up with environmental protection measures once the project is implemented. This will be critical as Da Nang City has recently decided to become an eco-city and a green growth city. However, to date there is no real thorough assessment of how these future construction activities would affect the city's land use patterns and natural environment. The same problem applies to decisions related to residential and commercial area development, which is closely related to the model for transportation and may significantly affect the efficiency of the BRT system. In addition, the recent construction of hotels and condominiums in the city center has altered the competitive landscape around the Son Tra area, although the occupancy rate is unlikely to be high through the years. Relevant regulations have been applied randomly case by case, without properly assessing the integrated impacts on the tourism sector or other eco-city development initiatives.

### **c. Environmental Land Use Management and Zoning**

The City Master Plan to 2030 with a vision to 2050 has identified land areas of restricted development as well as land for future expansion. Land areas considered for future expansion by 2050 include the area surrounding the existing airport, the military area in Phuoc Tuong, and the Tho Quang aquaculture service facility. Given that the city would need a considerable amount of land area for future expansion to accommodate the city's rapid population growth and economic growth, Da Nang will need to utilize existing land stock in the most efficient manner while protecting land for future development. Proper land use management is required for the implementation of the City Master Plan (including the staging of the infrastructure that comes with development), appropriate high density zoning, and policies that encourage the

speedy development of land that has been recently opened for construction.

Reference should be made to the densification strategies of other cities in other countries which promote environmental and social sustainability. For example, the densification strategy of Cape Town in South Africa indicates that density increase should be applied in mixed land use areas, with scale, height, and design fit for the existing fabric of the surrounding community. In addition, such a density strategy can accommodate large flows of traffic with provisions for upgraded public transport which does not cause negative impacts to the natural environment.

Another important point to be considered in relation to the city’s urban development is the suitability of land, particularly areas that are prone to climate-related disasters. Da Nang’s climate resilience action plan (2010) has identified areas likely to be affected by different types of climate hazards. For example, Lien Chieu and Son Tra have been identified as areas most vulnerable to typhoons, floods, drought and salinity.

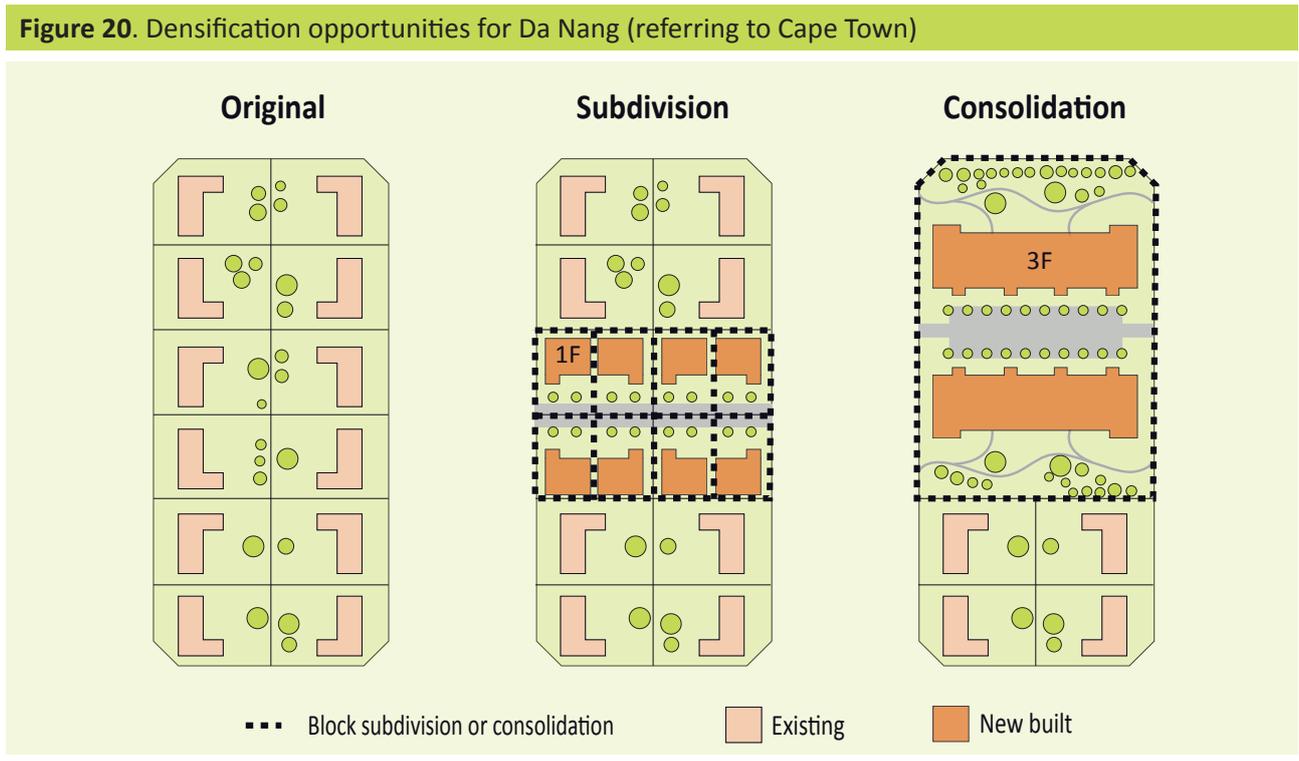
Suggestions for building resilience to climate change should be updated and included in the city master plan and the SEDP. The city should restrict future urban development in disaster prone areas to avoid the costs of building climate resilient infrastructure and to increase the suitability of these land areas for future construction and urban development.

**Zoning for Green Industrial Development**

Da Nang will focus on developing large scale high-tech zones in the Hoa Lien and IT industrial zones in Hoa Nhon. Apart from issues arising from agricultural land acquisition, these areas have been identified as flood prone areas that may require appropriate disaster mitigation measures. In addition, measures to address the social impacts from these high-tech zones need to be identified (such as job creation and resettlement for farmers). In tandem, a detailed plan of these zones should be updated to integrate disaster mitigation responses for these zones and for the surrounding region. Furthermore, the possibility of environmental pollution should be examined in detail so that polluting industrial development is not close to water supplies, river banks and eco-tourism spots. For the brownfield areas (location of industrial facilities to be relocated), priority should be given to green space and constructed urban drainage infrastructure systems, like parks and retention ponds, to increase water absorption capacity for the inner area of the city.

**Rural Areas Eco-Tourism Areas Zoning / Preservation Areas**

The majority of future tourism development will be located nearby sensitive landscape areas of the city such - as along the coastal line of My Khe-Non Nuoc, riversides (Han river, Co Co River) and in the mountainous areas like Ba Na and Son Tra. In order to ensure that these activities do not cause significant harm to the natural



environment, the city will need to implement appropriate environmental preservation zoning in order to guide new tourism development in these areas. In addition, the problem of environmental pollution from aquaculture activities in coastal areas in the city and deforestation should also be fully considered in environmental conservation zoning.

#### **d. Green Public Infrastructure and Construction**

In order to implement the “National Target Program on Energy Saving and Efficiency in Da Nang City in the 2011 - 2015 Period,” the Da Nang Department of Construction has issued the “Guidelines for Measures to Save and Use Energy Efficiently for Construction Works.” The target is to save 5% - 8% of the city’s total energy consumption and to save 11% - 12% of electricity used for municipal government offices. The city has also approved the project “Energy Savings and Renewable Energy” for the period of 2011 - 2015 at a total cost of 20 billion VND. Accordingly, there are five programs to be implemented

during this period. These include energy saving programs for 1) public agencies, 2) key enterprises, 3) public lighting, 4) school lighting, and 5) buildings and hotels in the locality.

Along with these efforts, the Da Nang administrative center, a building that is expected to achieve LOTUS (a Vietnam-specific green building rating system) is expected to be completed by the end of the year 2013. This would send a powerful message about the importance of this type of green building design and its viability in relation to the city of Da Nang. With the high speed of construction in Da Nang, including new residential areas, a high-tech park, industrial zones as well as commercial and tourism facilities, the city has a great opportunity to apply measures for reducing energy consumption in buildings and industrial production. In addition, fishery and agricultural industries could also apply low tech energy saving measures in their production processes. The principle of efficiency should be applied to water, energy, and waste.

### **Box 4. Vietnam Green Building Council**

Since January 2007, the Vietnam Green Building Council (VGBC) a subsidiary of the Green Cities Fund, an international non-profit based in California, USA, has been promoting green building initiatives in Vietnam. The Vietnam Green Building Council advocates eco-friendly buildings through activities such as Green Building rating tools called LOTUS, and seminars and workshops on the benefits of green buildings for Vietnam. In addition, the Vietnam Green Building Council provides training

courses on green basics and on LOTUS Green Building assessments and online Green Data-base resources. To date, only 41 buildings in Vietnam have received green building certificates under LOTUS, LEED (US), Green Mark (Singapore) and Green Star (Australia). Thus, city governments must encourage green building standards for public buildings and introduce incentives for the private sector to promote green buildings in Vietnam.

#### **2.1.3.2 Adaptive Capacity and Local Assets to deal with the Identified GG Opportunities**

##### **a. Local Assets and Practices**

The Association of Nature and Environment Protection of Da Nang City collaborated with the City Peoples Committee to plant 573 trees at the Da Nang steel factory as well as primary and secondary schools throughout the city. These initiatives should be promoted and further efforts are needed to mobilize community participation for tree planting. Community interviews found that many households would like to be involved in tree planting. Although the proposal for raising public awareness about urban tree planting has been approved, the specific mechanism for cooperation between the community and relevant government agencies needs to be clarified. Priority should be given to disaster prone areas where local communities, with government and private sector

support, can lead the replanting of protective forests. Newly established industrial parks should be encouraged to apply eco-industrial criteria, including criteria for green space and trees. Successful suburban planning models for community gardens, urban agriculture, and green wedges or agricultural belts can be considered for application. Moreover, enabling policies and incentives from city government will strengthen the role of the private sectors .

The relevant stakeholder capacity gaps identified in interviews include the following: a) appraisal of new technologies (to identify clean technologies); b) criteria development for investment in high-tech parks; c) establishment of cost recovery mechanisms for investment in green public infrastructure; d) accurate forecasting of city development, and e) calculation of optimum density zoning to integrate climate change mitigation, adaptation and disaster risk reduction in land use and construction planning. The establishment of the Da Nang’s high-tech

park will provide an opportunity for the city to promote green technologies. Therefore, the high-tech park and the green growth strategy for Da Nang City can be connected through the introduction of an innovative knowledge industry and a green model city that includes renewable energy technologies, green mobility, extensive inner-city natural parks, and the promotion of culture, industry, and technology. It is also necessary to consider multi-purpose land use and site planning on a diverse scale, with flexible housing and land use schemes that respond and adapt to future demand. Neighborhood living and service facilities with extensive green space will foster a multiuse recreational area convenient to the industrial zone.

Under the framework of the Da Nang Environment City Plan, an estimated budget has been developed for 41 projects, including those related to vegetation, eco-villages, and the SEA for socio-economic development plan of the city to 2020.

Investment capital constraints in the city budget and land acquisition are leading to delays in implementation. These issues should be dealt with in collaboration with planning institutions, the private sector, the local community, and mass organizations to amend the plans and to ensure effective and efficient resource use. This approach will develop a financially feasible option while taking into account the demands and benefits of all stakeholders. Following the city decision no.1833/QD-UBND dated 13<sup>th</sup> March, 2013, which approved the plan for the socialization of urban tree development, technical support and guidelines for green tree planting and protection should be improved in order to specify the partnership mechanisms

needed for investment in theme park construction projects. The Department of Foreign Affairs recently submitted a list of seven projects calling for ODA in Da Nang to the People's Committee. Given the limited city budget for many development programs, the integration of green space development and local resilience improvement into planning, as well as the investment of basic infrastructure should be further considered.

Under the National Target Program for Energy Saving and Efficiency and the Da Nang Environment City Plan, the city aims to improve the community and institutional awareness of environmental protection and energy savings. The Plan specified that environmental issues should be integrated into education at different levels, requiring the active participation of schools and universities. As many activities only started in 2012, results from this initiative are yet to be evaluated. In order to promote the creation and protection of urban green space within the community, the Urban Green Tree Development Plan recommends that civil society groups such as the City Father Land Front Committee, the Women's Association, Youth Association, Farmer Association, Veteran Association, and Labor Association introduce awareness raising activities. These groups should be supported through the integration of awareness-raising programs within the Environment City Development Plan and SEDP. Moreover, the public should have full access to information regarding the dangers of climate change. Efforts should be made to mobilize mass media agencies to accelerate awareness raising campaigns for green tree development and techniques for energy savings.

**Table 3.** Key Projects for the Development of Trees and Parks

No.	Name of program/ Projects	Owner	Schedule	Capital (billion VND)	Schedule		Investment source	Notes
					to 2015	2016 - 2020		
1	Youth park	Department of Construction	2012 - 2015	50	50		PPP	
2	Vendure green trees street, small park, gardens	Department of Construction	2012 - 2020	300	100	200	City budget	
3	Son Tra international park	Department of Construction	2015 - 2020	500		500	PPP	
4	Urban green tree development 2011 - 2015	Department of Construction	2011 - 2015	1,870	300	500	City budget and other outside sources	After 2020, it will be 1,070 million dong
	<b>Total</b>			<b>2,720</b>	<b>450</b>	<b>1200</b>		

**b. Institutional Settings and Capacity**

The city is committed to implementing the tax exemption policy for the reduction of land rent fees, land use fees, preferential land rent, infrastructure use fees, waste water treatment fees, value added tax, and corporate income tax for high-tech development. The city will also support high-tech investment by facilitating comprehensive services for dealing with immigration procedures, residence registration procedures, and procedures for the establishment of businesses.

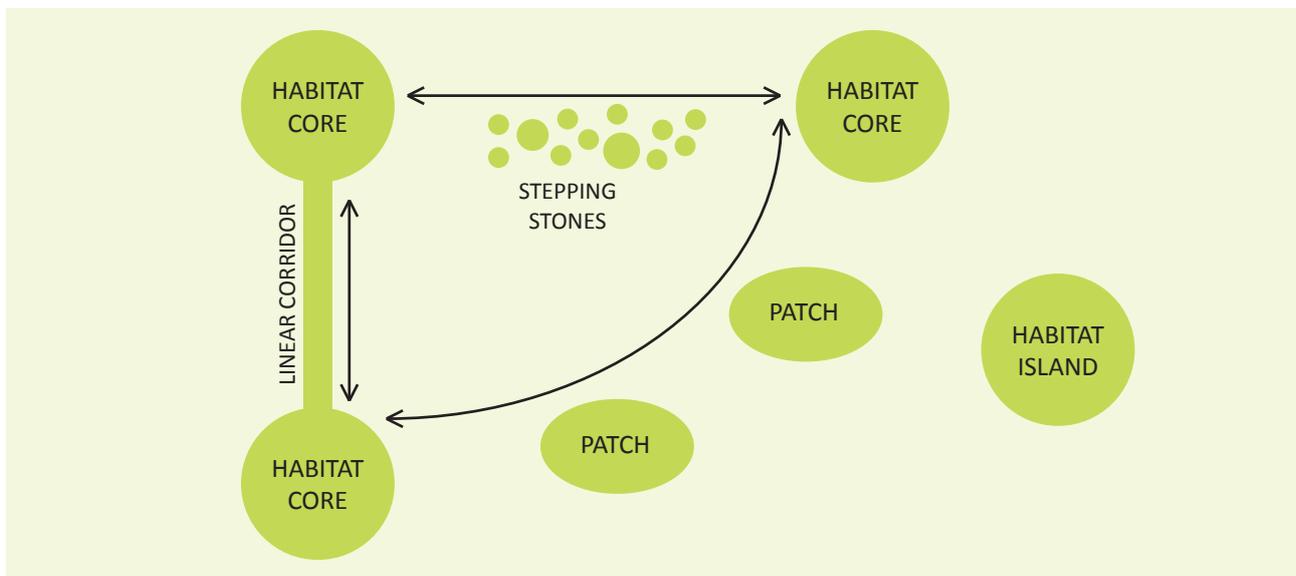
In specific cases, insufficient local capacity in technology appraisal is a serious obstacle. The city needs to develop a system to specify the appropriate incentives and disincentives for different types of technologies. International experiences can be drawn upon to determine a system for inviting industrial development, offering land price discounts, and other such incentives. Green building standards are currently being improved and expanded to enhance the benefits offered to investors who wish to invest in green, sustainable buildings. Traditional green development incentives have focused primarily on the financial savings from reduced energy consumption and the improved and favorable visibility of companies willing to support sustainable, economic growth. Current discussions are now looking at the possibility of providing investors with a faster approval process and favorable conditions for project appraisal. It is yet to be determined how this policy can be effectively implemented.

There are construction density regulations within sensitive landscape areas (coastal, riverside, Ngu Hanh Son, Son

Tra, Ba Na, Hai Van, along the Han River) which aim to reduce and control negative environmental impact related to construction activities. In 2012, Da Nang City implemented the “Regulation on Architecture” with the aim to control architectural details for public and residential buildings. The regulation aims to ensure that buildings use environmentally friendly materials, are designed for efficient energy use, are appropriate to the local environment, and can cope with the detrimental impacts of climate change. All buildings are required to comply with environmental protection regulations (e.g. waste water treatment, air pollutant emission). Principles of landscape urbanism should be included within planning and building regulations to ensure the protection and utilization of green space for landscape improvement, carbon absorption, and the mitigation of the urban heat island effect. One idea is to introduce the “patches and corridors” approach (Figure 21) in integrating nature in the urban context, which aims to protect the natural landscape, such as aquifers, stream headwaters, and animal and fish species.

Although the Strategic Environmental Assessment has been conducted for long term plans, it is still lacking in the list of investment projects consolidated by Department of Planning and Investment. Thus, the holistic approach specified in the Da Nang Environment City Plan has not been adequately applied for the mitigation of environmental impacts. This should have been integrated into the process of program/project appraisal of the DPI (Department of Planning and Investment) which includes criteria for air quality, noise control, tree density, water quality, waste water treatment, solid waste collection, and

**Figure 21.** Patches and corridors of Habitat Cores for Da Nang City



Source: Forman, R.T.T., Urban Regions: Ecology and Planning Beyond the City, Cambridge University Press, 2008

recycling. Moreover, the SEA framework should further emphasize the need to develop strategies for mitigating the potential impacts of future development and land-use plans on the suburban environment.

Although there are many sectors involved in the development and management of green space and infrastructure, the Department of Construction and the Da Nang Green Park Limited Company are the primary organizations responsible for managing activities related to green space. The Department of Construction manages spatial development and establishes the development control framework, while the Da Nang Green Park Limited Company is responsible for the implementation of projects related to green public infrastructure. As specified in the Da Nang Environment City Program, Environmental Impact Assessments (EIAs) should be developed for newly established projects by the Department of Natural Resources and Environment (DONRE). The involvement of the DPI and the Department of Finance is critical in this process as they are important stakeholders in project appraisal and budget allocation. However, there is a need to address the limited cooperation between DONRE and DOC in the preparation of construction and land use plans, as well as environmental and social assessments. This will control urban sprawl into agricultural land, protect existing urban green space, and prevent future expansion in disaster prone areas. Coordination between DOC and DOST in the appraisal of technologies and the issuance of certificates for green buildings should be improved. Enhanced cooperation between local government, the private sector, and research institutions is needed to strengthen local capacity for innovative and green technologies.

Finally, our review finds that there are inconsistencies between the Climate Change Action Plan, Master Plan,

SEDP, and the Da Nang Environment City Plan. This is particularly evident in the differing lists of prioritized programs and projects. Efforts should be made to integrate climate change adaptation and mitigation strategies into all sectoral plans and the SEDP: particularly those regarding land use, housing and green tree planting. This will improve cooperation and ensure the allocation of sufficient resources for activities for building resilience to climate change.

## 2.1.4 Green Industrial Development and Management

### 2.1.4.1 Green Growth Opportunities and Gap Analysis

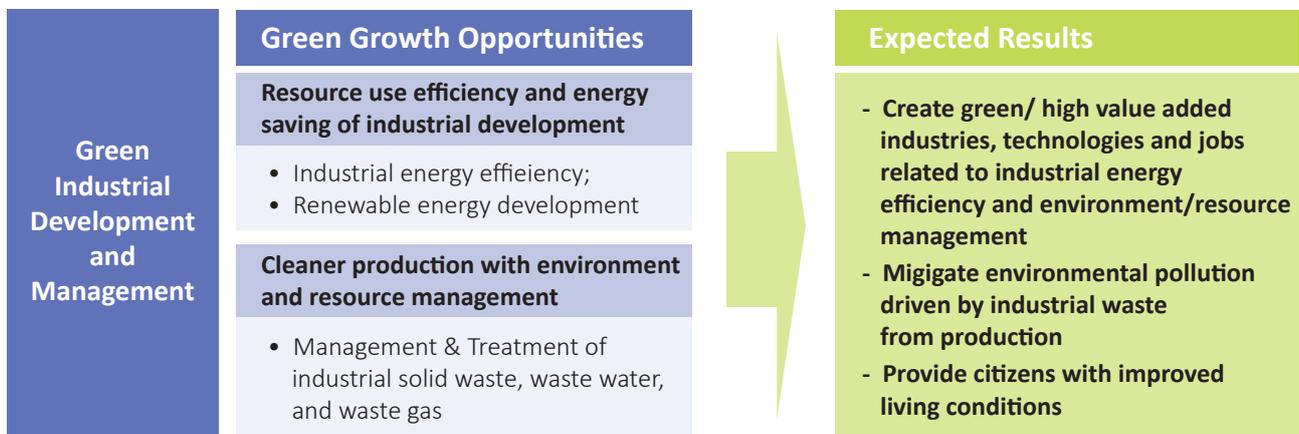
SEDP goals for 2020 focus on the development of high value industrial products. Clean and economically effective industrial development with green technology development is needed to increase overall industrial competitiveness. Economic sustainability would be strengthened by efficient resource use and clean, effective waste disposal. Green growth opportunities in industrial development are as follows,

#### a. Resource Use Efficiency and Energy Saving in Industrial Development

##### Energy efficiency in industrial production

The *Act on Efficient and Effective Energy Utilization* (Decision No.1294/QĐ-TTĐ dated 11/8/2011), states that high energy consuming enterprises must conduct Energy Auditing (EA) every three years. Initially, the Da Nang Industry Promotion and Development Consultancy financially and technologically supported enterprises

**Figure 22.** Green Growth Opportunities of Green Industrial Development & Management in Da Nang City



Source: Forman, R.T.T., *Urban Regions: Ecology and Planning Beyond the City*, Cambridge University Press, 2008

through this process. However, limited investments and inadequate knowledge and resources, combined with a long investment payback period continue to present challenges. Training programs are needed to improve expertise on efficient and effective energy utilization and to develop and adapt new technologies. The city must strengthen its incentive system to encourage industrial enterprises to establish innovative production methods that improve energy efficiency. In addition, the development of new, green technologies will spur job growth in the industry. A decrease in energy and resource use will reduce overall production costs and enhance the competitiveness of enterprises in the city.

### **Socialization of Solar Energy and Renewable Energy Development**

Da Nang City has a high potential for solar energy power. Solar power is dependent on a stable and favorable sunny climate. The expansion of renewable energy power in Da Nang City is restricted by the lack of knowledge and support from the local government and the community. A possible approach for the establishment of solar energy and other forms of renewable energy in Da Nang City would include establishing a locally focused development plan for encouraging the use of renewable energy power, setting up a policy mechanism for supporting research and technology transfer, using renewable power for generating electricity, expanding to heat and fuel, and cooperating with international organizations on human resource development

### **b. Cleaner Production with Environment and Resource Management**

#### **Industrial solid waste management**

Da Nang produces 292 tonnes of industrial waste per day. Generally, industrial facilities make contracts with URENCO for collecting their industrial solid waste. However, these enterprises do not separate their waste to the degree needed to meet environmental standards<sup>18</sup>. A recent report (2010) on the violation of environmental regulations in Da Nang City found that 40% of violation cases are related to the inappropriate disposal of hazardous waste. Previously, the discharge of toxic substances from industrial production has caused public health problems as well as eco-system degradation. Water and land pollution has often been caused by discharges of toxic waste substances. Waste separation at source would mitigate environmental pollution and prevent<sup>19</sup> hazardous wastes from mixing with different types of wastes or from being inadequately treated at industrial parks.

Even though some industrial by-products could be recycled as resources through exchanges among enterprises, those efforts have not been implemented.

In addition, the appropriate and regular monitoring system should be established at the industrial parks. Da Nang needs to strengthen related regulatory frameworks and departments such as the DOIT (Department of Industry and Trade) and DONRE (Department of Natural Resources and Environment). This would establish a regular environmental monitoring system and improve regulation enforcement. Finally, enterprises require technical support, guidelines, and incentives for appropriate hazardous waste treatment and waste separation at source.

#### **Industrial waste water treatment**

Da Nang has 6 industrial parks. Prior to 2008, only two industrial parks had centralized waste water treatment systems while the remaining parks treated waste water internally. This often led to the direct discharge of waste into the environment.

Currently, 94% of units in all of the city's industrial parks are connected to waste water treatment systems, and 50% of waste water is treated by following regulatory standards<sup>20</sup>. Only 5.6% of the units are not connected to the system due to limited infrastructure<sup>21</sup>. Limitations can be seen at the Da Nang aquaculture industrial park and Tho Quang ship station, which have struggled with complicated water pollution problems in the nearby residential areas, as water recycling and water efficiency programs are yet to be implemented. In addition, even though water recycling for industrial use is important in terms of water resource efficiency, it has not been applied in the city. Thus, there is a need for regulations and incentives which contribute to the reduction in illegal discharges. Considering this situation, it will be essential for an individual industrial park to build up a centralized system for the collection and treatment of waste water with strong environmental standards in order to significantly reduce pollution. In this respect, the city should develop related technologies and human resources for treating waste generated from industrial production in cooperation with enterprises in industrial parks and research institutes.

#### **Industrial Waste Gas and Air Pollution**

Industrial facilities release air pollutants such as particulate matter, sulphur dioxide, nitrogen dioxide, lead, and chemicals that react to form ground-level ozone. The development of industrial parks has been the main source for generating waste gas. The largest source is from industrial parks for steel production, construction ingredient chemistry, and ship building. These pollutants can cause severe health problems and greatly affect local eco-systems. Dust pollution is a particular concern in factories that produce cement, fertilizer, and electricity. Since 2008, the city government has not allowed steel refining companies with high air pollution to invest their

Figure 23. Industrial parks in Da Nang City



Source: Report on Assessment of Da Nang industrial parks using eco-industrial park criteria, VPEG project, 2013

new projects in the industrial parks, thereby greatly improving air quality. Enterprises have been encouraged to invest in innovative technologies to treat waste. The city should therefore develop and strengthen regulatory schemes for air pollution caused by industrial waste gas. However, this is restricted by a lack of investment, inadequate infrastructure, and low awareness and knowledge of waste gas recycling programs.

In order to pursue industrial green growth opportunities, the city should address the following measures to encourage the safe and efficient disposal of industrial

waste: a) improve the management and disposal of industrial toxic substances; b) strengthen the monitoring system of industrial waste on a regular basis; c) identify water recycling opportunities and develop and encourage a centralized water recycling system; d) enhance the regulatory system of overall industrial waste management; and e) encourage the recycling of by-products. These measures will likely encourage manufacturers to treat industrial waste in a safe manner, recycle by-products, and improve energy efficiency. In turn, this will contribute to developing related industries and technologies.

### 2.1.4.1 Adaptive Capacity and Local Assets to Deal with the Identified GG Opportunities

#### a. Local Assets and Practices

Energy Auditing (EA) is an important tool for improving energy efficiency. The Center of Industrial Development Consultancy and Industrial Encouragement under DOIT and the Center of Energy Efficiency and Technology Transfer Consultancy under DOST are able to conduct EA programs for enterprises. However, both agencies lack the knowledge and resources necessary to maximize energy savings. Their industrial environmental management strategies are outdated and there are difficulties faced when trying to improve production technologies and apply energy-saving techniques.

Despite the number of projects in green industrialization, the lack of financial and pricing mechanisms has made fund mobilization difficult. Coordinating budgetary allocations from different sections of government and private industry has proved difficult, making it challenging to concentrate on specific programs to achieve goals for industrial energy efficiency and environmental protection. Modern technologies are too expensive and technology transfer faces difficulties due to limited human resources. Appropriate PPP models should be established to fully utilize private resources, technologies, human resources, and management.

It is important to raise public awareness about industrial environmental management. To date, most enterprises have not properly managed and treated their industrial waste. Indeed, poor waste management often stems from a lack of knowledge and understanding of the severe damage to the environment caused by toxic chemicals and industrial discharge. Educational programs, organized in collaboration with the city government, NGOs and CBOs (Community based organizations), are crucial to ensure that enterprises understand the extent of damage potentially caused by their activities and how they can prevent environmental and health problems. These programs should be extended to the general public and school classrooms so that communities fully understand the threats of near-by industrial plants.

#### b. Institutional Settings and Capacity

The financial and technical EA support provided by the National Target Program on Efficient and Effective Energy Utilization needs to be expanded to encourage the industrial sector to actively participate in energy saving solutions. At present, the city government does not have clear and specific incentives for greening industries and industrial parks. Thus, the city should increase and expand the incentive system to encourage green industrialization. This should include specific and clear opportunities such

as tax cuts, technical support, and further collaboration between the enterprises. Further strategies could be developed through cooperation and participation between government, industry, and R&D institutions specializing in pollution control and energy efficient technology. Efforts should also be given to the development of incentive mechanisms for enterprises providing environmental services (i.e. research and consultancy on environmental technologies, clean energy, and other environmental products).

The city has implemented regulations based on the Act on Efficient and Effective Energy Utilization and the Regulation on Environment Protection in Industrial Parks. The DOIT has created energy saving guidelines for key energy users (industrial enterprises) and waste management inspections are conducted annually. However, a stronger sanction system is needed to encourage compliance with environment regulations and energy efficiency. The city should set up and regularly update a database which records the resource use and the waste generation of industrial facilities. This will require enterprises and industrial parks to register their resource use and waste management information.

It is essential to strengthen cooperation and coordination among the Department of Industries and Trade (DOIT), Department of Science and Technology (DOST), and Department of Natural Resources and Environment (DONRE). Thus far, collaboration among departments has not been strong. DOIT and DONRE should jointly establish a regulatory framework on industrial resource management, energy/resource efficiency, and integrated industrial waste management. In collaboration with DOST, DOIT needs to develop industrial greening technologies. When conducting an EIA (Environmental Impact Assessment) for investment projects, the DOIT needs the authority to enforce environmental regulations. This would improve enforcement and provide comprehensive and consistent supervision of industrial environmental management. For developing industrial environmental technologies, public-private-partnerships should be utilized. The Da Nang government should act as coordinator in the development of a sustainable city by working with enterprises (both manufacturing and technical), universities, and R&D institutes to promote technological innovation, the application of clean production strategies, and to increase job creation.

## 2.2 NATURAL RESOURCE BASED MANAGEMENT AND DEVELOPMENT

### Natural Resource Management and Green Growth

With changes in land use and rapid urbanization, the need to sustainably manage Da Nang’s natural resources (water, forests, and minerals) is becoming increasingly important. Efficient resource use is crucial to ensure environmental protection while also supporting the economic development of the region. Da Nang has an opportunity to sustainably expand the industrial sector to ensure natural resources, such as clean water, are efficiently shared between all who need them, from enterprises to communities to eco-systems. Water resources and eco-system are precious and should be used in a sustainable manner in order to support the development orientation of Da Nang City. This will encourage new businesses such as eco-tourism, and reduce poverty through job creation in emerging industries. Improved natural resources management can also lead to poverty reduction in surrounding rural areas. Increasing climate change resilience along with forest and watershed management will reduce economic losses (i.e. rebuilding infrastructure from climate impacts, social welfare costs related to public health issues).

### 2.2.1 Agriculture and Rural Development

#### 2.2.1.1 Green Growth Opportunities and Gap Analysis

Agricultural land loss in the Da Nang area has resulted in high value added agricultural production and an acceleration of rural development in relation to tourism and service industries. Rural areas urgently need to reduce poverty and maximize production. However, the

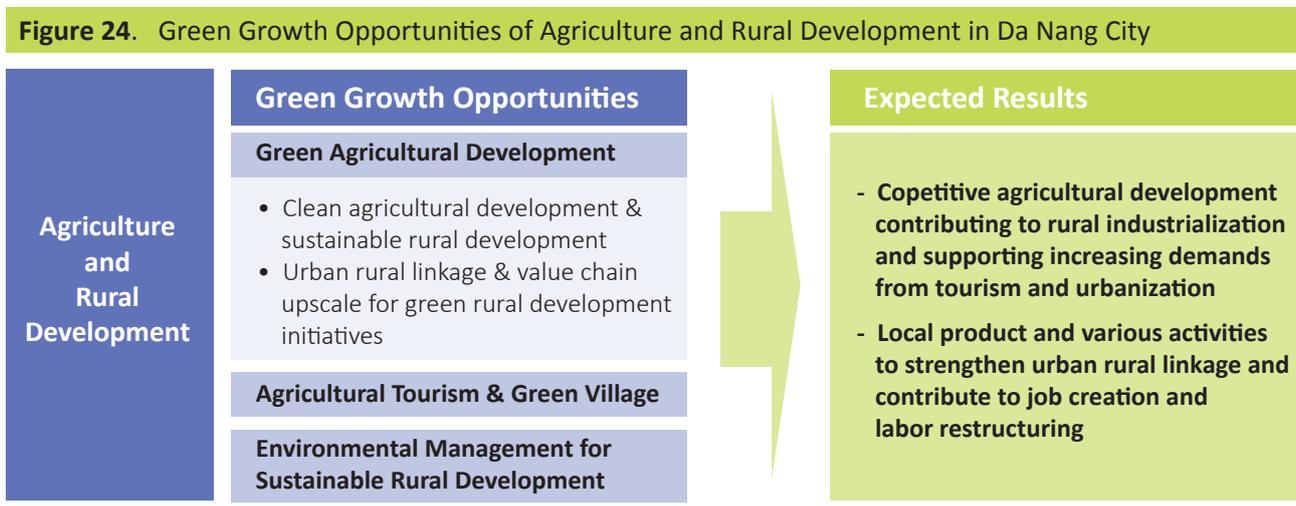
increasing agricultural output in a limited area requires further skills and resources which are currently non-existent in rural communities. Combining agricultural development, industrial expansion, and tourism could assist in reducing agricultural land loss and labor surplus issues. By improving the quality of locally produced products, Da Nang has the opportunity to sell high-quality products to the increasing urban and external market. Moreover, sub-districts, such as Hoa Vang, have the potential to increase sustainable development through existing enterprises (i.e. Hoa Lien high-tech park; central IT park; Golden Hill City) and new initiatives based upon cultural resources, eco-tourism, and High-tech Park plans.

#### a. Green agricultural development

##### Clean Agricultural Development and Sustainable Rural Development

With increasing demand for organic products, Da Nang has made remarkable progress in producing clean, high quality agricultural products for the community. By establishing safe and clean vegetable growing areas which meet the VietGAP (Good Agricultural Practice) standards, many regions are now producing organic products such as: rice and mushrooms (Hoa Tien Commune), flowers (Hoa Lien and Hoa Phuoc communes), and freshwater aquaculture in the Hoa Khuong and Hoa Phong communes<sup>22</sup>. In recent years, farmers in many sub-villages, such as Tuy Loan, have been trained to maintain the high standards and to use bio-fertilizer. This will be extended to other districts using a range of models, such as those designed to improve fisheries or to utilize biogas.

In early 2013, three production units reached VietGAP standards. This supplies enough for households and small businesses, but meets only 5 - 10% of market demand in Da Nang while demand for agricultural commodities is very high. Direct sales of high quality agricultural



products have increased due to growing demand from high-end resorts in the area. Cooperation between social enterprises and local farmers has expanded agricultural business models and methods to improve sustainable income to rural areas. For example, organic products such as oyster mushrooms are now being sold to Big C and Coop Mart. However, despite financial support from the local government and the ADB (Asian Development Bank) for organic farming using VietGAP and training for green agriculture development, farmers still do not have the financial capacity to support organic farming programs. Moreover, water resource management needs to be improved for the up-scaling of green agricultural activities.

### **Urban Rural Linkage and Value Chain for Green Rural Development Initiatives**

Strengthening urban-rural linkages would deal with the weakness of current rural development patterns while helping urban areas to effectively mobilize necessary resources. Rural areas need to up-scale value chains to serve diverse demands from service industries, high-tech and information parks, and urban residential areas. This will enhance the positive urban-rural economic relationship by expanding appropriate technology and market information, and accelerating labor restructuring in rural areas (particularly natural resource based developments such as eco-tourism and village tourism). Access to social services will also be improved which reduces socio-economic vulnerability in poor and isolated areas. As Da Nang's rapid urbanization reduces agricultural land, some vegetable growers in Son Tra District are taking advantage of vacant land lots to grow and sell vegetables. However, these vegetables are not of the quality or quantity required for the external market. As such, the city needs to consider investing in appropriate technology to increase productivity and quality to meet the market demands. Da Nang still lacks the infrastructure, human resource capacity, and curriculum development.

### **b. Agricultural Tourism for Sustainable Rural Development**

#### **Agricultural Tourism**

The international demand for agri-tourism activities across Vietnam has increased in recent years, as seen in the neighboring Tra Que village in Hoi An City. Agri-tourism not only supports sustainable and responsible tourism but also encourages local investment in VietGAP standard organic agricultural production. Expanding agri-tourism will directly increase demand for organic farming enterprises, which in turn, will strengthen the demand for Da Nang products on the growing market for safe, clean agricultural products. Ultimately, sustainable agricultural production and eco-tourism in the region will contribute to labor restructuring. This will directly contribute to an

increase in revenues in rural areas and better accessibility to social services. It will be important for environmental measures to be monitored in parallel. Further research is needed to develop viable business models that include participation from local communities, businesses, organizations, and government. The Vietnam Farmers Associations has successfully initiated small agri-tourism programs (farm tours) in the western provinces (An Giang, Tien Giang) but further work is needed to ensure this new type of service can fulfill its potential in creating rising income opportunities for rural people.

### **Green Agriculture and Eco-village Development**

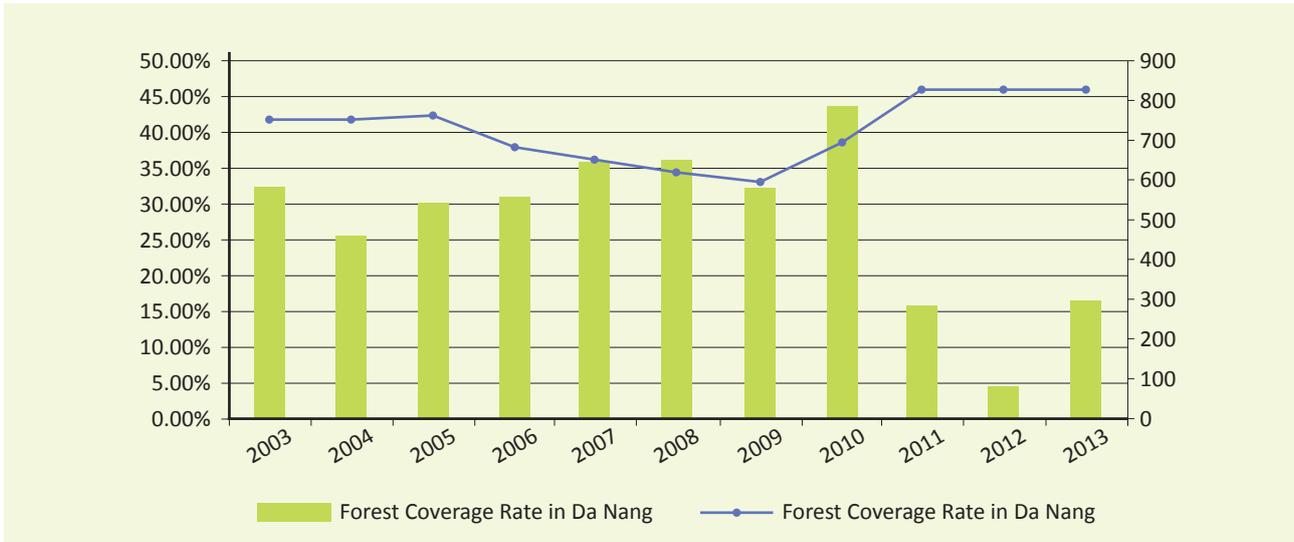
Da Nang plans to develop eco-cultural tourism in Hoa Vang District where the majority of trade villages strongly embrace and maintain traditional culture. Combined with the "no junk town" model which is currently being implemented in Phong Nam village and Bo Ban temple along Tuy Loan river, the city hopes to encourage handicrafts and organic farming. In addition, tourism routes through Hoa Ninh, Hoa Phu, and Ba Na Hill could be linked to enhance agricultural tourism. The expectation is to develop eco-villages along with plantations that grow one kind of fruit tree connected with tourism. Vietnam's current eco-tourism sector comprises primarily of home stays and community tours for international tourists. However, there is no successful pilot project for connecting tourism with agriculture due to limited tourism infrastructure development. Thus, the local city government needs to create competitive green agricultural production and to promote Hoa Vang as an eco-village. The local government must create a detailed plan for developing eco-villages which promote sustainable socio-economic development for the city and benefit local livelihoods and the environment. Coordination and cooperation among departments, agencies, organizations, and the local government is necessary.

### **c. Environmental Management and Rural Development**

#### **Water and Waste Management for Cleaner Production in Rural Areas**

In order to promote eco-tourism in Da Nang City, the problem of water leakage needs to be dealt with. In addition, waste water treatment coverage must be expanded, mainly from urban to rural areas, especially in Hoa Vang District. Large irrigation companies have left the area due to a declining population and increasing costs. It will be critical that Da Nang develop efficient irrigation and water supply systems to bolster agricultural production, which in turn, can lead to greater food security for residents. To improve waste management, organic fertilizer has been made from compost for planting mushrooms. A biogas cellar, for farmers in

**Figure 25. Forest coverage rate in Da Nang City**



Source: Da Nang Department of Natural Resources and Environment (DONRE), 2013

Hoa Tien and Hoa Xuan commune (Phase 2 of Project QSEAP), will contribute to generating electricity and environmental protection. For biogas production, there is financial support for districts and communes. In addition, there are trainings on biogas production, which have been successful for households involved in farming. The biogas model is also expected to save costs for production activities while it helps to reduce greenhouse gas emissions related to farming.

**Forestry and Watershed Management**

High river flows, riverbed deepening, bank destabilization from construction, and mining in watersheds are increasing erosion, altering river flow, and polluting the waterways. Water pollution has a significant effect on downstream households and sustainable forest and watershed management is critical for protecting community and agricultural health. The forest coverage rate of the city has risen from 41% in 2003 to 46% in 2012 (higher than the nationwide average of 40.2%).

It is important that river systems are managed in their entirety. From the head waters to the estuaries, forests are critical in the prevention of river erosion and water pollution. Although Da Nang City has been expanding urban forest cover, more needs to be done to ensure the health of the forests and waterways throughout the region. This includes supporting farmers in tree planting exercises and involving all sectors of the community in protecting forests throughout the region. This will not only ensure a safe, clean environment for local communities, farms, and industry, but also build resilience to climate change. Supporting farmers to plant trees (ornamental

and for gardens) along hill sides can provide revenue for surrounding rural areas and reduce material imports from other provinces.

**Sustainable Fisheries Management and the Marine-based Economy**

Recently, the local government has been encouraging food processing such as fresh seafood products. However, inadequate waste management in the fisheries sector is a serious problem. Cleaner seafood production would help to expand value chains to urban areas when the city manages to upscale production by applying new technologies and cleaner production processes. Since April 2012, the Drainage and Wastewater Treatment Company has been responsible for installing new wastewater treatment plants. This has included the completion of dredging projects and building sewerage systems in the Tho Quang industrial park. An interdisciplinary working group has been established to directly monitor contaminated areas within the industrial parks. Many enterprises have now re-established the operation of wastewater treatment systems to ensure the volume of COD (Chemical Oxygen Demand<sup>23</sup>) remains under 1,500mg/liter, thereby reducing air pollution and waste water. Some fish farms have been applying biogas production with VietGAP standards as in agricultural production. There is a need to promote offshore fisheries, limit inshore activities, move from inshore to deep sea fisheries, and carry out community based fishing activities. Efforts should be made to protect marine resources. In addition, dikes and embankments are needed to support a marine-based economy. Infrastructure is needed to prevent natural disasters and environmental degradation.

**2.2.1.2 Adaptive Capacity and Local Assets to Deal with the Identified GG Opportunities**

**a. Local Assets and Practices**

Hoa Vang has been developing and linking eco-tourism villages in Cam Ne and Phong Nam with villages such as Cam Ne. The “Civilized Route” which passes through the sub-wards of Hoa Chau, Hoa Tien, Hoa Ninh, and Hoa Son, has been completed. Da Nang is working to develop biotechnology<sup>24</sup> with a focus on flowers and medicinal plants that are profitable and sustainable for the local climate. Da Nang City has also been taking advantage of insects to control pest species in rice. New technological applications are needed for sustainable rice farming. Skilled human resources for biotechnology are limited and further practical experience is needed to effectively communicate with farmers about the benefits of reducing harmful pesticides in favor of alternative farming methods.

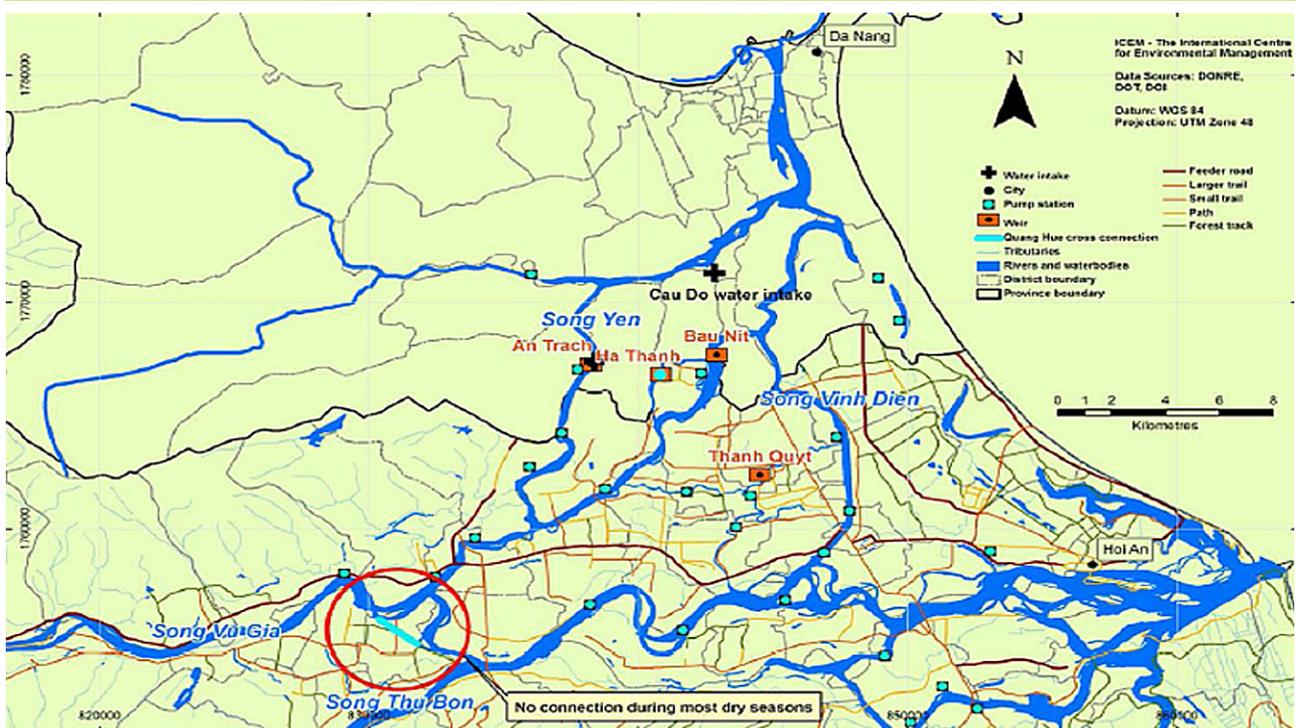
Major activities are currently funded by the state budget (including central and local budget). However, this is inadequate for supporting sustainable agricultural development. Raising community awareness about the importance of environmental protection, sustainable agriculture, and energy savings will be critical. Supporting farmers to be connected to markets in the central regions is critical considering that the local budget is limited.

Strengthening customer-farmer relationships will increase direct sales, stabilize incomes, and make a push towards up-scale value chains. Finally, bio-technology development requires investment. Prioritized areas should be identified so that investments can attract stakeholders of relevant interests.

**Institutional Settings and Capacity**

The project for strengthening the quality and safety of agricultural products in Da Nang focuses on improving infrastructure for safe vegetable production to meet VietGAP standards, and supporting biogas cellar development on cattle farms. The project, which supports 51 farmers and 8 workshops, has worked to raise awareness about economic efficiency and environmental sustainability. Key agricultural projects focus on biodiversity conservation in Son Tra Nature Peninsula Reserve and irrigation improvements in Trung Hoa and Dong Nghe lakes. However, support is low and thus farmer involvement has not been strong. Programs for the expansion of green agriculture and eco-tourism in Hoa Vang District have been conducted to improve the effectiveness of agricultural production, to expand eco-tourism villages, and to explore appropriate land for aquaculture in Bau Tram and Bau Tonneg. The Hoa Vang District focuses on controlling waste from breeding farms and introducing bio-gas as an alternative energy source<sup>25</sup>. Green agricultural development programs of DARD have

**Figure 26. The Quang Hue Cross Connection: Da Nang City’s Water Intake System**



Source: ICE, 2008

introduced IPM (Integrated Pest Management) and ICM (Integrated Crop Management) to improve production efficiency, decrease environmental pollution, and ensure eco-system conservation<sup>26</sup>. However, there needs to be more focus on improving green agricultural development and promoting eco-tourism. An urgent issue is the need to diversify value chains and to improve customer relationships, to save costs, and to have a stable income from green agriculture.

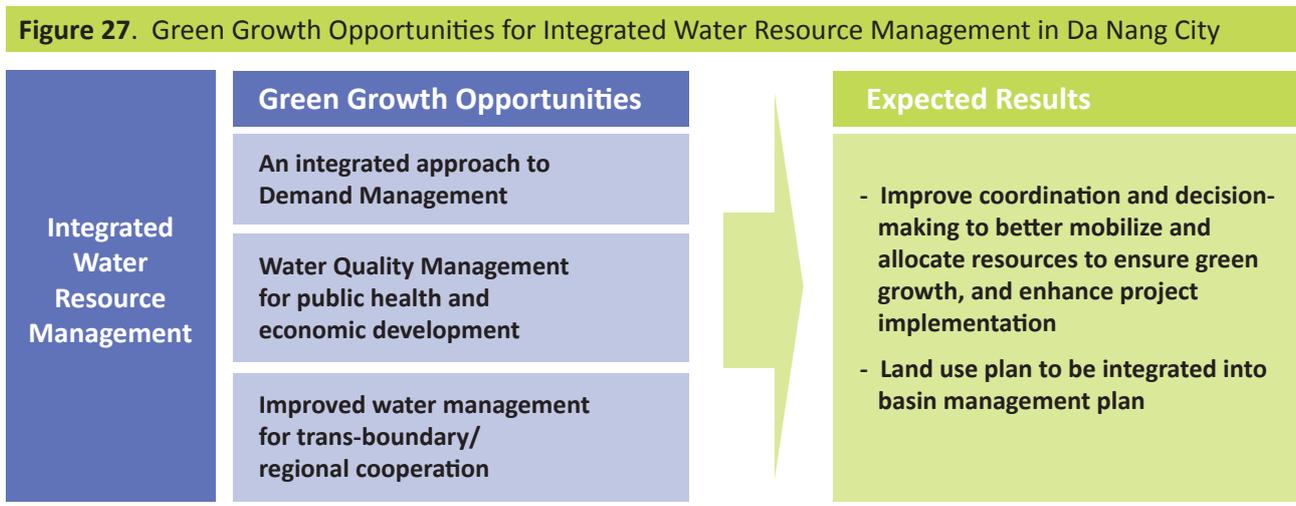
Agricultural and rural development requires strong multi-sectoral collaboration among industry, farmers, communities, civil society, and government<sup>27</sup>. Eco-tourism development needs to be strengthened through collaboration among districts and other relevant departments such as the DOCT. Eco-tourism programs should be promoted through marketing and branding at all levels, which should be supported by departments. Furthermore, the rural eco-tourism development plan should be integrated into the overall plans for tourism development and marketing of Da Nang City. This requires a high level of multi-sectoral cooperation among the district people’s committee, local enterprises, communities, and the city government. For example, the promotion of key attractions, such as Da Nang festivals,

should be linked with newly established natural resource based tourism around Hoa Vang.

## 2.2.2 Integrated Water Resource Management

### 2.2.2.1 Green Growth Opportunities and Gap Analysis

With continued environmental degradation and rapid urbanization, water resources are growing increasingly scarce and polluted. Currently, 70% of the city’s water resources are sourced from the Vu Gia - Ai Nghia - Yen River systems, which are a part of the Vu Gia - Thu Bon watershed. Among the eight districts in Da Nang City, six fall within this watershed. Activities such as hydropower development, which are implemented upstream in Quang Nam Province, pose one of the largest threats to the city’s water supply. The city is struggling to implement strategies to control water-loss from the river system and ensure long-term water security. Moreover, increased pollution, record-setting saltwater intrusion, and flooding are becoming increasingly serious.



**Table 4. Current and Projected Water Use in Da Nang City**

Water Use	Current Water Demand (2013)	Projected Water Demand (2020)
Industrial	63,970 million m <sup>3</sup> (69%)	176.29 million m <sup>3</sup> (73%)
Domestic		
Agriculture	28,605 million m <sup>3</sup> (31%)	63,970 million m <sup>3</sup> (27%)
Environmental	Not included	Not included
<b>Total</b>	<b>92,575 million m<sup>3</sup></b>	<b>245 million m<sup>3</sup></b>

Demand for water within the city is growing with rapid urbanization and growth in the industrial and tourism sectors. Thus, the introduction of an Integrated Water Resource Management (IWRM)<sup>28</sup> approach is essential. Da Nang's current waste water management plan is outdated and unsuitable for the changing dynamics within the city. There is a great need for an alternative management strategy that provides direction and flexibility while striving to balance resource use, land use, economic development, and environmental protection. An IWRM will go beyond the current, traditional methods to manage water resources. Current water management plans in Da Nang City fit into this traditional management paradigm, which is not in alignment with the national law, does not utilize an IWRM approach, and can undermine the potential for green growth.

#### **a. An Integrated Approach to Demand Management**

Water supply management is an essential component of IWRM, particularly in light of the rapid urbanization and industrialization of Da Nang City. The city's demand for water is expected to double by 2020 (Table 4). Both IWRM and green growth strategies prioritize the efficient use of water. In order to plan for the future, it is important to understand how water is used locally.

In accordance with IWRM, there are four uses for water resources. Environmental water use, or instream flow, is essential for eco-system management. However, it is not currently addressed within government plans or processes. Adequate instream flow maintains important habitat for aquatic eco-systems, especially estuaries. Given that the majority of Da Nang's water is extracted from surface water resources, evaluating instream flow and environmental water use is crucial to the city's water supply. Ignoring environmental water use may have dire consequences in the long term by undermining eco-system health, restricting the availability of water resources, and increasing the costs to provide water to industry, agriculture, and communities; thus restricting potential resources available for green economic growth. If costs for providing water increase, this could undermine green growth city development for Da Nang.

#### **Demand Management and Eco-system Service Valuation to Improve Decisions**

Eco-system services<sup>29</sup>, which are essential for the long-term wellbeing of Da Nang, are often undervalued as decision-makers prioritize monetary values. It is important that eco-system services are given appropriate value. The inclusion of water resources and eco-system services into the green growth agenda will also promote social equity and development goals. An eco-system services approach is usually highly cost-effective due to its reliance on natural systems rather than expensive

technologies to meet local needs. Maintaining instream flow and prioritizing environmental water use is one way to ensure a healthy future for eco-system services. This alternative approach can result in a cost-savings of billions of dollars and extensive habitat rehabilitation<sup>30</sup>. The valuation of eco-system services is particularly important when assessing infrastructure development in order to ensure proper expenditure of capital resources. The valuation of eco-system services in the capital budgeting process may provide a wider range of cost-effective, green growth alternatives to meet infrastructure needs<sup>31</sup>. It demonstrates that future strategies must empower society and local governments to fully value eco-system services in the decision-making process, in order to fully consider long-term impacts of their decisions and maximize green growth potential at the local level.

#### **LID (Low Impact Development): Alternatives to Address Conservation, Storm Water Management & Saltwater Intrusion**

Land use in Da Nang City is rapidly changing, and increased urbanization has caused issues with drainage and flooding, compounded by climate change. Currently, infrastructure does not have the capacity to absorb floodwater. There are only two anti-flooding pump stations in the city, designed for a maximum volume of 22.34m<sup>3</sup>/second. The drainage system does not have the capacity to prevent the smell of sewage, often causing private citizens to take measures to block drains and pipes, increasing costs to replace necessary infrastructure. A master plan for drainage has been approved to address challenges and to guide future development. However, to be successful the implementation of this plan must take both a bottom-up and top-down approach that emphasizes efficient technological upgrades, improves environmental literacy, and capitalizes upon local assets and eco-system services<sup>32</sup>.

LID (Low Impact Development)<sup>33</sup> strategies promote groundwater recharge, and help offset and safeguard the region from saltwater intrusion. Saltwater intrusion, one of the most serious issues facing the city, is directly related to water management and climate change. As water resources are exploited, aquifers absorb more saltwater in the dry season, making them unusable. This is further compounded by sea level rise. Salinity is becoming more extreme, and salt levels exceed national standards. In 2013, groundwater exceeded salinity standards at the Cau Do monitoring station for 11 days, a significant increase from the 87 days recorded in 2012. Increased saltwater intrusion is negatively impacting livelihoods, agricultural development, and food security. In addition, salinization has forced companies with groundwater use permits to source water from further away, increasing production costs and undermining profits. Despite the recognized consequences, there has not been an impact assessment

completed to date. Permitting processes for groundwater extraction for industrial and tourism sectors continue due to a lack of alternatives. In order to implement practical and feasible solutions towards green growth, an assessment of groundwater resources is necessary.

**b. Water Quality Management for both Public Health and Economic Development**

Although water quality is inherently tied to demand management, they are often addressed independently. For example, Da Nang’s Eco City Plan prioritizes measures to improve water quality, but fails to address issues associated with demand management. An IWRM approach should aim to address issues of quality and quantity more holistically. Water pollution is currently the result of domestic and industrial water uses, upstream agricultural runoff, and waste from the hospital and service industries. Water pollution in Da Nang City is not only an environmental issue, but it is also a public health concern. Wastewater carries germs and is an effective transport for disease throughout the city. Upstream contaminants from agriculture and industry include chemicals such as mercury, nitrogen, phosphorus, and cyanide, which can cause acute health impacts to the community. Water quality concerns demonstrate a wide-

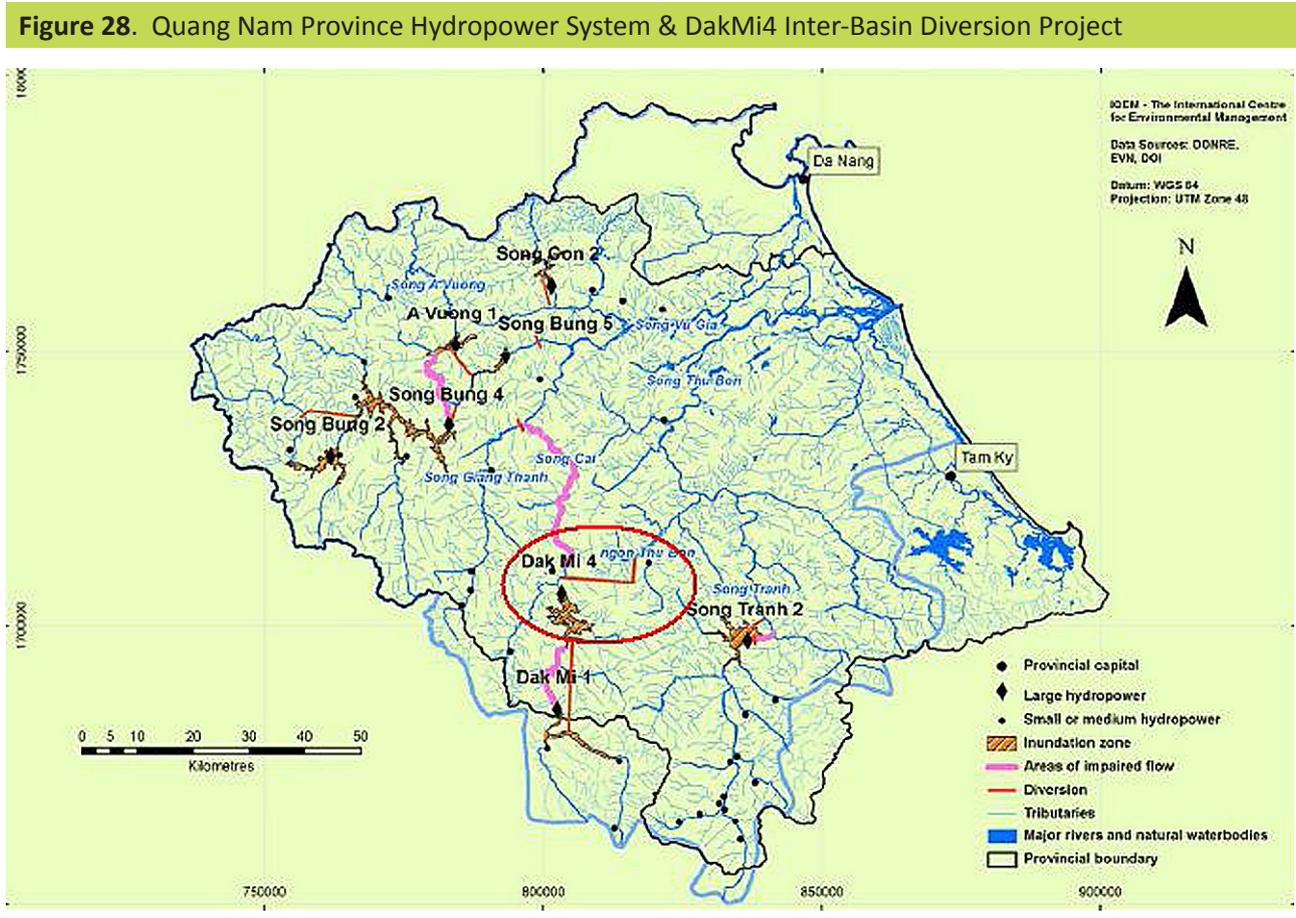
range of impacts, and must be addressed through a variety of coordinated management mechanisms.

**Urbanization and Impacts on Water Quality**

In terms of water quality, one of the most immediate threats is the high level of fecal coliform which is leached into nearby surface water sources. This problem is exacerbated by combined sewage overflow, which is made worse during the wet season due to the city’s limited capacity to manage storm water. The Master Plan for Drainage and Storm Water, and the Environmental City Plan demonstrate that Da Nang City officials understand the problem and are taking steps to address it. However, the city should ensure IWRM and the principles of green growth, while considering and implementing the necessary infrastructure upgrades to address challenges related to urbanization and water quality.

**Improved Regulation, Technology and Partnerships to Address Point and Nonpoint Source Pollution**

Da Nang City has six industrial zones with centralized wastewater treatment systems. However, the collection and treatment is limited. Although the government provides upfront investment, a joint-stock company is in



charge of the operation of wastewater treatment systems in each industrial park. Based on the EIA, investors are able to negotiate with facilities on the fee they must pay for wastewater treatment. However, given the current lack of capacity, it is clear that the fee structure may need to be reassessed. Business leaders do not understand the long-term implications of their actions on the local environment, and are likely to avoid paying for wastewater treatment to maximize profits. Instead the government pays many of the costs associated with the long-term impacts of industrial pollution, and fees do not provide the necessary incentives to ensure industries act responsibly.

Waste water problems are not confined to urban areas. In the Hoa Vang District craft villages represent small-scale industry, which include family run businesses that specialize in stonework and weaving. Despite the positive economic implications, these enterprises leave employees exposed to high occupational health risks<sup>34</sup>.

### **c. Regional Cooperation and Improved Water Management for Trans-boundary Cooperation**

Hydropower is a serious, controversial issue in regard to water resource management and regional development. Energy demands are increasing with industrial growth and hydropower offers a relatively inexpensive source of power. Quang Nam Province has taken steps to complete a Strategic Environmental Assessment (SEA) on hydropower development. As a result, four dams, which were illegally installed in national parks, have been removed and plans to construct numerous others were canceled. Despite these efforts, hydropower impacts continue to cause increased erosion, degraded water quality, adverse impacts on biodiversity, and increased flood risk for downstream areas. This may be especially problematic for Da Nang City.

Regional governance and the completion of a basin-wide management strategy are necessary in order to successfully manage hydropower, while simultaneously ensuring that water demands throughout the whole basin are met. This is in alignment with national law and the recommendations made by the SEA. However, action is yet to take place. Da Nang is highly vulnerable to upstream development in the Vu Gia - Thu Bon River basin and may be well suited to facilitate transboundary management.

Local experiences with hydropower development demonstrate that it is essential for stakeholders to work together to overcome potential threats, as well as manage eco-systems to maximize green growth opportunities. However, this is not possible without sharing economic benefits from ongoing development with upstream neighbors. Da Nang City needs to invest in Quang Nam Province to maximize resource potential and ensure

vital eco-system services are maintained. As a result, Da Nang will benefit from an increase in coordinated management due to an expansion of investment potential, and the assurance that natural resources will be available for future development. The absence of a transboundary organization to oversee activities throughout the basin has prevented successful inter-province cooperation in the past. However, these limitations would be overcome if a River Basin Coordinating Organization (RBCO) could be established under MONRE under Decree No. 120/2008/ND-CP. Da Nang City has the power and capacity to implement innovative strategies, and a new institutional mechanism, such as the VGTB Research Center could facilitate holistic, integrated management of water.

### **2.2.2.2 Adaptive Capacity and Local Assets to deal with the identified Green Growth Opportunities**

#### **a. Regulatory Framework to Promote IWRM Strategies**

Nationally, Vietnam has put laws into place to foster IWRM. Notably, Vietnam's water law strives to fairly allocate water to various uses, while protecting the rights of the poor and ensuring transparency in decision-making. Since 2008, the laws governing water are under the discretion of MONRE and the National Water Resource Council (NWRC), but implementation has been limited. The transition from MARD to MONRE has led to a lack of clarity about government responsibilities, and as a result, limited institutional capacity for the implementation of national policies. Innovative strategies will be necessary to overcome embedded challenges, and must include multiple local, regional and national stakeholders that are both directly and indirectly involved in the oversight of water resources. This will build stakeholder capacity to guide basin management planning and improve decisions. The legal framework currently in place is a promising start to sustainably manage water in Vietnam in the future, but now the government must take steps to ensure its vision becomes a reality in the central region. The establishment of an RBCO under national law, as well as the 'Vu Gia - Thu Bon Research Center' will improve management and give allow this region to be a model for the rest of the country (A proposal to be found in Appendix 7).

#### **b. Local Activities and Human Resources to Implement IWRM Strategies**

Since the inception of the national water law there have been several different capacity building opportunities for local stakeholders in Da Nang City and Quang Nam Province. These included a series of three workshops conducted by the ADB in 2006, and another series of workshops facilitated by the International Water Centre

with support from the Network of Asian River Basin Organizations (NARBO). The ADB also conducted workshops in February 2009. These workshops introduced “IWRM Guidelines at the River Basin Level”, authored by the UNESCO World Water Program and NARBO, and maybe a useful guide for future river basin management efforts. As a result of the past work done in the basin, stakeholders in both Da Nang City and Quang Nam Province developed a road map that could be used to prioritize specific IWRM activities. Motivated local stakeholders in Da Nang City have the knowledge and technical capacity from previous trainings to begin to develop strategies to better manage water resources through an IWRM framework. Such strategies strive to coordinate disjointed information and management practices, as well as to inform and improve decision-making processes. In addition, a comprehensive basin management plan that takes industrial, domestic, agricultural, and most importantly environmental water uses into account will be developed by the VGTB Research Center.

**The Environmental City Plan as a Step to Implement IWRM Strategies**

Da Nang City is working to address the current challenges in the region through technology and infrastructure upgrades outlined in the plan “Developing Da Nang: The Environmental City”. The city now has valuable experiences that it can learn from in order to determine the best steps forward. However, it is also important to recognize that there is not a one-size-fits-all approach to water resource management. The Environmental City Plan prioritizes actions to deal with water quality by addressing toxic discharge into local river systems (e.g. the Khanh Son Landfill and the Phu Loc River), as well as correctly identifying the need for improved wastewater treatment. However, current strategies do not move beyond traditional management paradigms, nor ensure that

officials choose the most long-term, cost-effective solution to maximize resources. The development of a local Research Center will ensure that integrated management plans may be implemented based on comprehensive knowledge and information that will not only enhance the local environmental situation, but also offset the impacts of climate change and save the city money in the future.

**2.2.3 Eco-system based Tourism Development**

**2.2.3.1 Green Growth Opportunities and Gap Analysis**

**Da Nang as an “Environmental City” with natural resource based tourism**

According to Investment Promotion Center (IPC) statistics, the tourism and real estate sectors represent 68% of total FDI in Da Nang<sup>35</sup>. Between 2004 and 2013, the total number of tourists visiting Da Nang increased 19%, with international tourism increasing 13% and domestic tourism increasing by 21%<sup>36</sup>. In 2012, tourism revenue reached 4,600 billion VND, 7.4 times to the revenue recorded in 2007 and representing 7% of the GDP. Thus, the city is highly motivated to continue tourism development. Da Nang City covers a broad spectrum of possible tourism markets that reduce seasonality and raise average occupancy. The city targets both international and domestic tourists who want to explore cultural history as well as recreational activities.

Da Nang City’s development orientation identified tourism as a priority for sustainable development and the industry aims to become a leader for economic growth. Many natural reserves are located near the city center and convenient transport options make them popular tourist destinations. Da Nang’s forests make a significant



contribution towards economic development, climate change mitigation, scientific research, conservation, and tourism development. Natural and cultural resources hold great potential for eco-tourism development, such as: diving and snorkeling, fishing, exploring Son Tra peninsula, cyclo tours, Phuoc Nhon hot springs tours, and Hai Van tours.

#### a. Eco-system Based Strategic Tourism Development in Da Nang

Da Nang enjoys a good infrastructure for tourism development, including a traffic system, a cruise ship terminal on the banks of the Han River, and the dredging of a branch of the Han river and Co Co River bridges such as Han River Bridge, Cam Le Bridge, Tuyen Son Bridge, Thuan Phuoc Bridge, and Dragon Bridge have all been effectively integrated into the road system. In addition, in recent years, Da Nang People's Committee has advocated for cooperation with Quang Nam province for the dredging of the Co Co River and the investing in the infrastructure along the river side to improve the environment, while creating urban landscape architecture, tourism and transportation. Notably, most eco-villages in rural areas have the potential to attract many visitors as they offer a mixture of cultural and natural resources (i.e. some traditional villages such as Phong Nam Village and Non Nuoc stonnee carving village with a beach). However, homestay and community tourism, which many international visitors prefer in order to explore the local lives and cultures of people, have not created significant profit and need infrastructure and services development.

One of Da Nang's key challenges is to mobilize resources to increase accessibility to newly developed eco-tourism. As private transportation has played a major role in urban traffic, the limited public transportation system needs to be improved to serve diverse demands related to eco-tourism. Marketing, branding, and the promoting of information to meet the needs of tourists must to be strengthened. More importantly, environmental threats associated with tourism development should be considered in the overall planning and implementation of projects. The private sector needs to pay its share of development costs to deal with environmental services while local government, especially DOSCT, need to make efforts.

#### b. High Value-added Tourism and Socio-Economic Impacts

Da Nang has observed an increase in the number of tourists due to cultural activities, such as festivals. Da Nang has been constantly investing and developing tourism festival events, continuing to diversify tourism products, and pushing to promote the city image through festival activities such as the Da Nang Fireworks Festival (DFIC). The DFIC brought a very large number of tourists to hotels and travel agencies and it was organized without using the state budget. In addition, events such as Da Nang's International Paramotor Race and street music festival should be integrated into tourism packages to bring more tourists.

Da Nang will require more entertainment activities to increase the competitiveness of tourism development at the regional and international levels. Festivals need to be integrated with eco-tourism packages with a focus on specific natural resources. The development of natural resource based programs and festivals would lead to the creation of more social revenue. For example, community-based tourism has created jobs for local people in eco-tourism areas, including Son Tra Island, Ba Na, and Hai Van, thereby integrating handicraft villages with communities. As a result, the living standards of local people can be improved, jobs can be created, infrastructure will need to be improved, and traditional crafts will be restored.

#### c. Environmental Impact Assessment of Tourism Development

Most tourism development projects are being appraised and environmentally monitored. The city has refused some mega-projects which would have a detrimental impact on the environment. The recent process of developing tourism will require greater efforts to protect the natural environment in the near future. Pollution to the marine environment is a key problem which Da Nang City needs to manage in the near future, as waste from resorts, hotels, and restaurants are not fully captured in the EIA process. The private sector needs to be given opportunities and responsibilities to participate in the EIA process and application.

**Table 5.** Number of tourists to Da Nang during the fireworks festival (DFIC)

Year	2010	2011	2012	2013
The number of tourists during DFIC	100,743	159,393	178,754	205,104
International tourists	7,398	16,579	19,508	25,821
Domestic tourists	93,345	142,814	159,246	179,283

Source: Da Nang Department of Sports, Culture and Tourism (DSCT), 2013

### 2.2.3.2 Adaptive Capacity and Local Assets to Deal with Identified Green Growth Opportunities

#### a. Local assets and practices

There are over 20 vocational training schools for tourism. Currently, training schools have used trainers from the European Union (EU) to retrain employees in the tourism department, using experts from the Intercontinental, Hyatt Regency, etc. In addition, local experts and experienced teachers from Hanoi and Ho Chi Minh City have been hired for on-site training. DOCST cooperates with the People's Committee of Hoa Vang District and the Hoa Chau Commune to make a marketing plan about the Phong Nam village and its attractions. Although capacity-building for tourism development has improved, eco-tourism related training should be developed to create appropriate eco-tourism development programs and to guide local government officers to coordinate with local communities on eco-tourism development.

In Da Nang, the capital investment budget is 167.6 million VND (business capital is 23.61 million and capital for development is 144.15 million). The remaining funds are mobilized from the private sector (about 3,022.56 million VND). From 2003 until now, the city has focused on calling local and foreign investors for the development of marine tourism, with a focus on projects in the Son Tra peninsula, the coastal line project Son Tra - Dien Ngoc (now Hoang Sa - Truong Sa), Van Village, Nam O and the central area. So far, the city has 60 investment projects in the tourism sector, including 13 foreign invested projects with a total investment of 1,457 million

USD and 47 domestic investment projects capitalized at 2,546.8 million USD, of which 2 projects are amusement parks (large scale investment for a cultural park and an amusement park in Southeast Memorial and the Son Tra Ocean Park). Capital to develop eco-tourism projects and to green current tourism development projects needs to be well integrated in the planning of the current budget.

In terms of public awareness, the Department of Culture, Sports, and Tourism has focused on propaganda activities, raising community level awareness about the importance of environmental protection. City residents are educated about preserving the marine environment, forest ecology, and there is even a training course on environmental protection in the travel service business. Pollution of rivers and beaches due to tourism development activities along the coastline require stronger environmental regulations. In particular, eco-tourism in the Son Tra Peninsula, Ba Na - Nui Chua and Hoa Spring has affected natural eco-systems and biodiversity.

#### b. Institutional Settings and Capacity

##### Analysis of Key Programs and Regulatory Framework

Decision No. 5228/QD-UBND on "Tourism Development Program in the Period of 2011 - 2015" encompasses 4 main development issues: 1) Marine Tourism; 2) Resort and Eco-Tourism; 3) Cultural tourism/eco-village; and 4) MICE (Meetings, incentives, conferencing, exhibitions). Decision No. 18/2007/QD-UBND and Decision No. 1584/QD-UBND aims to perform sanitation work, the maintenance of landscapes, and to build public facilities and pilot services to attract services. Decision No. 4444/

**Table 6.** Total budget for developing tourism in the period 2011 - 2015 (unit: million VND)

No.	Index	2011	2012	2013	2014	2015	Period 2011 - 2015
<b>A</b>	<b>State budget</b>	51,230	45,870	30,070	20,250	203,140	167,760
1	Tourism development planning	730	670	340	220	240	2,200
2	Investment for developing	45,950	40,650	25,150	15,100	15,100	141,950
3	Upgraded tourism products	2,040	2,040	2,040	2,130	2,160	10,410
4	Marketing and promotion	2,370	2,370	2,400	2,650	2,690	12,480
5	Human resource development	140	140	140	150	150	720
	Total state budget including:						
	- Business capital	4,550	4,550	4,580	4,930	5,000	23,610
	- Investment development Capital	46,680	41,320	25,490	15,320	15,340	144,150
<b>B</b>	<b>Social capital</b>	604,460	604,330	604,340	604,650	604,780	3,022,560
	<b>Total program capital</b>	655,690	650,200	634,410	624,900	625,120	3,190,320

Source: Program on tourism development of Da Nang City in the period 2011 - 2015

QD-UBND is related to the protection of coral reefs and other marine eco-systems in the Son Tra peninsula area, while Decision No. 2693/2011/QD-UBND focuses on introducing regulations and activities in the Son Tra peninsula for sustainable tourism development.

Decision No. 02/2007/CT encourages eco-tourism and community tourism development. Decision No. 25/2007/QD-UBND introduces regulations on the management, conservation, and restoration of the historic value of Da Nang City. The Da Nang People's Committee has assigned the Department of Culture, Sports and Tourism to develop the project "Developing River Tours & Eco-Tourism Village in Da Nang City." DISED (Da Nang Institute for Socio-Economic Development) is building the Co Co River project which is expected to be approved in 2013. The project on investing in tourist infrastructure (Decision No. 9298/QD-UBND) is focused on tourism development of high quality, international standards.

By 2015, basic coastal tourism projects and new investments in public beaches, traditional village development, and garden area tourism activities along the river will be completed. There is also a plan for developing tour routes and village tourism products in Da Nang to ensure the conservation of tourism in Phong Nam Village. Recently, the city has introduced a series of policies and incentives to encourage and create favorable conditions for investment for projects such as the eco-tourism entertainment park in Ba Na-Suoi Mo and the Silver Shores resort (now renamed as Crown).

As mentioned above, there are a few projects for promoting tourism development. However, the question of how to conserve the overall cultural landscape remains a big challenge. Some of the landscape has been altered due to the construction of resorts. In particular, Ba Na Hill has lost its charm as recent investments have transformed the area into an entertainment complex. This is not a long term strategy to attract tourists. It is important that the activities of the Co Co River do not negatively impact the community along the river. Potential negative impacts include flooding and salinity caused by the dredging of the river, salinity from agricultural activities, and water pollution. Mitigation measures have yet to be identified and there is the urgent need for DARD and DISED to coordinate mitigation measures.

Notably, DOCST helps the Da Nang People's Committee in performing the managerial functions of tourism activities, subject to the direction, guidance and inspection of MOCST. DOCST needs to improve collaboration with relevant functional departments (i.e. Department of Natural Resources and Environment, Department of Health) to implement the environmental protection program and environmental impact assessment. In addition, DONRE, DARD and DOCST should cooperate

more to develop agricultural based tourism, eco-village tourism, and environmental monitoring measures.

## 2.3 SOCIAL DEVELOPMENT AND GREEN GROWTH

In order for Da Nang to achieve sustainable development, it will be critical to focus on social development as a tool to mobilize local assets and social capital (esp. human resources). More importantly, it will be critical to focus on Social Sustainability as a foundation of "Human and Social Well-Being" to optimize the quality-of-life for current and future generations. Existing and potential institutional arrangements that facilitate sustainable social development need to be analyzed and adjusted for advancing Da Nang's social and community development within the context of green growth. Improving public health policies related to increasing environmental degradation and inappropriate waste treatment would contribute to improving the quality of life of urban residents. In order to build resilience to climate change in Da Nang City, social vulnerability and the resilience of livelihoods need to be strengthened. The city should enable different social groups, who are vulnerable to climate change in different ways, to respond to the existing and future impacts of climate change. Ultimately, the GG-CDS needs to be built on the premises of deliberative governance, representative and accountable participation of communities (including government), and equity.

### 2.3.1 Health and Labor for Green Growth

#### 2.3.1.1 Green Growth Opportunities and Gap Analysis

Pollution from industrial parks, chemicals from farming, and medical waste are threatening public health in Da Nang City. In particular, poor people are particularly vulnerable to environmental degradation. Thus, resources for pollution reduction need to primarily target poor regions. The incidence of health problems caused by environmental degradation can undermine people's ability to generate income to support their families. At the same time, there is increasing awareness about the need to create a decent working environment based on the health and safety of laborers and the better management of pollution. Green growth development can reduce the government's burden of providing universal healthcare for all.

The city has had difficulties tackling its high unemployment rate which has fallen from 4.9% in 2008 to 4.6% in 2012 (.3%), as the majority of conventional industries have reached their limits in terms of job

creation. As a result, there is a need for community based approaches to sustainable urban development to create green jobs and new markets for eco-friendly products.

**a. Health and Green Growth**

**Non-hazardous Living Environment**

Unfortunately, to date, there is no substantial survey on the impact of industrial waste on public health in the city despite the fact that there are many risks due to the lack of waste water treatment facilities and strict regulations on waste treatment and disposal. As a result, soil, water, and air in the city are increasingly polluted. In particular, the industrial parks located near farm land are leading to pollution of irrigation water, soil and agricultural fields, thus threatening food safety. In the farm areas near the Hoa Vang District, chemical fertilizers, pesticides, and herbicides are affecting food safety, with negative human health implications for farmers and nearby residents. Dioxin contamination surrounding the Da Nang Airport is also posing a critical health threat to surrounding communities. Such contamination has resulted in illnesses, genetic diseases, and birth defects for children born in the city. Women have high rates of miscarriage and stillbirths in the city<sup>37</sup>.

Thus, there is a need for facilities and social welfare and health care programs for those with disabilities. More critically, the lack of a treatment facility for medical waste in the city is threatening public health. Treatment infrastructure and investments in medical waste management are limited and cannot meet current requirements. Furthermore, the lack of a quality medical wastewater treatment system is significant. At present, only 6 out of 8 city hospitals and 5 out of 7 district and suburban district hospitals have waste water treatment systems in place<sup>38</sup>. Adding to the green health care facility building, its medical waste treatment will be another green industry which benefits public health.

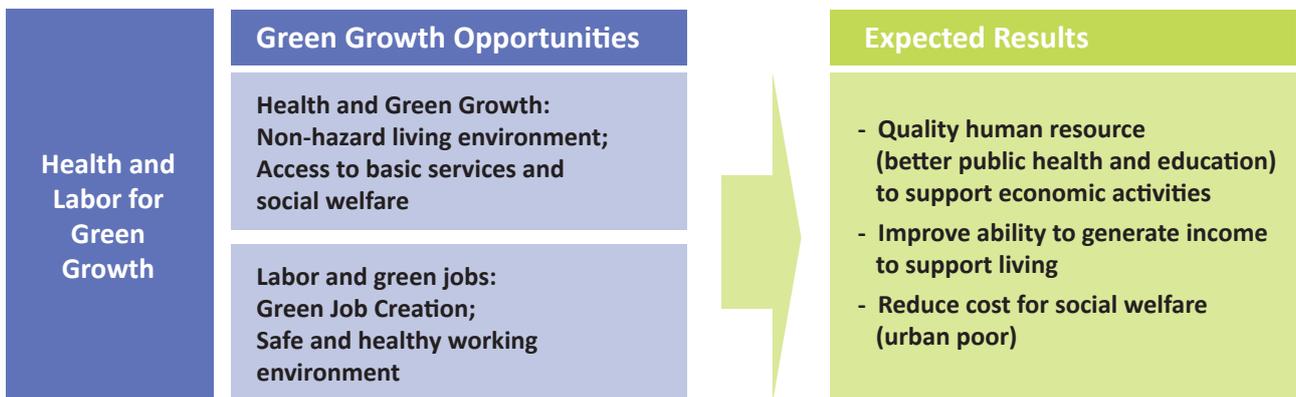
**Access to Basic Services and Social Welfare**

The lack of clean, potable water and proper sewerage facilities poses a critical challenge to public health in Da Nang City. Although public access to water supply is quite high in the main center of Da Nang, many residents in the Hoa Vang District have little access to piped clean water supply. In addition, the quality of existing water supply pipelines are too low to properly deliver potable water to city residents. Also, the lack of a comprehensive sewerage system is increasingly threatening public health in Da Nang City. Current sewerage infrastructure covers almost very little of Da Nang City, and the majority of sewage is disposed of in the ground. As a result, there is a high incidence of waterborne disease and the diseases transmitted by the fecal-oral route. The Hoa Vang suburban district (75% of the total city area and 13% of the whole city population) has only 11 healthcare stations with 77 beds and 120 medical staff persons percent on average<sup>39</sup>.

Considering the city’s low population density of 169 people per square kilometer, good quality roads and efficient transport networks between hospitals within the district as well as to the city center need to be developed. Although all communes and wards in the city have healthcare stations and the number of hospitals has increased, the human resources for responding to increasing needs is still low. Currently, there are only 4.78 healthcare staff and 1.32 physicians per 1,000 persons, which is only slightly over the World Health Organization (WHO)’s minimum recommendation of one physician per thousand people<sup>40</sup>.

In rural areas, public awareness on sanitation is relatively low, thereby leading to the high disease incidence in the area while there is lack of facilities for public health. Da Nang’s poorest of the poor are resettled from their communities for various reasons to clean up the environment or to build new structures. A major concern

**Figure 30. Green Growth Opportunities of Health and Labor in Da Nang City**



is that those with the least ability to voice their concerns may be re-located to environmentally undesirable areas, i.e. areas that lack access to water, arable land, or that have high potential for flooding. Thus, policies must be devised to protect the health of the city's most vulnerable populations.

## **b. Labor and Green Jobs**

### **Green Job Creation**

The city's high unemployment rate together with low job creation is a big challenge. In 2012, the unemployment rate in Da Nang City was 4.6%<sup>41</sup>. Currently, the city's major industries include the following: manufacturing industry (e.g. machinery, electrics, chemicals, shipbuilding, and textiles) and the retail consumer product industry (e.g. aquatic products, fabric, clothes, bricks, fertilizer, cement, soap, paper, and medical tablets). However, the city's competitiveness is being challenged due to changes in market demands as well as the global financial crisis. As a result, current industries in Da Nang City are facing difficulties in generating job opportunities. At the same time, there is increasing pressure on existing manufacturing industries to reduce their levels of environmental pollution, which would eventually require more human resources for green technology.

The Da Nang City government has developed or supported diverse programs for job creation. One in particular is the Department of Labor, Invalids and Social Affairs (DOLISA), which is the main government body dealing with labor issues in Da Nang City. As part of the "Specific Project on Resolving Work for Laborers on Da Nang City region in 2012 - 2015", DOLISA supports diverse approaches to tackle unemployment through loan programs, job consultations, training programs, and guides for the establishment and management of businesses. It also works closely with the management board of high-tech parks to identify orientation of the labor supply.

### **Safe and Healthy Working Environment**

The increasing number of occupational illnesses and accidents is a growing concern in Da Nang City. The city has a plan for allocating more manufacturing companies and high-tech industries. However, companies feel burdened because a lot of investment is required to develop safety related facilities and systems. There are no strict regulations for labor safety conditions in Da Nang City.

## **2.3.1.2 Adaptive Capacity and Local Assets linked with Identified Green Growth Opportunities**

### **Certificate Regarding Food Safety**

The city government issues certificates for food suppliers (food processing and manufacture, food and beverage supply, and food business) when their sanitation conditions satisfy municipal standards. It is estimated that approximately 96% of the registered food suppliers have received certificates in the city. According to city officials, this system aims to regulate the supply of food contaminated by heavy metals. The system also regulates sanitation conditions in the process of product manufacturing and packaging, and encourages food security and sanitation under supervision. However, the current regulations have limitations to ensure food safety in the city. For one, it is not compulsory to have a certificate to run a food business. Second, it rarely covers informal entities which are providing affordable food to low-income people in the city. Third, it cannot regulate original source of pollution such as chemical waste from factories<sup>42</sup>.

### **Projects/Programs for Disabled People Affected by Dioxin**

As Da Nang City is one of the most heavily dioxin polluted areas in Vietnam due to the Vietnam War, there are quite a number of funds and programs for people affected by dioxins. For example, the government of United States of America has granted 84 million USD through USAID for the program "Treatment of Dioxin Polluted Environment at Da Nang Airport". In addition, there are a diverse number of funds and programs from international non-governmental organizations and agencies for this issue. However, they often have overlapping activities. While the diverse funds from donors are an important and valuable resource for the city government, there is a need to develop a mechanism to coordinate different resource and projects. For example, the city designates target areas, facilities and groups to different actors. In addition, beyond care services, many programs do not provide services for those with disabilities. Programs are needed to engage people with disabilities in private and public enterprises.

### **Project on Medical Waste Treatment under the Ministry of Health 2011 - 2017**

For this project, the total amount of funds are 155 million USD, consisting of 150 million USD loans from the World Bank and 5 million USD from other sources, such as the city budget. Furthermore, the health sector of Da Nang has implemented legislation related to hospital waste management under the Decision No.

8708/QD-UBND issued on 23/10/2012. Under this legislation, non-poisonous medical waste is to be buried at the Khanh Son landfill while poisonous medical waste is to be incinerated. The stabilized and solidified ash of poisonous medical waste is buried separately at a poisonous waste unit. However, the collection and treatment of medical waste has been in place only since 2009. Many hospitals and health centers in the city do not have waste storage space, nor have they followed waste collection regulations, such as labeling and using the containers made of specific materials. Less than 25% of total poisonous medical waste in the city is properly treated, and only a few hospitals have medical waste water treatment facilities. Hence, more attention should be given to the planning and the mobilization of resources for medical waste and wastewater collection and treatment in the city. This will likely significantly improve public health in the city.

**Improving Basic Services and Healthcare Facility Provision in the Hoa Vang Rural Suburban District**

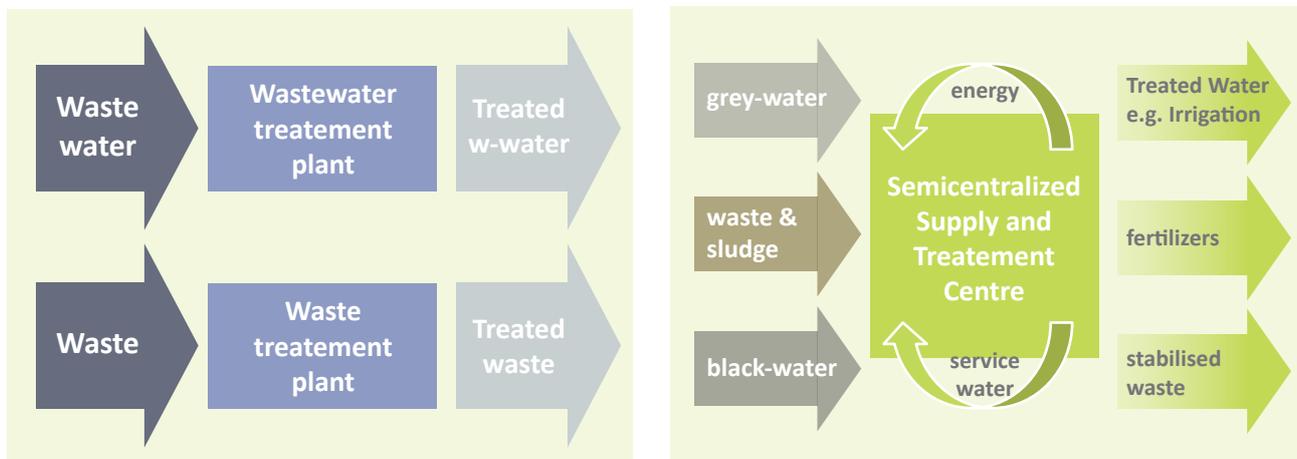
The Hoa Vang suburban district has implemented a national and city wide program on clean water and environmental sanitation. As financial resources allocated under the program may be limited, local community participation will be critical to ensure that resources are sufficiently mobilized for the upgrading of water supply systems for residential use and for improvements of household sanitation facilities in order to mitigate ground water pollution. Considering that flooding will likely have a serious impact on the city, efforts should be made towards improving the city’s drainage system. Low cost

and resource saving options should be identified for large infrastructure, such as semi-concentrated drainage and irrigation systems. In addition, a micro finance mechanism should be set up, such as a community development fund, for connecting individual houses to main water supply pipeline systems and household sanitation facilities.

An ADB loan has provided investment for the project “Support Health in the Coastal Southern Central Region - ADB Loan”, with a scale of 100 beds. Given the insufficiency of human resources for the health care sector (in terms of quantity and quality) in rural areas, it will be critical that the development of health care facilities should be associated with policy incentives to attract good quality labour in the health care sector. In order to diversify job opportunities within green industry, it will be critical to provide the following: 1) financial support for new, green businesses; 2) informative guides for entrepreneurs of green industry; 3) training programs for potential employees with green technology and knowledge. The city’s current programs are providing a good platform for guidance and training<sup>43</sup>.

It is worth highlighting DOLISA’s close network with diverse associations, particularly for conducting vocational training programs. For example, it collaborates with co-operative associations for conducting vocational training for rattan, bamboo, and knitting production. It also collaborates with communes and hamlets such as Ta Lang and Gian Bi Hamlet and the Hoa Bac and Hoa Lien commune for creating jobs in the fields of mushroom, flower, and decorative plant breeding. The Da Nang Technology University focuses on teaching and

**Figure 31.** Comparison between conventional centralized infrastructure facilities for wastewater and solid waste (left)  
**Figure 32.** Semi-centralized supply and treatment center at district and neighborhood level that combines infrastructural functions and generates multiple useful services (right)



Source: Schramm, S. (2011). Semi-centralised water supply and treatment: options for the dynamic urban area of Hanoi, Vietnam. *Journal of Environmental Assessment Policy and Management*, 13 (2), 289. Illustration by Susanne Bieker.

researching innovative green technologies and practical projects in industrial parks.

Informal Solid Recyclable Waste Collection and Recycling provide good job opportunities as the poor people collect recyclable solid waste for their income, which also contributes to reducing waste in neighborhood by recycling. This activity is also made in community level. In this case, the income is contributed to community funds that are used or revolved for, such as, community development, supporting the poor and people in crisis, and loans for small business seed money. The Women's Union is taking an important role of leading green activities of local communities. The activities have potentials of being transferred to a green job and business. For example, the Women's Union has played a leadership role in the bottle collecting project, and in composting unused vegetables for growing vegetables as well as for generating income. The District Volunteer Associations and the Centre for Job Training are also taking an important role of communicating with people in micro-level and providing diverse supports and information.

### **2.3.2 Livelihood Resilience to Natural Disasters and Climate Change Impacts**

#### **2.3.2.1 Green Growth Opportunities and Gap Analysis**

The increasing incidence of climate-related extreme weather events is causing damage to the health, wellbeing, and livelihoods of the poor. In addition, climate hazards and natural disasters can disrupt the activities of local businesses in Da Nang City. The current mechanisms for coping with climate-related damages are limited when it comes to enhancing the resilience of citizens and local business. Meanwhile, the abundant experience of the city administration in disaster risk reduction activities may indicate a potential to build local level resilience to climate change.

Special attention to protect vulnerable groups from negative climate hazards is required. The urban poor in Da Nang City are among the most vulnerable to the negative impacts of climate change. The urban poor find their difficulties compounded by the increasing risk of storms, flooding, landslides, heat waves, and drought that are exacerbated by climate change. Their livelihoods are most at risk since their assets are meager. Therefore, the city should allocate resources for adaptation, disaster risk reduction and recovery programs. These programs should be primarily targeted to the districts where the urban poor live. This section will analyze the gaps and opportunities for enhancing the livelihood resilience of the vulnerable groups in the city.

#### **a. Building the Livelihood Resilience of Vulnerable Groups**

The city of Da Nang is vulnerable to climate related hazards and natural disasters such as typhoons, floods, and storms, all of which can cause epidemic diseases. In 2012, the city noted 1,308 cases of bleeding diseases and 3,213 cases of hand-foot-mouth diseases<sup>44</sup>. The lack of a drainage system and solid waste treatment facilities have resulted in the formation of stagnant water bodies after storms and flooding events, thereby increasing risks for related illnesses and diseases. In addition, frequent extreme weather events, such as heat waves, storms, and heavy rainfall, can lead to food insecurity and an increase in the incidence of diseases. Furthermore, saline intrusion from sea level rise can have a negative impact on agricultural production, thereby jeopardizing the livelihoods of the poor. The poor are inevitably the worst affected by climate related hazards. According to Da Nang City standards, the overall poverty rate is just above 9%<sup>45</sup>. Thus, the city of Da Nang will need to design strategies to build the city's urban adaptive capacity in order to minimize damage to the urban poor's livelihoods, health, and overall wellbeing.

#### **2.3.2.2 Adaptive Capacity and Local Assets linked with the identified Green Growth Opportunities**

##### **Poverty Reduction Programs with Subsidies**

Currently, the DOLISA's social protection programs include subsidy programs such as health insurance (which includes low cost health treatments), free education, and social housing provisions. However, to date, there are few if any programs in place to protect the urban poor from the impacts of climate hazards and related natural disasters. Climate resilient housing and infrastructure will need to be built in order to protect the poor from climate hazards and related disasters. Post disaster recovery must be included in the operation of community development funds or social enterprises for eco-community development, a cost effective mechanism that should be facilitated to both address poverty reduction and to promote community resilience.

##### **Financial Resources and Distribution**

The costs for post disaster reconstruction have been primarily supported by the central government budget or from international aid. However, most funds are allocated for disaster response and relief, with limited funds available for preparedness and capacity building activities. The centralized budget structure is causing many delays in terms of project implementation. In addition, there is a mismatch between financial resources and the

responsibilities of agencies. Annually, each commune in Da Nang City receives just a few hundred US dollars from the central government budget to respond to disasters. Efforts are needed to increase financial resources to integrate disaster preparedness and adaptation measures into urban planning frameworks.

### **Public Engagement and Multi-Sectoral Climate Change Response**

Communities in Da Nang are already taking an active role in building resilience to climate change and in disaster recovery. According to research case studies in Da Nang City, poor communities are finding ways to protect their local assets by drawing upon their own resources and by developing community-led initiatives such as community savings programs. Information about climate hazards such as floods and typhoons are informed by local TV and radio programs. However, most poor families have no access to such forms of media. Thus, there is a need to provide the poor with access to media channels. The links between the city government, civil society, academic institutions, and the private sector should be further strengthened through city development forums and dialogues.

The city leaders have an understanding of the local communities' participation in regard to climate change response and disaster mitigation through diverse training programs and projects with international organizations, such as the World Bank, GIZ, and UN-Habitat. Decree 52 has permitted the flood and storm control sector to collect household contributions for recovery and relief activities, thereby encouraging more community engagement. The Women's Union and the District Volunteer Association of Da Nang City have developed initiatives to build local resilience to climate change.

## **2.3.3 Governance for Inclusive Green Growth**

### **2.3.3.1 Green Growth Opportunities and Gap Analysis**

For Da Nang to become a green growth city there is a need for enhancing co-ordination across all levels or scales of government (vertically) as well as across different policy sectors and departments (horizontally). The city of Da Nang has experience in integrating different government tiers, although its effectiveness has limitations when it comes to achieving comprehensive policy and programs. In terms of vertical co-ordination across multi-levels, the current government structure is relatively well organized from the city government to district, commune/wards and the village/section level.

However, decisions about urban planning remain top-down, thus there is lack of bi-directional communication between the government and the people of Da Nang City. Considering the importance of collaborative and multi-directional communicative governance for comprehensive and inclusive green growth, the following themes should be taken into consideration: 1) collaboration across and within different tiers of government; and 2) participatory processes of green development.

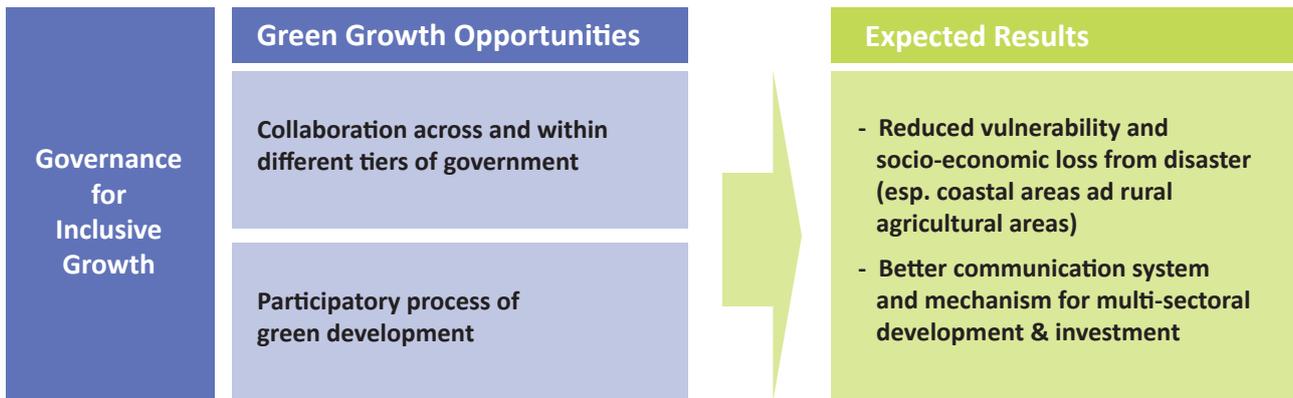
### **Collaboration across and within Different Tiers of Government**

Multi-level governance (vertical and horizontal collaboration) is critical for green growth. There have been initiatives to incorporate multiple sectors, such as agriculture, aquaculture, environment, disaster management, tourism and health, for natural resource management. The integrated approaches have been gradually accepted with new planning paradigms such as the Integrated Coastal Zone Management (ICZM). Existing committees (e.g. Disaster Management, Rescue and Relief Steering Committee) are often missing social assessment elements. Indeed, DOLISA has dealt with social issues separately and has been quite limited in its ability to mitigate the negative impacts of urban development in Da Nang City. In addition, due to the lack of coordination amongst sectors and agencies, conflicts between different agendas of different government tiers and development sectors are increasingly common, such as coastal protection for tourism and port development for industrial parks. There is a need to consider how to develop a multi-level governance framework which can address many of the challenges related to effective policy design and implementation.

Finally, administrative gaps can also deter the move towards green growth city development. Like other cities and countries, in Da Nang City there is a geographical mismatch between the green growth challenge or opportunity and administrative boundaries. For example, it can be difficult to address the sources of water pollution affecting aquaculture industry in the Lien Chieu District. Chemicals in the rivers from the agriculture and animal husbandry in the Hoa Vang District and waste water from the Hoa Cam IZ in the Hai Chau District can both influence the lives of people and contribute to pollution of the marine environment in the Lien Chieu District. The mismatch can be within the city as well as between the city and nearby provinces.

### **b. Participatory Process of Green Development**

According to the Vietnam Provincial Governance and Public Administration Performance Index (PAPI), Da Nang has scored as one of the best performers in the dimensions of participation, vertical accountability,

**Figure 33.** Green Growth Opportunities of Governance for Inclusive Growth in Da Nang City

corruption control, and public administrative procedures. Also, the city compares at the high average in terms of transparency and accountability. However, it has often been noted that there is a lack of public participation in decision-making in urban planning processes. For instance, the majority of plans for urban disaster management are prepared by leaders of the commune/ward, district or city level, and the approved plans and decisions are disseminated to people through community meetings or through the mass media.

In other words, communities are just informed about decisions related to flooding and storm control and they are required to prepare resources accordingly. As a result, the real needs for risk management at the micro-level are often missing. There have been many reported cases of conflicts during the urban development process, such as involuntary resettlements and inadequate compensation. This implies the lack of proper communication between different stakeholders. Indeed, even city government officials mention that there are difficulties in communicating with people, especially those living in rural areas or the poor households.

### 2.3.3.2 Adaptive Capacity and Local Assets to deal with the Identified GG Opportunities

Innovative approaches to participatory planning have been piloted in Vietnam by organizations such as UNDP and the Red Cross. The results of these project provided evidence that, in fact, those in the lowest levels of government can develop and utilize leadership skills for the benefit of the community. Another study discovered an extremely poor resettlement community creating multiple and varied positive socioeconomic outcomes for the community with minimal financial resources. Da Nang's diverse urban community, even those without professional training or substantial resources, can make important, valuable, and positive contributions towards local level

sustainable development. Good governance requires that the government identify, activate, and facilitate this critical community resource for the good of society. In this regard, a few programs have been identified in Da Nang to encourage multi-sectoral collaborative working practices.

First, the One Stop Shop model<sup>46</sup> is an important asset for the city to develop mechanisms for collaboration across and within different tiers of the government. With the public administration reform as part of the National Public Administration Reform Program 2001, all agencies relating to licensing issues are housed in one building and it has substantially increased efficiency of service delivery. It has been particularly useful in the most common areas of land use and housing, basic construction, transportation and business registration. This model incorporates more than ninety agencies from the city level to the district and commune level. It has been enhanced with more than forty legal documents providing guidance for administrative reforms and for improving procedures, contributing to harmonizing administrative procedures across all seven districts of the city.

The city's Integrated Coastal Zone Management Program (ICZM) has also provided a platform for stakeholder involvement and inter-agency and multi sector coordination for integrating environmental concerns into economic development plans. The city has experience coordinating consultation workshops and meetings, developing on-site training courses, organizing public awareness activities in coastal communities. In addition, the city coordinates the publication of a quarterly newsletter about the ICZM project. Civic participation has the potential of promoting green growth in the city. More importantly, many civic groups are already engaged, developing and implementing community-led innovations for development.

It will be critical for the city government to encourage locally-driven innovations for sustainable development.

City government officials may need training on strengthening community-led participatory processes. In this way, they can support the creative ideas of civil society organizations, sponsor innovation, and pay for services and products which have been developed locally. Government policies, regulations, processes and procedures will need to be reviewed to ensure that they support the active involvement of citizens and provide necessary resources to encourage community led initiatives. Additionally, citizen organizations may need training on leadership and participation in order to strengthen collaboration with the city government.

# 3.

## GREEN GROWTH - SWOT ANALYSIS OF DA NANG

Strengths, weaknesses, opportunities and threats (SWOT) related to Green Growth based development for Da Nang are analyzed in this section. The analysis is critical for developing the strategic initiatives of the Da Nang Green Growth City Development Strategy.

### GREEN GROWTH STRENGTHS

1. Intra-regional and intra urban accessibility: the city attracts domestic and foreign financial and human resources to retrofit itself with good access to other regions, and to develop relatively well-equipped infrastructure and intra-urban street networks and bridges.
2. ODA (Overseas Development Assistance) has contributed to developing and upgrading environmental infrastructure (e.g. Khanh Son Landfill). Further ODA projects to implement green growth strategies are also being planned.
3. Human resources are being trained to create locally adoptable technology for the effective use of resources, for mitigating the impacts of climate change, and for developing a green and innovative industrial park.
4. Well-developed and separated preservation zones are maintained as key tourism sites while polluting industrial development has been relocated.
5. Local green industry and technology development: Da Nang has policies to develop high-tech industry and energy efficiency programs such as solar power applications for water heating (residential and industrial), and bio gas development in rural areas in order to save costs and reduce environmental pollution.
6. Da Nang has a thriving eco-tourism sector, which attracts local and international tourists. It has an

image as an eco-tourism city.

7. Rural areas outlying the city have extensive natural and cultural assets. These are well preserved and maintained despite rapid urbanization, with enough labor supply to work on eco village tourism and green agricultural development.
8. Leadership in developing Da Nang as an eco-city: Local officials are actively taking initial steps to mitigate major environmental threats like salinization from sea level rise. In addition, the city government has initiated a green agricultural movement.

### GREEN GROWTH WEAKNESSES

1. Rapid urbanization and population growth have increased environmental pollution such as waste and transport pollution.
2. Poor environmental safety standards: The city has inconsistent regulations and a weak legal system related to hazardous waste treatment, with authorities who work separately among relevant departments. Regulations related to health and safety at work are weak with little consideration for the quality of life of workers. Water resources are heavily polluted by industrial waste discharge, construction projects in the upstream basin, and illegal mining. Conflicts about water sharing between Quang Nam province and Da Nang have yet to be dealt with.
3. Lack of waste management and economic loss:
  - Da Nang has no water recycling system in place although they experiencing heat loss and low rate of waste recycling. As there is no data collection on energy use, waste, and water resource use, industrial parks and enterprises pay extra costs to compensate for the economic losses.
  - Lack of local government support and no policy implementation for waste separation at source as well as no technology application for recycling make it difficult to support efficient uses of materials program. For example, SWM programs such as composting and effective uses of land.
4. Geographical disparity in infrastructure development and accessibility to basic service: insufficient and poor quality infrastructure and basic services (vulnerable to climate change) and a weak IT platform make it difficult to support green industrialization, green agriculture, and eco-tourism.

5. With a high risk of erosion at coastal areas and agricultural land in rural areas, weak measurements for development control and disaster risk reduction need to be strengthened, and integrated into the overall master plan.
  - Investment in public lighting, green buildings, energy saving facilities of industries and tourism services.
6. Poor agricultural land planning and management has led to urban sprawl with little indication of strategies for improved densification for a shift to public transport.
7. Limited opportunities for public private partnerships and the weak involvement of investors and the private sector in sharing costs for environmental facilities.
  - Weak initiatives of the government in raising environmental service fees such as for waste water treatment.
  - There is no pricing mechanism for enterprises investing in public transportation, thereby making it difficult to improve the quality of public transport in the city and discouraging people from using public transportation.
8. Technology development and application gaps:
  - Various technology projects have been developed without prioritization and fund mobilization, while technology transfers in facilities and operations have not been properly planned.
  - No databases on renewable energy potential and increased energy efficiency. Companies are discouraged to assess investment decisions on green technology applications.
  - Weak capacity to assess the environmental impacts of industries. In particular, high-tech parks need to select and identify categories of polluting industries.
  - Weak knowledge sharing networks and platforms exist for green/ high-tech development.
9. Regulation/ mechanism gaps for greener production and pricing mechanisms:
  - No strict regulatory frameworks and limited implementation of industrial waste management and energy efficiency.
  - No pricing mechanisms for solar energy generated power and the construction of grids developed for using solar energy (technology is available).
10. Fragmented planning system:
  - Lack of multi-sectoral cooperation among waste and other related urban sectors such as energy, industry, water, agriculture, tourism, and public health.
  - Construction plan does not incorporate resettlement factors in the master plan and overall land use planning does not reflect economic activities.
11. Low awareness and lack of community involvement in the eco-city development plan make it difficult to realize various program effectively
12. High prices for importing clean technology cannot be dealt with as market demand is still low.

**GREEN GROWTH OPPORTUNITIES**

1. Newly developed and committed projects to improve public transportation systems such as the BRT.
2. With rapid urbanization, new construction of residential areas, the high-tech park, industrial parks as well as tourism service infrastructure bring opportunities to apply energy efficiency measures and resource circulation systems in construction and industrial parks.
3. Infrastructure between neighboring provinces and cities (i.e bridge, road networks) to be developed and improved and will increase accessibility to eco-tourism destinations and support value chain upgrading while building resilience to climate change.
4. High demands from services industries, the high-tech park, and urban centers for local and safe agriculture products are expected to increase. This will also encourage different technologies to upscale production in cooperation with farmers and enterprises.
5. Regulations and a strategy to expand environmental management infrastructure such as waste water management which would facilitate user charges for operation and maintenance costs, expand treatment capacity, connection and transmission, and

construct centralized treatment systems for industrial parks. The city is committed to saving energy and developing a renewable energy strategy, such as solar power for heating water. For example, replacing fishing boat lights with solar powered ones would also save costs, increase safety, and even improve communication.

6. Overseas Development Assistance (ODA) and development agency projects to pilot low tech locally adaptable solutions such as biogas will be supported by various programs with the aim of improving the quality of agro-products and for developing biogas. These initiatives can increase the livelihoods of rural areas.
7. Social enterprises, community associations, and unions are actively involved in local environmental protection programs and resource recycling activities to generate revenue.
  - Social enterprises focus on solar energy and wind renewable energy applications and businesses. Associations/ unions (i.e. farmers and women's unions) are involved in environmental awareness programs.
  - Organic farming enterprises grow and sell organic produce and help to provide vital solutions to the local farming community.
8. River management opportunities are developed from reservoir and embankment building projects for green agricultural development. Considering the importance of river tourism and disaster impacts while dredging the Co Co River to connect Da Nang City with Quang Nam province.

## GREEN GROWTH THREATS

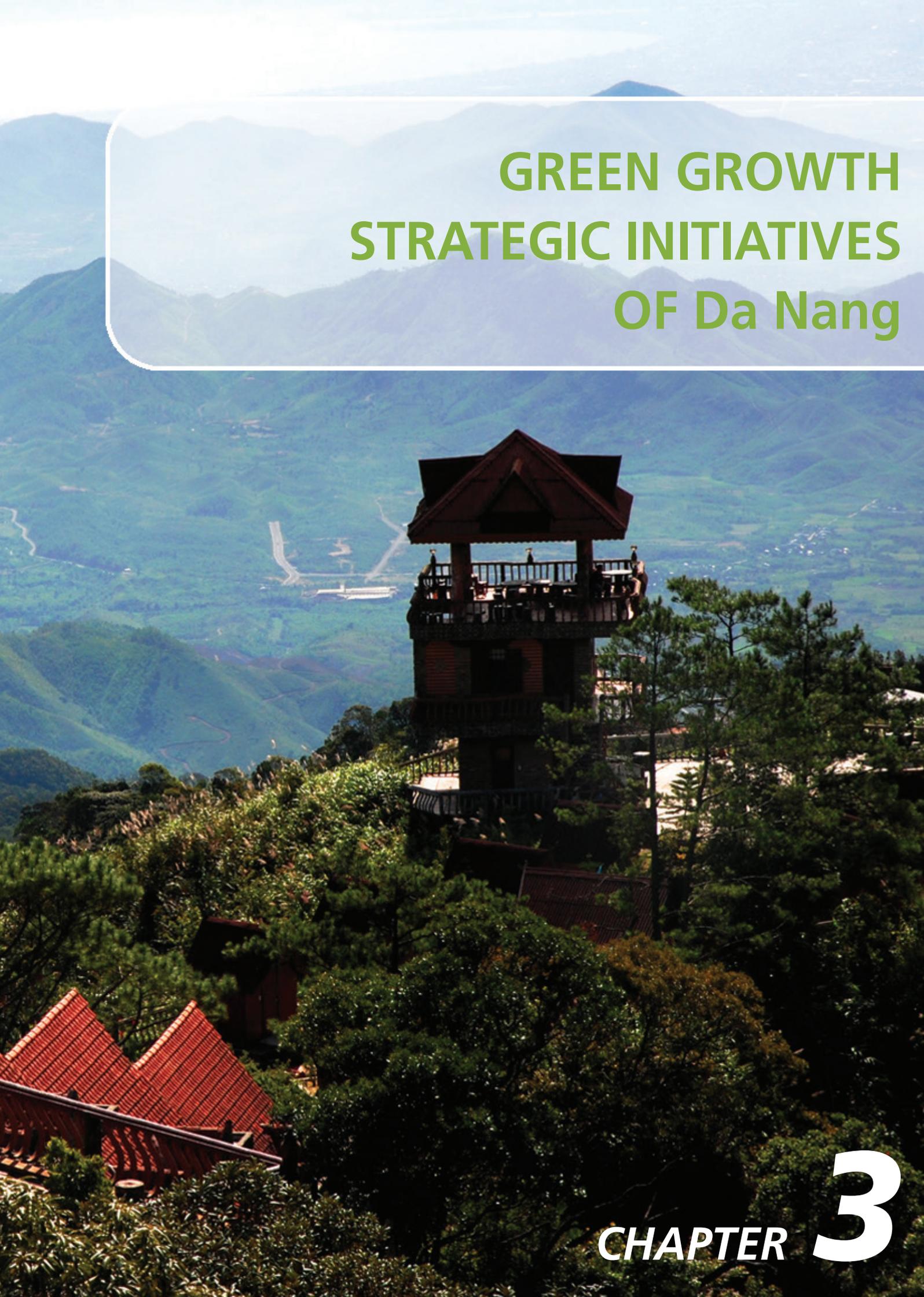
1. The global economic downturn and fierce inter-regional competition could affect government commitment to long-term investment planning for green growth programs and projects.
2. Water resources degradation due to key economic activities related to urbanization and industrialization
  - Loss of natural resources, agricultural land, and wetlands for urbanization and industrialization. The destruction of upstream forests will likely lead to flooding, erosion, and landslides.
  - Increase of aqua-cultural activities around the coastal areas causes more water pollution.

- Increasing waste water of increasing service industries such as restaurants and hotels need to be linked with water treatment systems.
3. Without strict regulations and incentives to apply appropriate environmental protection measures, the city's commitment to restructuring industries to high-tech and tourism oriented industries could accelerate environmental pollution.
  4. Newly developed construction in the urban center along the Han River may affect and significantly alter the landscape around the Son Tra Peninsular and Han River, one of Da Nang's most competitive features as an eco-city.
  5. Plans of future expansion toward disaster prone areas (high risk of coastal erosion and salinization) need to be adjusted urgently, particularly around settlement areas.
  6. With plans to expand infrastructure and the BRT, the city needs to improve its transport infrastructure. Poor traffic planning and infrastructure leads to congestion, problems related to traffic safety and poor accessibility from rural to urban areas.
  7. Rapid urbanization without long-term planning and investment can reduce the capacity of waste management.
  8. With a fragmented planning system, the lack of resettlement plans in the construction master plan could cause ineffective spatial planning and jeopardize livelihoods.
  9. With loose legal frameworks and institutional structures for multi-sectoral coordination, it remains difficult to encourage local communities and the private sector to change production patterns and lifestyles to use resources more efficiently.

**Table 7.** Summary of SWOT

Strengths	Weakness
<ul style="list-style-type: none"> <li>• Intra-regional and intra urban accessibility</li> <li>• Increasing environment friendly ODA with a focus on upgrading relevant infrastructure</li> <li>• Strong human resources trained to develop locally adoptable technology</li> <li>• Preservation zones and relocation strategy for polluting industries</li> <li>• Local green technology (promotion policy on high-tech; bio-gas facilities)</li> <li>• Thriving tourism sectors based on extensive natural and cultural assets</li> <li>• Leadership in Da Nang to make it a sustainable city in the region and in ASEAN</li> </ul>	<ul style="list-style-type: none"> <li>• Rapid urbanization increasing environmental burdens and land use planning</li> <li>• Lack of institution/enforcement to create appropriate environmental standards</li> <li>• Lack of waste management leading to economic loss from unrecycled resources</li> <li>• Gaps in infrastructure development and accessibility to basic services (urban-rural)</li> <li>• Weak measurements for risk reduction and control of the impacts of climate change</li> <li>• Limited options for public private partnerships</li> <li>• Technology development and application gap</li> <li>• No pricing mechanism for greener production</li> <li>• Fragmented planning system</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>• Newly developed/committed projects to improve public transportation systems</li> <li>• New infrastructure for urban, residence, high-tech/ industrial park, and tourism services</li> <li>• Infrastructure for linking neighboring provinces &amp; cities</li> <li>• High market demands for local and safe agricultural production</li> <li>• New strategy to expand environmental management infrastructure and capacity</li> <li>• ODA and potential projects to pilot locally adoptable solutions</li> <li>• Active social enterprises, community associations and unions</li> <li>• River management opportunities from reservoirs and embankment building projects</li> </ul>	<ul style="list-style-type: none"> <li>• Global economic downturn and fierce inter-region competition</li> <li>• Increase in pollution related industries and services, and increasing rapid urbanization</li> <li>• Without strict regulations and incentives, strong focus on high-tech and tourism oriented city development strategy</li> <li>• Newly developed construction will have a negative impact on the natural landscape and urban amenities (competitive attraction of the eco-city)</li> <li>• Future expansion towards disaster prone areas</li> <li>• Inappropriate land use planning and infrastructure development before adopting the BRT system</li> <li>• Lack of long-term planning and investment plans to increase local capacity</li> <li>• Loose legal frameworks and lack of environmental awareness</li> </ul>





# GREEN GROWTH STRATEGIC INITIATIVES OF Da Nang

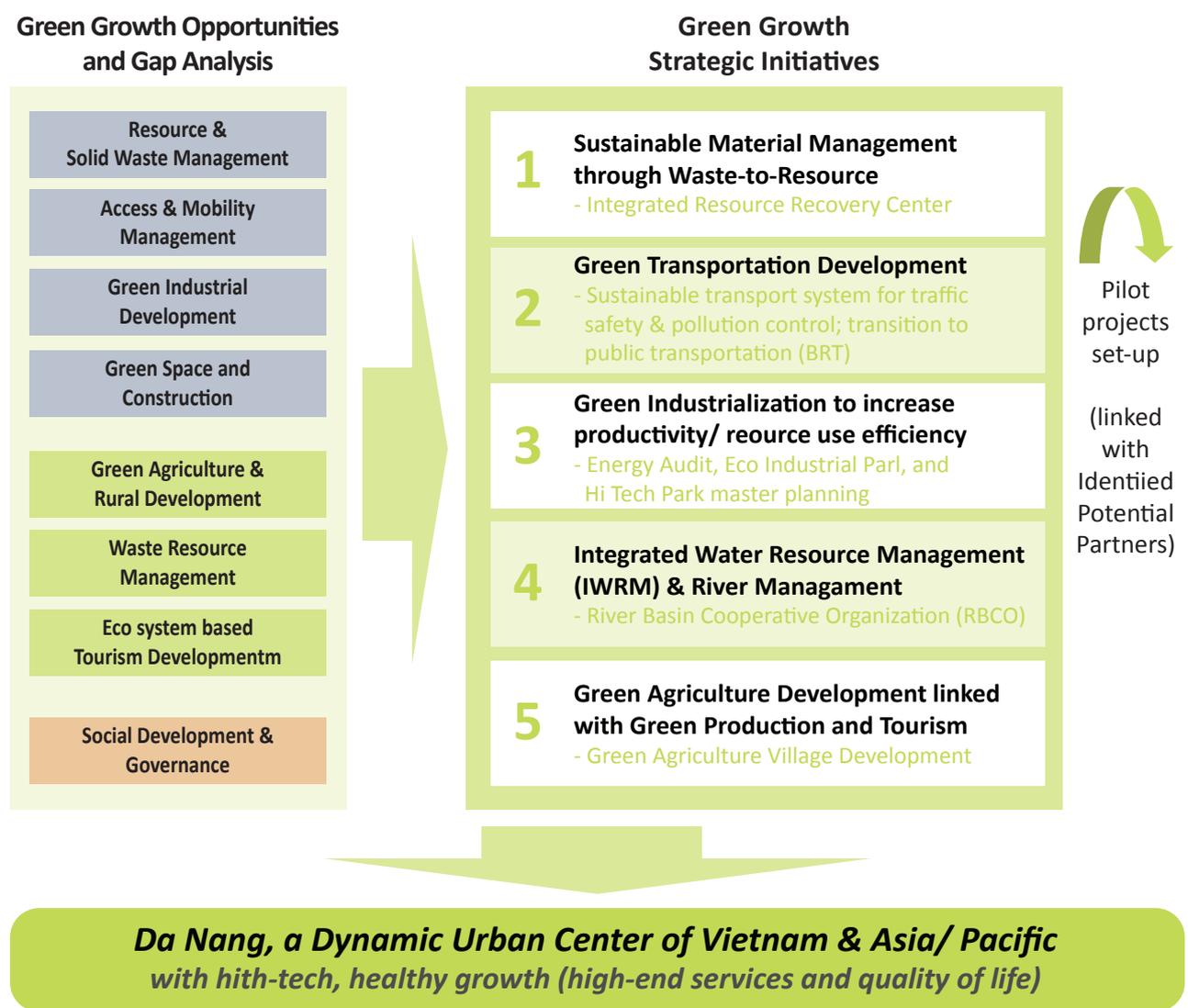
CHAPTER **3**

# 1. OVERVIEW

Based on the identified green growth opportunities and the analysis of local practices and institutional settings, green growth strategic initiatives were identified with cross-cutting and integrated GG-programs and pilot project ideas. More than one identified opportunity under the three green growth criteria groups of the GG-CDS are used to formulate multi-sectoral key strategic programs. First, solid waste management, water resources

management, and social development opportunities are used as the basis to formulate the following strategic initiatives: 1.Sustainable Material Management through Waste-to-Resources, which emphasizes the overall greening of material management and creating socio-economic values from waste-to resource approaches. Strategic initiative number 2 is Green Growth Transportation, which refers to low carbon and sustainable mobility development. This strategic initiative is strongly based on social development opportunities, access, mobility, and green space and construction opportunities. The formulation for the other strategic initiatives - green industrialization, IWRM(Integrated Water Resources Management), and green agricultural village development- used the same approach. Notably, social development is a cross-cutting theme and is used for developing all strategic initiatives.

**Figure 34.** Overview of strategic initiatives of Green Growth Orientation for Da Nang Development



Under each integrated and multi-sectoral initiative, key programs are identified along with innovative concepts and principles, processes, and financing possibilities. Furthermore, key pilot projects ideas have been discussed with potential development partners, with the aim to attract investors and international development organizations interested in sustainable and cost effective solutions for city-wide socioeconomic development with high and long-term impacts.

These strategic initiatives should strengthen the image of Da Nang as a vibrant urban center in the Asia-Pacific region. Ultimately, these green growth initiatives are expected to contribute directly to rebranding Da Nang City as the first city in Vietnam to mainstream green growth into the overall development orientation in Vietnam to become socio-economically competitive as well as provide a high quality life.

### Green Economic Benefits of the GG-CDS Strategic Initiatives

The strategic initiatives in the GG-CDS are expected to generate substantial economic benefits for Da Nang City. For example, investments in the Integrated Resource Recovery Center (IRRC) are likely to bring economic gains through job creation, energy savings, and reduced costs for health and other social service programs. Moreover, the poorest of the poor will improve their living standards as the IRRC will employ workers from the informal waste pickers' community, thereby providing them with higher paying jobs. The move towards low carbon, sustainable modes of transportation, such as the Bus Rapid Transit system, will create both skilled and unskilled employment opportunities while reducing costs for expensive, polluting fossil fuels. And finally, initiatives such as the Eco-Industrial Park (EIP) and the High-tech

## Box 5. Viewpoints of the Green Growth Orientation of Da Nang City

On the basis of the creative application of the five main themes of Vietnam's National Strategy for Green Growth (VGGG), Da Nang City has identified some main viewpoints, such as the following:

- Enhance green growth based investment and conservation, development, and the efficient use of natural resources, reductions in greenhouse gas emissions, improvements in efforts to protect the environment, while stimulating local economic growth.
- Focus on capitalizing the city's advantages of the city to ensure the rapid and sustainable socio-economic development of the city. Ensure harmony between economic development with protection of natural resources and social equity. The focus is on continuing to promote economic restructuring towards services - industry - agriculture and to improve the quality of growth towards industrialization and modernization. In addition, the city will promote the development of sustainable tourism as a key industry in the city.
- Development of synchronic infrastructure that promotes effective development and social equality in the city. Socio-economic development should be associated with urban upgrading and urban infrastructure development. Focus on infrastructure development in association with improving the quality of urban public services such as public transport, water supply, solid waste, and waste water treatment, sanitation, green space development and green building to improve conditions for green growth.
- Green growth must be based on scientific achievements and modern and innovative technology that is appropriate to local conditions. Quickly resolve conflicts between using clean technologies and high-quality rapid growth. At the same time, for manufacturing industries, select and prioritize the development of products using advanced techniques which cause less environmental pollution, with a high level of knowledge and high added value.
- Integrate green growth into local programs and plans for environmental management, the management of disasters, and building the city's resilience to climate change.
- Green growth should stimulate job creation, reduce poverty, and improve the living standards of people.
- Green growth should involve the communist party and the general public, as well as different levels of government, ministries, agencies, localities, enterprises and social organizations. Thus, achieving green growth will require promoting and enhancing the community's responsibility. Public-private partnerships in all fields are vital. Also important are the construction of green infrastructure, sustainable urban services, the management of natural resources, social development, and equitable growth.

Park are expected to bring significant earnings through the creation of innovative industries, such as renewable energy startup companies, high-tech computer technology enterprises, and green waste businesses. GG-CDS strategic initiatives are expected to create jobs in sectors such as organic agriculture, renewable energy, energy efficiency, public bus transportation, and waste to resource recycling. Specific projections for economic earnings (i.e. job creation, energy savings, resource efficiency, etc.) are outlined in each strategic initiative.

While initial public and private investments are required for these green growth initiatives, it is expected that these investments will eventually pay off through the growing number of competitive enterprises and higher paying, skilled “green” jobs generated for Da Nang City. In turn, rising incomes and profitable enterprises will spur economic growth for the city and for the region. In tandem, it is important that a comprehensive investment framework be developed to ensure that investments are properly managed, leading to equitable “green growth” city development. Da Nang City will therefore need to introduce a comprehensive policy and regulatory framework for domestic and foreign investments.

## 2. KEY STRATEGIC INITIATIVES

### 2.1 STRATEGIC INITIATIVE 1

#### **Sustainable Solid Waste Management through Waste-to-Resource to develop Eco-Efficient Industries and Socially Inclusive Development for Da Nang City**

##### **Rationale and Objectives**

The city needs to dispose of waste in a sustainable manner, by pursuing waste-to-resource based on separation at source. The policy response should contribute to coping with the increasing demand for landfills in accordance with rapid urbanization and population growth in the city. Waste segregation can also decrease the loss of recyclable items by improving the recycling process. Recycling can lead to economic gains in connection with related industries and can

generate employment opportunities. Recycling can also increase resource efficiency in the industrial production process by combining green industrial development while mitigating negative impacts on the environment. Ultimately, sustainable waste should be closely linked with a sustainable urban economy on the basis of resource recirculation within closed-loop production. Also, it is critical to expand basic services for collecting and treating waste in rural areas. Bio-degradable waste in particular should be efficiently utilized by composting or biomass power generation to increase economic gains while reducing environmental pollution.

#### **Key Program 1: Establish an IRRC (Integrated Resource Recovery Center) with a Multi-Sector Participatory Solid Waste Management System**

##### **1. Background**

Da Nang City needs to set up a “multi-sectoral” solid waste management system in order to deal with the growing amount of waste accompanying the city’s rapid urban development. It will be critical to implement waste-to-resource initiatives, all of which should be based on waste separation at the source. In turn, these initiatives will contribute to economic growth in Da Nang City. These initiatives will also lead to an improvement in environmental quality. Moreover, the informal sector will be engaged in community-based solid waste management projects, thereby providing jobs and income for the urban poor.

##### **2. Expected Outcomes**

- **Improve economic benefits through waste-to-resource initiatives which provide energy and create related industries which lead to jobs:** Sell resources produced from waste and promote recycling to produce healthier material such as organic fertilizer and bio-gas. This will entail promoting industries and technologies relevant to recycling, composting, and waste-to-energy.
- **Deal with environmental pollution in land, water, and air. This could be driven by increasing waste generation in accordance with rapid urbanization and population growth:** Minimize the amount of waste generated which can contribute to reducing pollution caused by increases in dumped waste. Decrease GHG emissions through various initiatives for waste-to-resource energy.
- **Provide the poor with jobs by integrating the informal waste sector into community-based IRRC:** This would benefit the urban poor by creating

- Monitoring indicator examples
  - Total amount of waste generation (non-biodegradable and bio-degradable waste)
  - Waste amount sent to landfill and the ratio in total waste generation
  - Recycling rate/amount: Waste-to-resource for industrial use (plastic, glass and etc.)
  - Composting rate/amount from bio-degradable waste
  - Resource efficiency or productivity driven by Life Cycle Assessment (LCA)<sup>47</sup>
  - Size/ratio/conditions of solid waste management enterprises including public, private, and informal sectors as well as IRRC (Integrated Resource Recovery Center): Market size, number of companies, workers (jobs), and working conditions
  - Number of workers integrated into IRRC from the informal sectors
  - Technologies for supporting overall solid waste management and IRRC
  - Illegally dumped waste into environment
  - Waste impacts on pollution in air, land, and water
  - Waste flows for incineration
  - Hazardous industrial waste amount collected and treated
  - Public health related statistics (rate of environment related illnesses, etc.)
- Assumption under total amount of residential waste with 238,498 tonne in 2011
  - Estimated rate of recyclable waste: 20% of total waste
  - Total estimated weight of recyclable waste: 47,699 tonne
  - Estimated recycling rate: 5~7% of recyclable waste
  - Total estimated weight of recycled waste: 2,384~3,388 tonne
  - Target recycling rate: 10~14% (in next 5 years) → 4,769~6,677 tonne
  - If the recycling rate improved above, the economic impacts on recycling industry and urban economy could be increased from perspectives of job creation, personal income, local tax revenue, projected annual growth, and estimated total economic impact (in next 5 years).
- \* Consideration for Estimating Economic Impacts of Recycling Municipal Solid Waste: Commodity: Glass (Brown, Clear, Green, Mixed), Steel, Aluminum, Other/Scrap, Metal, Plastic (PET, HDPE), Paper (Cardboard, Office paper, Newspaper, etc.); Amount Recycled (tonnes); Price per tonne (in accordance with commodities); Estimated Recycling Rate (%); Total Estimated Weight (tonnes); Estimated Weight in Landfills (tonnes); Value in Landfills; and avoid Cost of Landfilling.

higher paying jobs, along with safer working conditions.

- **Promote and strengthen civic participation and public-private partnerships for overall material management via the building of community-based systems for sustainable solid waste management:** This will contribute to social and economic sustainability.

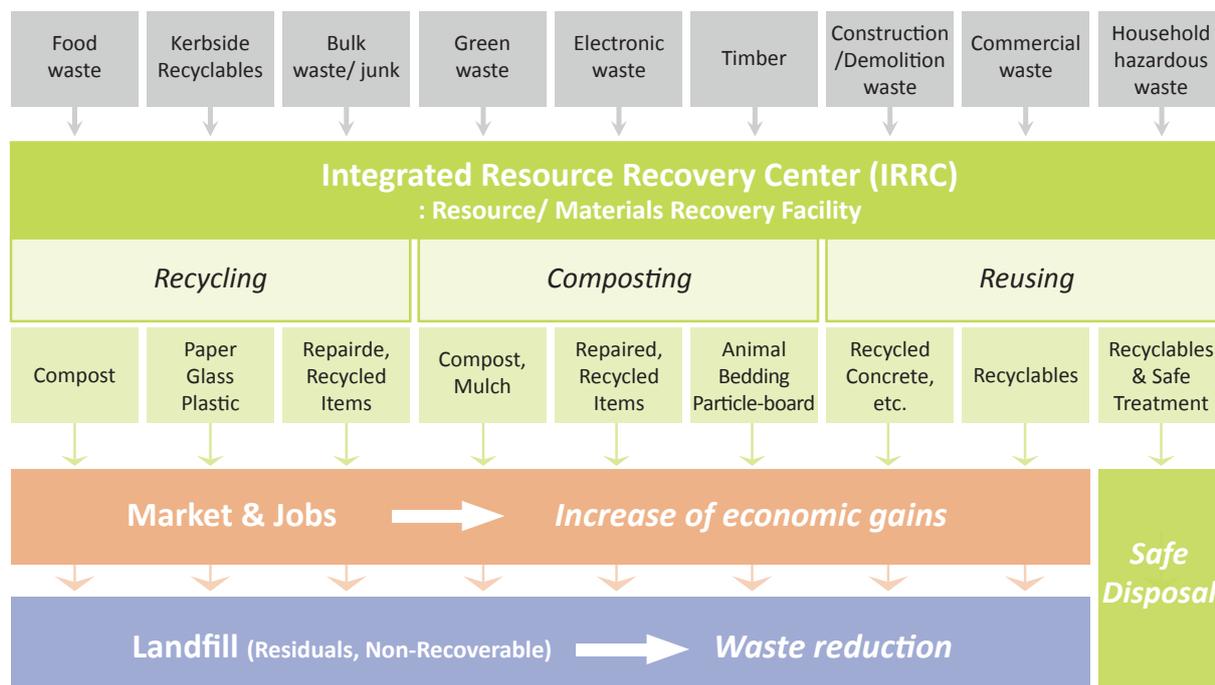
### 3. Main Concepts and Principles

**IRRC (Integrated Resource Recovery Center) is a community-based center** which aims to improve efficiency for managing, collecting, and treating solid waste generated by each community. This should be located in the neighborhood to keep transportation costs low. The IRCC would enable vegetable/fruit vendors in the area to bring their bio-degradable waste directly to the disposable center. The attractive features of an IRRC is the close involvement of the community and the small scale of the facility.

With regard to designing and implementing the IRRC, the key principles are as follows: 1) Waste separation at source as a key prerequisite; 2) Improvement of recycling; 3) Development of composting; and 4) Development of a market-oriented incentive system. They are closely connected with each other, contributing to community-based waste management

First, **waste separation at source** in collection should be a starting point which contributes to improving resource/energy efficiency and reducing environmental pollution driven by improper waste management. The city needs to implement this at households and businesses in order to encourage waste-to-resource in citizens' daily lives through segregating waste into recyclables (e.g. glass, plastic, PET, packaging materials, paper, cardboard, tin/metal, and styrofoam, etc.), hazardous waste (e.g. battery), bio-degradable waste (e.g. food waste and agricultural by-products), and the rest (general waste sent to landfills).

In regard to **improving recycling**, above all, it is essential to segregate recyclable waste in the collection process in order for waste not to be sent to landfills. Collecting

**Figure 35.** Waste solution through IRRC mechanism

the recyclable waste from households in the community regularly (e.g. once a week), and transferring them to the center would be followed by selling the recyclables to bulk buyers (recycling companies) after preprocessing at the center. At the city level, it is critical to improve related industries/enterprises, their capacity and quality of the recycled resources at city level. The city needs to provide market-based incentives to encourage recycling industries (e.g. subsidies and investments in R&D for related technologies and facilities/ equipment). In addition, the industrial sector needs to use recycled resources in industrial production in practice. The city should back this up by linking recycling industries with manufacturing companies with regard to industrial resource and environment management (i.e. building symbiosis relationship between recycling businesses and industrial companies). This contributes to establishing a closed-loop system for sustainable waste-to-resource in production to keep the recycling market consistent in the long-term.

To support the **development of composting**, the city needs to distribute public bins for collecting biodegradable waste from each community in a ward and to provide collection service every day. Also, it is necessary to build the facilities for composting bio-degradable waste and to operate them to process biodegradable waste segregated. The procedure includes weighing, sorting, mixing, loading, temperature/moisture control, maturing, screening, storage and packaging for selling. Composting contributes to producing different kinds of fertilizer for

specific soil and crops by varying quantities of nitrogen, phosphorus and potassium and other nutrients added to the composts. It is essential to develop not only technologies but also markets for composts by establishing a bulk market for composts to be profitable and possible distribution channels to sell them.

Last, **market-oriented incentives** should be devised in terms of introducing a market-based system to encourage efficient and effective solid waste management. It is important to motivate consumers and businesses to reduce waste generation and dispose of waste responsibly, thereby contributing to increased demand for the greening of the waste sector. Specifically, the incentives include taxes/ fees, recycling credit, other forms of subsidies, and deposit-refund, etc.

In this respect, the introduction of a **volume-based waste disposal scheme (Pay-As-You-Throw: PAYT)**<sup>48</sup> to collect general (unrecyclable) waste to be sent to landfills in an efficient way. However, in the case of “poorest-of-the-poor,” subsidies should be provided to support those collection fees for promoting socially inclusive development. The **Extended Producer Responsibility (EPR)**<sup>49</sup> scheme can be considered as a regulatory institution at the central and local level to improve material management in production. It is feasible by assigning producers physical or financial responsibilities with different scales and setting (collection, recycling or recovery) targets upfront and matching the specific

**Figure 36.** Main principles and expected outcomes of IRRC

operating scheme with the types of waste, manifested as follows. In order to implement EPR, **mandated product takeback** is to require producers to be responsible for

the collection of products and packaging at the end of a product's life. It requires each producer to meet specific recycling rate targets, encouraging producers to consider reducing waste and recycling in designing products. In addition, deposit & refund is required as a type of product take-back policy, a payment made by manufacturers of certain products into a fund by giving a refund to consumers when returning the products to the seller.

#### 4. Major Tasks and Processes

##### 4.1. Major tasks

The IRRC program for Da Nang has three major tasks:

1) Reform the institutional system for waste management; 2) Build up IRRC with multi-sectoral participation; and 3) Treat waste into resources in practice. IRRC can be activated as a center for community-based waste management through not only hardware, such as buildings and facilities, but also software, including renovated institutions and operations to ensure circulated financial flows. Details are as follows:

- **Reform the way in which waste is discharged at households/ workplaces**

- Develop a system for the organized collection of legal documents. Waste separation at source at households and workplaces; Collect and treat separated waste.

- Introduce the volume-based waste disposal scheme to encourage people to reduce their total amount of waste;

- Develop a roadmap for the introduction of a volume based waste disposal scheme, including the identification of a fee calculation mechanism, fee collection measures, as well as human resources for monitoring and fee collection. In addition, promote the development of waste containers which are suitable for volume-based waste disposal schemes;
- Continuous communication and awareness-raising on the 3Rs should be conducted earlier and in association with this scheme.

- **Implement an indication system for separating and sending out recyclable waste, linked with carrying out waste separation at source at households and workplaces**

- Put labels on packing materials in accordance with source, to make it easy to separate recyclable waste at source and to improve the rate of collecting and recycling (Refer to the following Figure: paper, paper cartonne, metal (can), glass, synthetic resin (plastic) packing and vinyl);
- Equip community-based recycling bins classified into each kind of recyclable, to encourage residents to easily discharge their recyclable waste.

- **Conduct regular monitoring to ensure compliance with regulations/guidance on waste separation at source by coordination among relevant agencies** (e.g. DONRE, people's

committees of wards and communes, and community leaders, etc.).

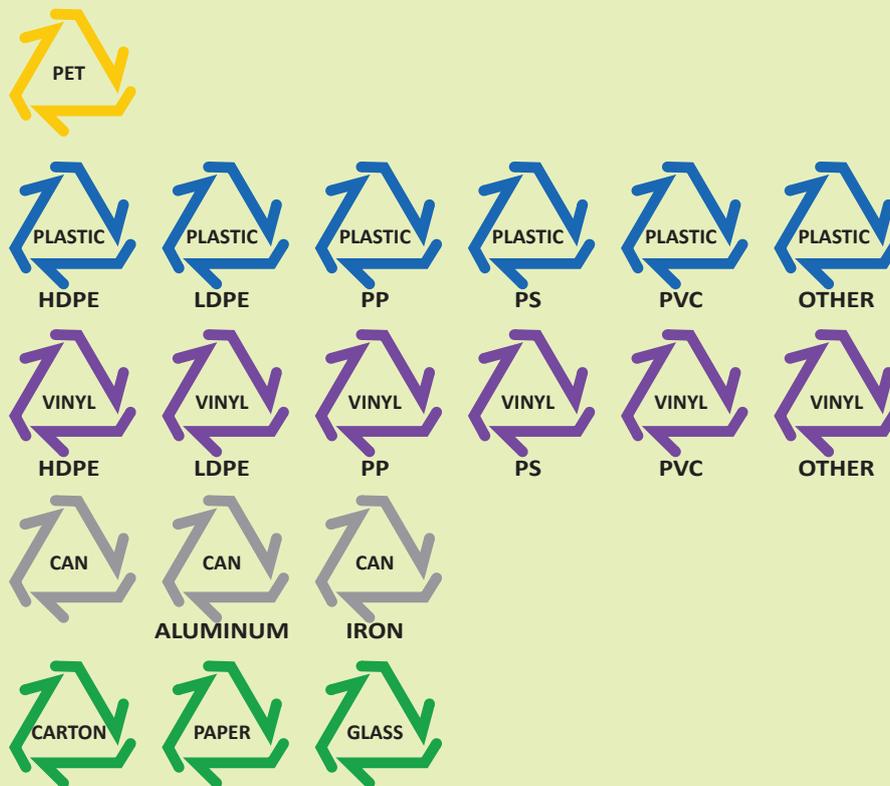
- **Introduce the collecting system for farming waste in rural areas**
  - Deal with bio-degradable agricultural waste (Refer to the program of biomass plants);
  - Separate and collect waste vinyl used for farming and packaging containers of agricultural chemicals, by offering compensation to farmers in order to prevent illegal discharge and environmental pollution.

- **Build up multi-sectoral IRRCs with the operating systems of multi-stakeholders**
  - **Mobilize joint multi-sectoral funds for setting up the IRRC from SMEs, community unions and associations, etc. Establish the operating system for IRRC.**
    - The city government and URENCO (urban environment company) plan to build a cooperative partnership with residents in each community in building and operating an IRRC.

**Site Requirements for Developing IRRC Pilots**

- One IRRC at an selected ward/commune unit of each district in the city
- Easiness to control waste discharge (related to collection, transfer, and treatment)
- Relatively high payment rate of waste collection fee secured
- Linkage with informal waste sector
- City IRRC : Relatively high generating rate of recyclable waste; geographic proximity of the recycling companies to be efficiently treated
- Rural IRRC : Relatively high generating rate of the agricultural/ bio-degradable waste for composting to supply resources

**Figure 37.** Indication system for separation of recyclables: example of Korea



- Set up and operate IRRC models appropriate for urban and rural areas as follows:
  - City IRRC : focused on recycling & reusing; cooperated with SMEs for recycling
  - Rural IRRC : focused on composting; local residents and unions; link with biomass plants
- Employ informal waste collectors & provide education/ training programs to increase public awareness at IRRCs.
- **Design “Social Enterprises (SE)” to direct and operate the IRRCs**
  - The SE will be owned and administered by community members in a PPP arrangement
  - The SE will include the IRRC as well as the projects related to separation-at-source, composting and waste-to-energy.
  - Community members will assume leadership roles in the Social Enterprises and will be paid accordingly - just as in private businesses.
  - The SE can be designed as a cooperative, giving opportunity to all employees to participate in the planning and operations of the SE.
  - The city government will direct all incentives and supports typically provided to private businesses towards the Social Enterprises.
- **Treat waste into resource in practice**
  - **Conduct pre-processing of recyclable waste at IRRC**
    - **Link with development of recycling industries:** Make contracts with recycling companies or utilize internal facilities/ equipment for recycling in practice.
    - Develop the capacity and productivity of the existing recycling companies by providing them with institutional and technical support as well as financial support in the form of market-based incentives such as tax reductions or subsidies for development and improvement of technologies, facilities, and equipment.
- Organize a cooperative association or social enterprise for operating the IRRC.
- Provide residents with community-based solid waste management services including collection, transfer, and treatment in an efficient and effective way.
- **Phase 2: Transform the pilots into full-scale implementation after monitoring and evaluation (the 2<sup>nd</sup> year)**
  - Conduct evaluations on the operation and management performance of IRRCs.
  - Provide feedback for improving the operation of IRRCs.
  - Make operational manuals to share related methodologies and know-how.
  - Promote full enforcement of IRRCs from pilots.
- **Phase 3: Disseminate IRRC models across the city (the 3<sup>rd</sup> year)**
  - Expand IRRCs to other wards/communes in the city.
  - Establish close linkages and interaction between community-based IRRC systems and a centralized solid waste management system at the municipal level.

#### 4.2. Process

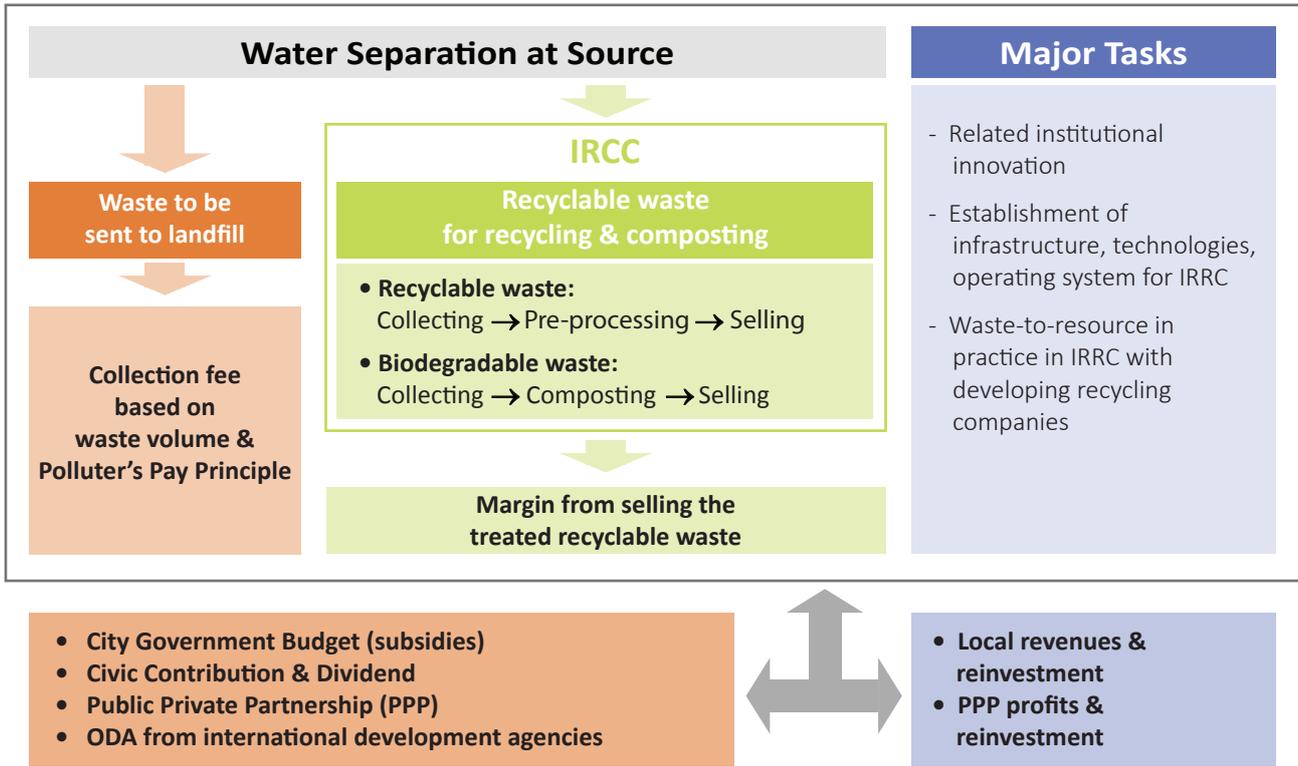
- **Phase 1: Develop key pilot projects for the IRRC in Da Nang (the 1<sup>st</sup> year)**
  - Build an IRRC in each selected ward/commune of some districts where solid waste management is not enough, including in rural areas (Hoa Vang sub-district).
  - Encourage households/ businesses in each community to participate in separation at source (i.e. recyclables, bio-degradables (food waste), agricultural, hazardous, etc.)

#### 5. Financial Mechanism

Financial flows are described below. Economic revenue would be generated from collection fees and from the selling of recyclable waste and compost made by bio-degradable waste. Revenue would be used to pay salaries for employees at IRRCs as well as to operate the process itself such as recycling and composting. In the initial period, the city government should mobilize forms of financial support such as subsidies from the city government to complement the budget for operating expenditures. Build a systematic mechanism for PPP with regard to community-based IRRCs in order to directly coordinate public and private investments. PPP and ODA should be closely linked and managed to improve efficiency and the effectiveness of investments in the IRRC.

*Regional-Capacity Development Technical Assistance (R-CDTA)* of the Asian Development Bank (ADB) is a program for the mitigation of Hazardous Waste Contamination in Urban Areas to support inclusive growth. The project is financed by the Japan Fund for Poverty

**Figure 38.** Financing component and financial flows in the IRRC program for Da Nang City



Reduction. The project Coastal Cities Environmental and Sanitation Project, funded by the World Bank, aims to improve environmental sanitation in the project cities in a sustainable manner thereby enhancing the quality of life for city residents. The Additional Financing (AF) will bridge an unanticipated financing gap resulting from a period of exceptionally high inflation in 2007 - 08 exacerbated by low original cost estimates. The project was approved March 2011 and the closing date is open. The total project cost is 79.30 million USD.

**6. Role Design and Collaboration Mechanism**

It is critical for enterprises to participate in recycling system in practice, based on institutional innovation. The enterprises (product producers) need to be encouraged to bear a certain portion of recycling expenses by committing to the treatment of recyclable waste to recycling companies, which has to be supported by legal and institutional reforms at the local and national levels. Overall, recycling capacity should be expended by developing and improving related infrastructure (facilities and equipment) and technologies in existing recycling companies. Each IRRC should closely cooperate with domestic and international companies specialized in processing/ treating recyclables. The city government (Department of Natural Resources and Environment) and

URENCO also need to give shape to the basic frameworks and priorities for coordinating short/mid/long-term investments in solid waste management programs/projects based on building a systematic mechanism for public-private partnership. This needs avoiding overlapped investments by focusing on satisfying the urgent demand for community-based solid waste management all around the city. PPP and ODAs can be closely linked and managed together to improve efficiency and effectiveness of investments in SWM in order to deal with financial problems caused by the global economic downturn.

Above all, there needs to be an awareness of the importance and necessity of efficient/effective systems for SWM and then a request for related supports to the central government. To back up this, IRRC related legislation and regulations should be set up together with not only market-based incentives such as PAYT and EPR, but also relevant subsidies and support funds for encouraging community-based waste management. It is important to build up a closely cooperative partnership among the central government, city government, businesses, and citizens to implement the plans/policies/projects for SWM as established vertical integration. Solid waste management in the informal sector needs to be integrated into the IRRC by closely cooperating together to achieve formalization. Each IRRC should provide informal workers with jobs and safe working conditions. The city

needs to support this by setting up related political support and policy reforms, such as extending micro-credits and arranging external funding.

Ultimately, the city needs to make horizontal integration among waste and other related sectors for multisectoral cooperation/coordination. With regard to waste management, the city has to cooperate with other urban sectors such as energy, industry, water, agriculture, tourism, public health, and labor in developing/applying SWM technologies (e.g. biogas plant technology to be

developed by combining agriculture, waste and energy sector; technologies treating leachate from waste to be closely related to improved water resource). Lastly, it is critical to improve civic and industrial participation into waste separation at source in a more positive manner. To back this up, the city needs to encourage waste sorting and waste-to-resource and provide consistent awareness raising programs made by not only IRRCs but also relevant public department/agencies such as DONRE, URENCO, and other NGOs or CBOs. Specifically, the role design for promoting the IRRC system is described as below.

**Figure 39.** Role design for promoting the IRRC system in Da Nang City

<p><b>IRCC managing board</b> (in the city, district government and URENCO)</p>	<ul style="list-style-type: none"> <li>- Make overall plans and implementation</li> <li>- Manage the system</li> <li>- Coordinate public and private investments</li> </ul>
<p><b>IRCC</b> (in each community, by a ward unit)</p>	<ul style="list-style-type: none"> <li>- Collect, transport and treat waste generated in each community</li> <li>- Link with biomass plants (in rural areas)</li> </ul>
<p><b>CBOs</b> (Community Based Organizations)</p>	<ul style="list-style-type: none"> <li>- Participate in operating an IRRC</li> <li>- Develop awareness raising programs on SWM for the community</li> </ul>
<p><b>Local SMEs</b> (related to recycling)</p>	<ul style="list-style-type: none"> <li>- Support technology transfer and development</li> <li>- Connect recycling with industrial production in practice</li> </ul>
<p><b>Evaluation agencies</b></p>	<ul style="list-style-type: none"> <li>- Assess overall performance and provide feedback</li> </ul>

## Box 6. Best Practices (Korea and Sri Lanka) related to IRRC

- **Volume-based waste charging scheme in Korea**
  - The Korean Ministry of Environment introduced the volume-based waste charging system in 1995 to incentivize residents to reduce their waste. It is based on separate waste streams, segregating recyclable items from non-recyclable waste. Households are required to purchase government-issued plastic bags and to dispose of what cannot be recycled. Each municipality sets the price for the official plastic trash bags, thereby setting the price of disposal according to the amount of waste generated. Fines apply for households who violate the law.
  - The results from this scheme were as follows.
    - Waste reduction: Waste generation per capita per day has been reduced 23% from 1.33kg in 1994 to 1.03kg in 2004.
    - Economic benefits accrued from 1995 to 2004 are more than 8 trillion won (8 billion USD) from avoided waste treatment and market value of increased recycling products. The amount of recycles in 2004 is 2.8 times higher than 1994 (8,927 tonnes per day in 1995 to 24,588 tonnes per day in 2004).
    - Ecological benefits: The reductions have resulted in reduced contaminated water from landfills and reduced pollution from incinerators.
  - Success factors:
    - An appropriate fee rate: The price needs to be set to incentivize people to reduce the amount of waste but not burden their household budget. The earnings from selling the plastic garbage bags can be recycled to operate the scheme, thereby alleviating the financial burden on the local government.
    - Communicate the benefits and provide detailed guidance: The segregation between recyclables and non-recycles has to be done properly by households. The central government provided a detailed list of what waste can be disposed and where via brochures and commercial advertising.
    - Impose a penalty for non-compliance: People can be fined up for disposing garbage not in the officially issued plastic bags.
- **IRRC in Sri Lanka**
  - In 2006, Matale Municipal Council and UN-ESCAP (United Nations-Economic and Social Commissions for Asia and the Pacific) jointly piloted a “Community-Based Decentralized Solid Waste Management Project” to improve services in one ward while reducing costs, producing economic outputs and minimizing the amount of waste that was sent to the landfill.
  - The partners established an IRRC in Gongawela ward to collect waste from households and businesses through the employment of a staff of six waste pickers who then sort and treat the waste for various uses, including turning it into the compost that they sell.
  - The results were as following.
    - Reduced waste and greenhouse gas emissions.
    - Turned a profit: The IRRC struggled to make a profit in the first years but has since improved its management and is now turning a profit. The current collection of fees form households and the sales of compost almost cover its operating costs.
    - Created jobs and increased quality of life: The IRRC has employed workers form the waste-picker community and provided a clean working environment. Other waste pickers in the city have also benefitted.
  - Success factors
    - Site selection: The center is located within the neighborhood it services, leading to reduce not only transfer costs but also the risk of contamination as transportation distance are short.
    - Involvement of the community for waste separation at source: Asking households to sort their waste helps relieve excess labor in the center. This involves households in the recycling process and helps sensitize the community more deeply about individual consumption and waste levels.
    - The support and leadership of the local authority: The municipal council was willing to engage in a public-private partnership with an NGO. The municipality supported the IRRC by providing workers and giving it a land concession.

**Key Program 2:**  
**Establish Biomass Plants in Rural Areas**

**1. Background**

Da Nang needs to utilize bio-degradable waste in rural areas for energy resources by taking appropriate measures. The city should focus on the following key points:

- a) increase waste-to-energy through biomass power generation;
- b) obtain electricity from bio-degradable rural waste such as agricultural by-products;
- c) reduce environmental pollution caused by inadequate collection and treatment of bio-degradable rural;
- d) and encourage civic participation in biomass power plant operation, especially regarding feed supplement and related job creation from the perspective of community-based solid waste management.

**2. Expected Outcome**

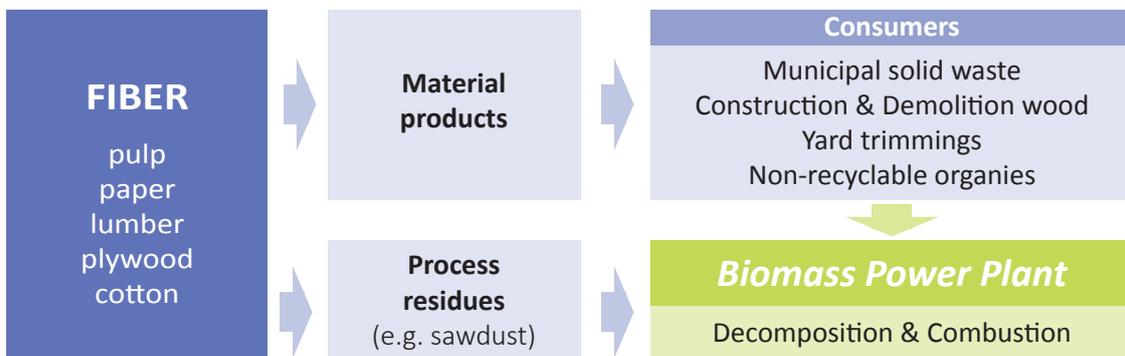
- Disposed bio-degradable rural waste in expanding urban areas in the city.
- Recover energy and other useful by-products from waste, leading to the implementation of waste-toenergy.
- Generate economic profit which leads to income for local, rural residents and develop related industries, technologies and jobs. Biomass plants have the added benefits of a much higher job creation rate per TWh, compared with fossil fuel energy and nuclear energy.
- Mitigate environmental pollution driven by growing bio-degradable waste and agricultural byproducts in accordance with rapid urbanization and population growth by turning them into energy resources.

**3. Main Concept and Principles**

Biomass refers to all biological material from living or recently living organisms that can be burned, gasified or fermented to produce bio-energy. Beneficial sources of bio-energy can be divided into four categories as follows: 1) Agricultural crop residues, such as rice husks; 2) Sustainable wood and forest residues; 3) Energy crops grown specifically for the use as bio-fuel on land that cannot be used for food crops (more advanced technology can use algae harvested from water); and 4) Urban and industrial wastes. Specifically, biomass power plants use biomass sources to generate steam or heat. A biomass power plant most often produces steam through combustion. The steam can be used for industrial processes or to produce electricity. Alternatively, the heat from combustion could be directly used in an industrial process. Another variation is a co-fired power plant fueled by coal or natural gas combined with a biomass source. Major components of a biomass power plant are fuel storage area, fuel conveyor system, chipper /grinder, boiler; condenser, pollution control devices, smokestack, cooling system, electrical substation, and an administration building.

Wood waste fuel would typically be stored in an outdoor pile in quantities adequate to fuel the power plant anywhere from 60 days to several years. Agricultural waste fuel would be stored in silos. Agricultural products such as switchgrass, hybrid poplars, or cottonwood trees would be stored in barns or storage domes on site. Depending upon the type of boiler, the fuel is either transported directly to the powerhouse via a belt conveyor, or first processed in a chipper/grinder to produce a finer texture. Municipal solid waste is deposited into pits where cranes mix the refuse and remove any large, noncombustible items. Sometimes, it is further processed to remove ferrous materials, glass, and other noncombustible materials. In a fluidized bed boiler, the fuel is suspended on high-pressure jets of air during the combustion process. This not only allows combustion at relatively low temperatures and

**Figure 40. Concept: Biomass to Electricity**



Source: revised from <http://www.energy.ca.gov/biomass>

higher efficiency, but it also decreases the production of nitrogen oxide, an air pollutant.

#### 4. Major Tasks and Processes

##### 4.1. Major tasks

The biomass power plant program for Da Nang has the following major tasks: 1) Feasibility studies for searching adequate resources; 2) Location selection; 3) Fund mobilization based on public-private partnerships; 4) Promoting a system set-up; 5) Plant construction and operation. The city needs to draw up a set of essential prerequisites such as financing and participatory allocation before building up and operating plants. The details of the major tasks are as follows:

- **Conduct feasibility studies to find out the most competitive resources for biomass power generation:** Research the prospect of introducing biomass plants which generate power from agricultural waste, such as grass, crops, and coconut rachis, to find out appropriate resources in the city which lead to sustainable development at the local level.
- **Select an optimum location for the biomass plant in rural areas:** Select and secure the site appropriate for building the plants, considering location advantages in terms of supplying raw materials (rural by-products) and electricity demand/ shortage.
- **Mobilize funds through “public-private-civic” joint investment/ contribution** from community unions, other private investment (domestic, foreign), and ODA, in addition to the public budget (city and central government).
- **Set up the promotion system of role allocation among participants for implementation:** Public sector (city and central government) to provide financial, legal and institutional support and to establish a pricing mechanism such as **FIT (feed-in tariff)** for renewable energy electricity, known as a fixed-price policy as the government defines a fixed tariff for renewable energy electricity.
- **Construct the plant building and operate the plant with adequate technologies** to produce electricity and heat for households and industries by **connecting with a national grid** for selling power based on established pricing mechanisms for renewable energy.

#### Box 7. Site Requirements for Biomass Power Plants

- An overall site area of 5 hectares (in case of 30 MW electrical power outputs) is required to encompass approximately 2.6 hectares for buildings, with the remaining land for ancillary works, such as landscaping and car parking.
- Connection to the grid must be achievable to enable 30 MW electrical outputs from the power plant. A general assumption is that “a connection to the grid could be made, notably within or close to urban areas. Where a site is in a more remote location away from centers of population or development, it will be assessed that the connection to the grid would be lengthy, and therefore costly, and be in an area which would not require reinforcing of power supplies.” It would be more appropriate to score the sites in terms of their distance from the existing sub-stations and NIE power stations within the province, and their proximity to the consumer base.
- Proximity to fuel source (such as bio-degradable waste): to minimize the need for transporting the material, the costs involved and emissions arising from transporting in accordance with the proximity principle
- Availability and viability to identify available sites for acquisition: A site which is costly to acquire, or located where a connection to the grid would incur excessive costs or where potential additional costs may result because of the location, such as new road works, would undermine viability. A site closer to the existing grid would result in minimal new road works.
- Water availability and sensitivity
  - For the incinerator to operate, a cooling method has to be applied, which can have implications on the design requirements and in selecting a site. One assessment examines water sensitivity as a criterion whereby air cooling could operate. The second assessment includes the key criterion of water resource availability to enable either the evaporative or water cooling to take place.

Source: UN-ESCAP, Low Carbon Green Growth Roadmap for Asia and the Pacific, 2012

**4.2. Process**

- **Phase 1: Develop a key pilot biomass plant project in Da Nang (the 1<sup>st</sup> year)**
  - Build a biomass plant in rural areas based on a feasibility study and site selection (e.g. Hoa Vang sub-district).
  - Produce electric power by using agricultural waste and provide it to neighboring households and industries.
- **Phase 2: Conduct monitoring and evaluation (the 2<sup>nd</sup> year)**
  - Evaluate operation and management performance of the plant.
  - Provide feedback to improve operations of the plant.
  - Make operational manuals to share related methodologies and know-how to upscale.
- **Phase 3: Disseminate biomass power plant model to other areas in the city (the 3<sup>rd</sup> year)**
  - Expand biomass plant model to the urban areas to deal with increasing bio-degradable waste.

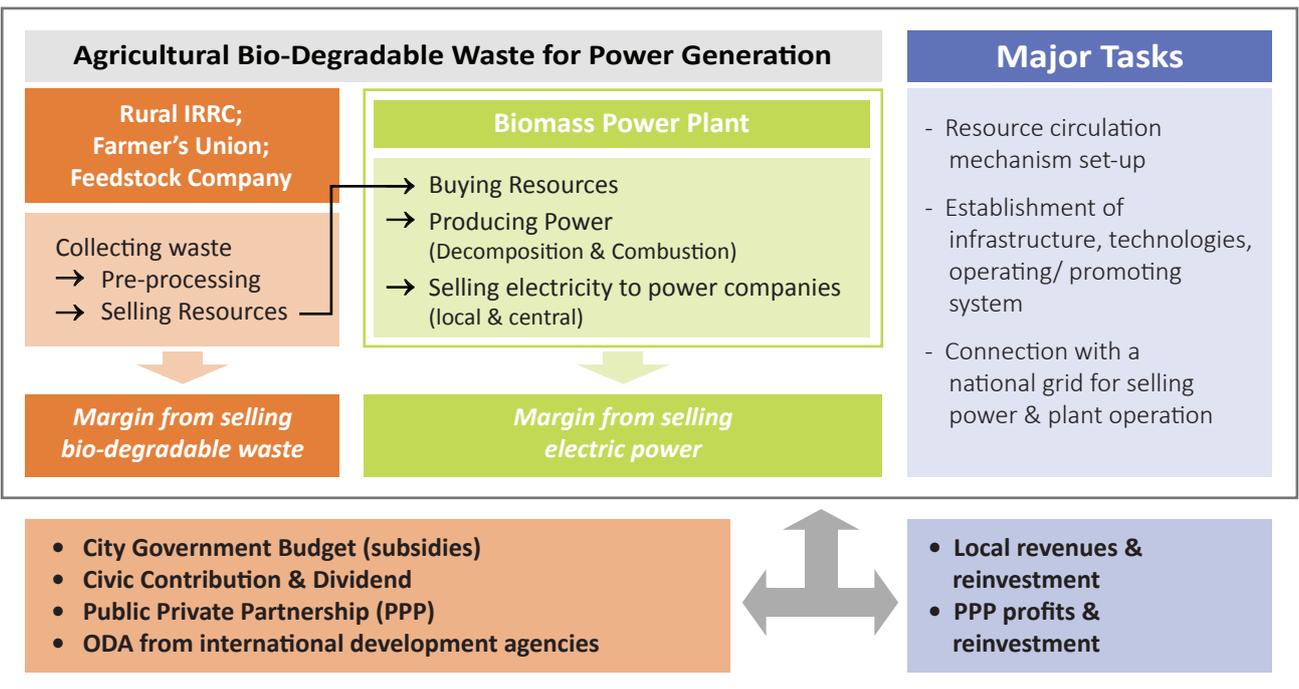
**5. Financial Mechanism**

**5.1. Financial flows and financing mechanism**

Mobilize finances in a community-based way: Farmers in rural areas will be encouraged to feed supplements of rural bio-degradable waste and by-products to obtain economic gains by selling biomass resources. They can also participate in developing and operating the plants, obtaining profit from selling electricity to power companies at the central and local levels. These profits have to be re-invested to operate plants as well as paid workers. The annual dividend from operating plants can be paid to civil shareholders such as farmers/rural residents. The city government should provide the plants with financial support, such as subsidies, to complement the budget for operating expenditures in the initial period. It is critical to establish a systematic mechanism for PPP for the city government to coordinate public and private investments, including domestic and foreign investors, and to cooperate with relevant investors. Also, PPP and ODA to be closely connected to improve efficiency and effectiveness of financial inputs in developing/operating biomass plants.

The Asian Development Bank (ADB) will provide 74 million USD to fund thousands of biogas plants across Vietnam to help reduce the country’s mounting piles of rural waste, which harm the environment and endanger human health. The Low Carbon Agricultural Support Project will process agricultural and rural household

**Figure 41.** Financing component and financial flows in the Biomass Power Plant program for Da Nang City



waste into biogas and bio-slurry, a clean organic fertilizer. The project will run for six years with an expected completion date of December 2018. The ADB loan is from its concessional Asian Development Fund, with the government of Vietnam and state-owned financial firms contributing a combined 10 million USD. In addition, the Bio Green Energy Fund of Korea is a project funded by the Korean Ministry of the Environment, the Korea Environment Corporation, private enterprises, and banks. These agencies focus on supporting and implementing waste-to-resource and biomass energy related businesses contributing to economic profit through waste treatment and energy securing as well as reductions in GHG emissions.

## 6. Role Design and Collaboration Mechanism

Collaboration mechanisms and management structure are described as follows:

- The biomass power plants should be closely related to or integrated with the IRRC in rural areas in accordance with local conditions in order to collect the agricultural waste appropriate to biomass power generation;
- The plants will be operated in many ways, including public, private, and PPP (public-private partnership). Specifically, farmers will organize an association corporation, similar to a union, to participate in the investment and the operation of biomass power plants. This will contribute to the community's participation and revitalization in terms of improving energy independence and creating related jobs.
- University and R&D institutions to cooperate and provide advising for plants to develop and support related technologies. In addition, the city government should provide subsidies in order to develop facilities and technologies for biomass plants in rural areas.

**Figure 42.** Role design for promoting the Biomass Power Plant in Da Nang City

<p><b>Biomass Plant Managing Board</b> (Consists of city/ district government and relate public agencies)</p>	<ul style="list-style-type: none"> <li>- Provide institutional, financial supports including pricing mechanism</li> <li>- Make overall plans and implement</li> <li>- Coordinate public and private investments</li> <li>- Manage overall system in the city</li> <li>- Set up related infrastructure</li> </ul>
<p><b>Special Purpose Company (SPC)</b></p>	<ul style="list-style-type: none"> <li>- Operate the plant</li> <li>- Manage labors in a plant</li> </ul>
<p><b>Farms and Farmer's Union</b></p>	<ul style="list-style-type: none"> <li>- Provide agricultural by-product for free or at a cost</li> <li>- Participate in operating a plant</li> </ul>
<p><b>Feedstock Company</b></p>	<ul style="list-style-type: none"> <li>- Collect resources (agricultural by-products), preprocess and transport to the plants</li> </ul>
<p><b>Electric power supply company</b> (at central and city level)</p>	<ul style="list-style-type: none"> <li>- Connect with a national grid based on an pricing mechanism</li> </ul>
<p><b>Technology supply company and R&amp;D institutes</b> (local/ national/ international)</p>	<ul style="list-style-type: none"> <li>- Design facilities and equipments through technical cooperation and transfer</li> </ul>
<p><b>Evaluation Agencies</b></p>	<ul style="list-style-type: none"> <li>- Assess overall performance of the plant, and give feedback on system operation</li> </ul>

### Box 8. Best Practice: The Biomass Plants of Güssing, Austria

- Güssing is a small town with about 4,000 inhabitants, located in the eastern part of Austria near the Hungarian border. The region was very poor until biomass as source of energy was discovered and utilized in the region. In the year of 1989, the mayor of Güssing, along with experts, worked out a concept for the energy supply of Güssing. The aim was to satisfy the local energy demands based on local energy producers who utilize local resources. This way the region can be independent from imported fossil fuels and fluctuating oil prices. In addition, money spent on energy (oil, power, fuels, transportation etc.) could stay in the region, with a positive effect on local industries.
- First, the energetic optimization of buildings was carried out - reducing local energy demand - then demonstration energy plants were established. The flagship of the most important innovation is the **combined heat and power (CHP) plant with fluidized bed steam gasification technology**. Apart from the gasification CHP plant there are various research projects being carried out in Güssing concerning incineration, solar energy, hydrogen generation, fuel cells, the production of methan from syngas, Fisher-Trops synthesis etc. The aim of these research projects is to produce heat, electricity, gaseous and liquid fuels to satisfy the energy demands of the region. In this way, the region can be as much independent from energy imports as possible.
- The **Güssing gasification** plant uses a special **fluidized bed steam gasification technology** which was developed at the Vienna University of Technology in cooperation with AE Energietechnik and RENET. The plant started operations in 2001 and after the optimization phase it is still working perfectly. It is the first utility-scale power plant of its kind in the world, with a rated capacity of 8MW, producing on average about 2MW of electricity and 4.5MW of heat per hour. Operating at 8,000 hours per year for the last several years, the Güssing facility, together with a network of smaller district heating plants and other renewable energy units, produces more energy than the town consumes on an annual basis. The material is wood chips which are collected from local farmers from the nearby forests. Those resources were essentially made up of local grown agricultural crops and residues and wood/ forest biomass. The combined heat and power plant uses a so-called **fluidized bed steam gasification technology** which was developed by the Technology University of Austria. The plant produces heat and electricity from local raw materials and is used in the region. The acceptance of the CHP plant by citizens as well as the local authorities is excellent.
- The positive effects of the technology would be a complete energy supply for the city from biomass; the utilization of local resources; sufficient local biomass; energy supply independent from fluctuating oil prices; attracting industrial activities to the region; income for the local wood farmers and the municipality from local business taxes; local job creation in the region; and low gaseous emissions; no liquid emissions, ash only from the combustion zone.

Source: Katalin Bódi, "Case Report: Biomass CHP Plant in Güssing", Austria, BioMob, 2010

## 2.2 STRATEGIC INITIATIVE 2

### Green Transportation Development to Improve Access and Mobility Based on Public Transit

#### Rationale and Objectives

Da Nang needs to improve intra-city public transit services to increase people's mobility by expanding regular routes. This would prepare people to adapt to public transport before the overall implementation of the BRT, and reduce dependence on private vehicles, traffic congestion, fuel consumption, and air pollution. Moreover, green transportation development will provide people with jobs, education, and greater access to healthcare services, thereby improving the quality of lives of urban dwellers. Thus, the city should establish a system of transport planning, development, and management of road networks and facilities. The city should focus on developing sustainable public transport systems integrated with proper land use planning.

These measures should aim at developing public transit related industries and jobs, from infrastructure construction to technology/ management development. Ultimately, it should be closely linked to develop a compact city in order to deal with uncontrolled urban sprawl by increasing development densities along with public transit taxes. Overall objectives and outcomes are as follows:

#### *Objective 1: Increase people's access and mobility through public transportation to achieve socioeconomic development in Da Nang City*

- Outcome
  - Provide citizens with public transportation services as a safe means to travel.
  - Improve the mobility of rural residents and tourists.
  - Increase people's access opportunities to jobs, education, and other services.
- Monitoring indicator examples
  - Transport (mode) share out of the entire traffic volume: Ratio of public transit (bus services), private motorized vehicle (cars, motorbikes), and non-motorized vehicles (bicycles).
  - Wide coverage of public transportation services and operation.
  - Transport networks in rural areas to improve urban-rural linkage in transport (in HoaVang sub-district): road connectivity with urban areas and public transport services.

#### *Objective 2: Mitigate negative environmental impacts caused by transport by using clean fuels and vehicles as well as integrated land use planning*

- Outcome
  - Decrease fossil fuel (energy) consumption by private vehicles.
  - Reduce air pollution by vehicles dependent on polluting fossil fuels.
  - Improve public health in accordance with upgraded air quality standards.
  - Preserve land resources through integrated transport and land use planning and mitigate uncontrolled urban sprawl.
- Monitoring indicator examples
  - Estimated economic and environmental damage by traffic congestion.
  - Reduction in energy consumption as a result of public transport services, such as the BRT.
  - Ratio of vehicles using clean transport fuels (including cleaner, low-carbon fuels). These include Gasoline, Diesel, LPG, LNG, CNG, bio-fuels, and electricity, etc.
  - Number of electricity charging station (infrastructure for electric bikes and cars).
  - Amount of GHGs and air pollutants emitted from transport vehicles (transport-driven impacts on air pollution).
  - Develop densities in accordance with public transport corridors.

#### *Objective 3: Foster competitive industries for the development of low carbon public transportation*

- Outcome
  - Develop related industries, jobs and technologies to support green, sustainable public transportation systems and to pursue sustainable city development.
  - Promote local economic earnings based on high-value added industrial development.
  - Increase value of assets and promote economic activities along public transport corridors.
- Monitoring of indicator examples
  - Companies and jobs created by overall introduction (enforcement) of public transport systems, such as the BRT: Research & Development, Management & Operation, and Monitoring & Evaluation, etc.
  - Companies and jobs for developing industries for clean fuel (LPG, LNG, CNG, bio-fuels) and clean vehicles (electric bikes): numbers, sales, net revenues, etc.
  - Technologies related to sustainable public transportation development as mentioned above.

- Real estate tax and enterprise income tax collected from developments with increased value and commercial facilities along new public transport corridors.

**Objective 4: Improve traffic safety and walkability in the city**

- Outcome
  - Provide people with a safe and walkable environment to encourage the use of public transport.
  - Improve the quality of lives of people through experiences of safe transport.
- Monitoring indicator examples
  - Traffic accidents and casualties (number of deaths and injuries).
  - Violation against traffic regulations (e.g. helmet, seat belt wearing, speed limit, number of passengers limit and traffic signals, etc.) and situation of pedestrian transport facilities (sidewalk, crosswalk including traffic lights, barrier-free, and street furniture, etc.).

**Key Program: Develop the Sustainable Transport System to Deal with Traffic Safety, Air Pollution, and Transition to Public Transportation - BRT (Bus Rapid Transit)**

**1. Background**

Da Nang needs to establish a comprehensive sustainable transport system in order to effectively deal with rapid urbanization, population growth and the increasing number of private vehicles. The city should focus on some key points: a) the increase of people's accessibility and mobility through the transition from private vehicles with high energy consumption to public transport services with improved energy efficiency; b) the opportunity to deal with air pollution caused by private vehicles; c) The need to transition to clean fuels to reduce air pollutants; d) The need to improve traffic safety and walkability in the city through enhanced regulations and facilities; and e) the development of competitive industries related not only to public transport but also to clean fuels/vehicles.

**2. Expected Outcome**

- **Reduce the extensive use of private vehicles and related fossil fuel energy consumption, traffic congestion and associated losses in productivity; Improve transport demand management in**

an efficient and effective way; Generate new employment and industries including manufacturing, processing businesses and services, while creating economic profits.

- **Mitigate transport-driven air pollution** emitting GHGs, air pollutants, noise and vibration which pose serious threats to human health and wellbeing by setting up a public transport system and developing clean fuels/ vehicles, contributing to environmental protection and the high quality of peoples' lives.
- **Provide people, especially rural residents and the poor, with safe, comfortable, and affordable public transport services to improve accessibility and mobility:** Overcome a vast gap between income groups in terms of access to paved roads and affordable, safe transport; Protect the most vulnerable members of the city from some of the adverse transport impacts, such as traffic accidents.

**3. Main Concept and Principles**

It is critical to support a variety of environmental, economic, and social objectives in planning, building, and operating transportation systems. This shift has been driven by diverse factors: one factor is the desire for a more integrated and holistic approach to transportation decision-making to consider the complex interrelationships between built and natural environments. The other is the important societal priorities to consider with the multi-faced implications of transportation system changes in decision-making<sup>50</sup>.

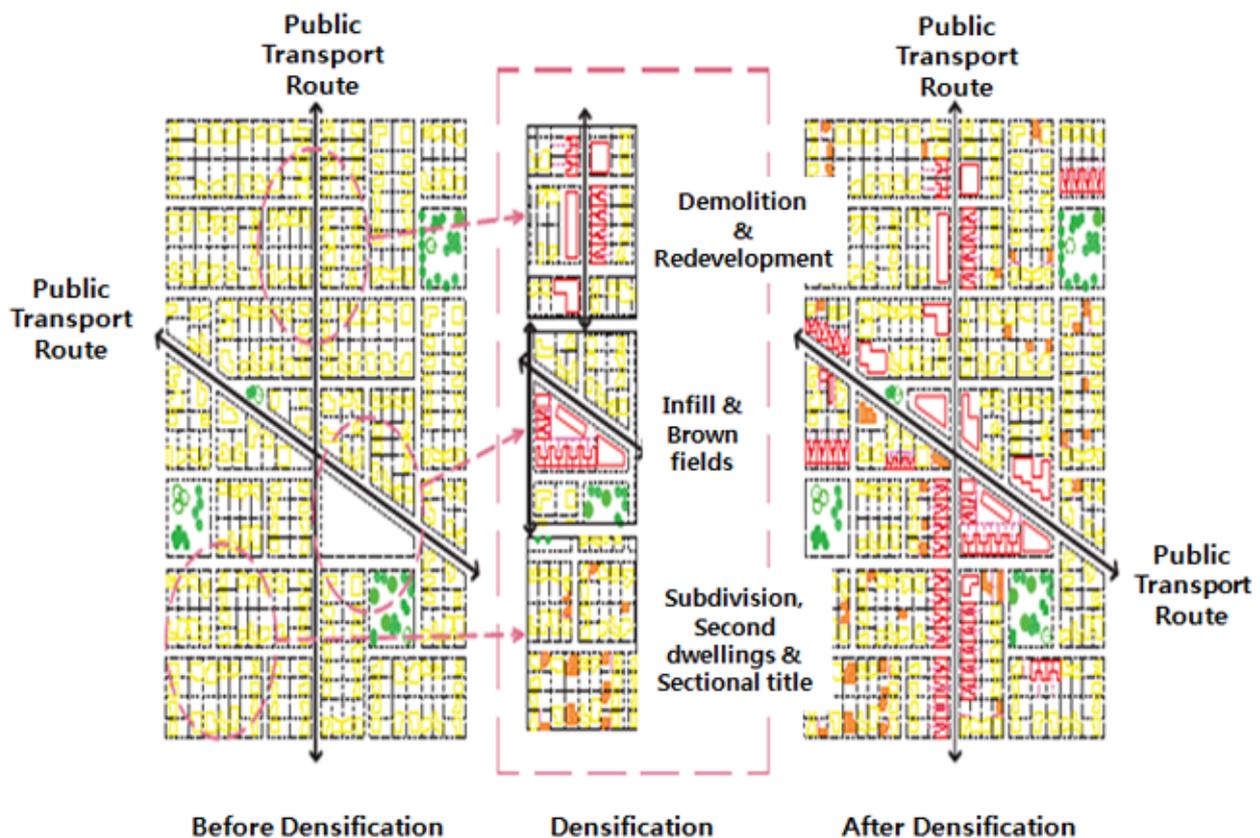
In sum, sustainable transport systems make a positive contribution to the environmental, social, and economic sustainability of the communities they serve. In addition, such modes of transportation support green job creation and a competitive economy<sup>51</sup>. Following are the key principles of sustainable transportation:

- ***The transition to public transportation oriented development and improvement of overall traffic safety*** has to be preceded before ***devising and applying preparatory measures for implementing the BRT*** (i.e. developing infrastructure and managing the system as the main public transportation in the city while at the same time expanding intra-bus services.
- First, it needs to enhance ***walkability and the use of non-motorized vehicles*** in the city with the aim to improve people's ***awareness of traffic safety and public transportation***. It is critical to plan and design the city to encourage people to walk/ cycle and use public transport. For raising public awareness, related information on traffic safety as well as public

transport should be provided, contributing to a reduction in fuel consumption.

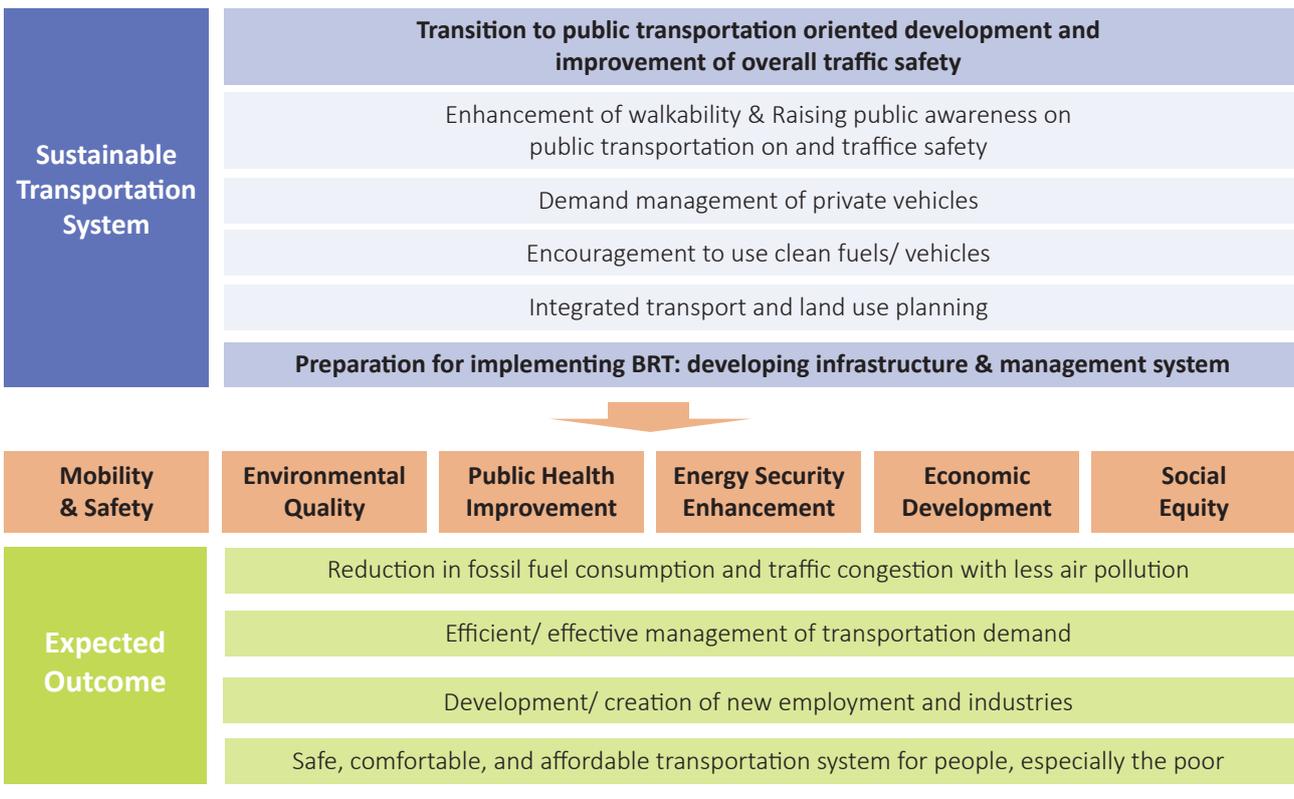
- Second, **demand management of private vehicles** should be complemented. There is a need to organize regulatory schemes to manage the use of certain motorized vehicles and to influence the types of vehicles used and the standards required to adhere to vehicle performance. Thus, it is essential to introduce policies and related mechanisms favorable for public transportation, i.e. measures on the demand management of motorized private vehicles, in accordance with implementing public transport services like the BRT. In addition, there is a need to reform the fuel tax system (e.g. increase in tax rate on fossil fuels and related vehicles; reduction in related subsidy cuts) to encourage people to use sustainable modes of transport.
- Third, **the use of clean fuels** must be encouraged. There is a need to encourage public buses to use clean fuels for improving energy efficiency and reducing air pollution. Also, it is essential to set up the system to support clean fuels such as the CNG (Compressed Natural Gas), LNG (Liquefied Natural Gas), and other bio-fuels. There is a need to introduce market-based incentives, such as subsidies for developing/ investing in related technologies. It will be critical to utilize disincentives such as imposing environment charges on existing fossil fuels which cause negative environmental impacts. There is a need to foster the market for electric motorbikes to deal with air pollution. There is a need to provide subsidies for consumers purchasing electric motorbikes to increase demand.
- Fourth, **integrated planning between transport and land use** should be established. There is a need to bring people and their activities closer together through improved transport planning, thereby increasing the attractiveness of green transport infrastructure and public transport. It will be essential to consider transport planning when working on the master plan for construction, by indexing development densities to transport demands based on major routes and corridors of public transportation (i.e. the closer to major routes the higher development densities, and vice versa) to encourage compact city development making main

**Figure 43.** Methods of densification in integrated land use and transport planning



Source: MCA Urban and Environmental Planners. (2007). Settlement Restructuring: An explanatory manual in terms of the Western Cape Provincial Spatial Development Framework

**Figure 44.** Sustainable transportation system: main principles and expected outcomes



urban functions geographically concentrated in the center, thereby reducing urban sprawl.

Related references are made to other cities’ methods of densification along public transport corridors, as found in the following Figure. This shows the need to pay attention to 5Ds in planning for built environment to influence travel: 1) Density gauges (how many people, workers, or built structures occupy a specified land area); 2) Diversity of land uses, housing types and mobility options; 3) Design street layout and network that influence the likelihood of walking; 4) Destination accessibility measures ease of access to trip destinations; and 5) Distance to transit usually measured as the shortest street routes from the residences or work-places in an area to the nearest rail station or bus stop.

**4. Major Tasks and Process**

**4.1. Major tasks**

The program for sustainable transport has four major tasks: 1) Improvement of traffic safety and the establishment of a walkable environment; 2) Traffic congestion management and air pollution control; 3) BRT system set-up; 4) Public transportation oriented policy transition. Details of the tasks are as follows:

- **Improve traffic safety and set up a walkable and cycling-friendly environment.**
  - Raise public awareness among pedestrians and car and motorbike drivers through public advertisement and education campaigns. These campaigns should take place on a long term basis.
  - Design pedestrian friendly streets for walking and cycling through innovative infrastructure development.
  - Strengthen and enforce traffic safety regulations (e.g. speed limit and traffic signal regulations) with the imposition of fines.
- **Deal with traffic congestion and air pollution caused by the high level of dependence on motorized private vehicles**
  - **Traffic congestion management:** Set up para-transit operations such as carpooling or the sharing of small buses. Complement non-motorized transport (NMT) services such as rentals and stations for bicycles. Take HOV (High occupancy vehicle) lanes into account in order to reduce traffic congestion. Develop appropriate policies to reduce traffic congestion, such as fuel pricing (e.g. gas

taxes), parking fees, ownership restrictions and other regulatory mechanisms.

- **Air pollution control:** Cities should introduce regulations for conducting regular vehicle maintenance and check-ups in order to prevent excess emissions of exhaust gas. Strengthen smoke regulation standards through a system of imposing fines on vehicles that violate these standards. Promote the use clean of fuels, such as CNG or LNG, and low carbon vehicles such as electric motorbikes by providing subsidies to related industries. In addition, subsidies should be provided to consumers in order to replace existing petrol motorbikes which emit large quantities of air pollutants. Moreover, small/ lightweight vehicles and ultra low emission engines should receive support in the form of subsidies.
- **Set up the BRT system in terms of both physical infrastructure and social services.**
  - **Adaptation to public transportation:** Expand intra-city bus services with high service quality (especially including the rural areas to improve urban-rural linkages). Demonstrate test operations of the BRT in the partial routes for linking main points in the city with short allocation intervals, before starting the BRT in earnest. **Develop related transport infrastructure.** This will help urban residents have experiences of effective value when it comes to using public transportation. **Develop related transport infrastructure.** Reconstruct transportation systems with the aim to improve

safety and to reduce congestion. Construct and operate large scale public parking lots or park-and-ride lots for motorbikes in order to implement the BRT in the urban center. Reduce traffic congestion caused by illegal parking along the roads.

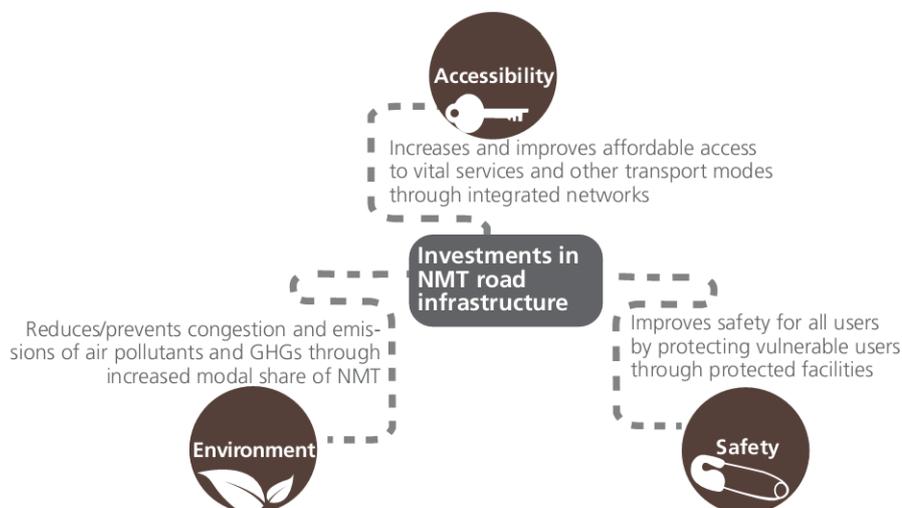
Strengthen fine imposition on illegal parking and **establish related management and operation systems: Quasi-Public Management System; Bus Management System (BMS) and Flat Fare System**<sup>52</sup>.

- **Pursue the transition from private to public transport oriented policies in the long term:** Develop a sustainable transport system for a more a livable city, by developing and implementing public transportation oriented policies and plans. This entails a transition from the current system focused on private motorized vehicles with higher energy consumption and levels of GHG emissions. Develop and implement integrated transport and land use planning to concentrate on sustainable urban development along the public transport corridors.

#### 4.2. Process

- **Phase 1: Improve traffic safety as well as walkability/ cycling in the city; transition to green transport the 1<sup>st</sup> year~)**
  - Conduct public service advertisements and education campaigns on a regular basis to improve public awareness about traffic safety and public transportation.

**Figure 45.** Investments in road infrastructure for non-motorized transport



- Develop streets friendly to pedestrians and cyclists including installing related infrastructure.
- Strengthen and enforce transport regulations (e.g. speed limit, traffic signal, smoke control, maintenance check, etc.)
- Foster markets for clean fuels and low-carbon vehicles by developing related industries/ technologies; and by encouraging the consumption of clean fuels through economic incentives.
- Expand intra-city bus services while providing rural areas with services to improve urban-rural connectivity.
- Introduce an operational demonstration of the BRT for the adoption of bus routes.
- **Phase 2: Integrate transport and land use in the long term (the 1<sup>st</sup> year~)**
  - Increase development densities along the BRT corridors aimed at compact city development.
  - Develop a traffic management system to increase capacity through central traffic control system. Raise safety and reduce the number of crashes, reduce pollution, and develop monitoring and enforcement based on integrated land use planning.
- **Phase 3: Establish BRT infrastructure and management system (the 1<sup>st</sup> ~ 2<sup>nd</sup> year)**
  - Develop core financing mechanisms directed towards investments in sustainable transport and mobilize private investments, Public Private Partnerships (PPP); and support indigenous technological development. This development should encompass R&D capability.
  - Align and confirm the major routes for BRT in the city.
  - Set up the management system for BRT.
  - Promote public awareness about the BRT through public campaign and education programs.
- **Phase 4: Implement the BRT system (the 3<sup>rd</sup> year~)**
  - Open the operation of BRT in phases (by routes).
  - Complement necessary measures for infrastructure and management systems.
- Conduct monitoring and evaluation of the overall operation based on collected data.
- Provide feedback on BRT operation based on the assessment results and improve overall management and operation.
- **Phase 5: Establish the city's transportation system by integrating BRT and the metro system with a focus on the initial construction of infrastructure and facilities for the long term (the 4-5<sup>th</sup> year~)**

## 5. Financial mechanisms

Da Nang City needs to develop and implement both public transport systems and clean fuels/vehicles to link with the development of related industries by providing subsidies as well as grants for consumers.

Expand the market for public transport and clean fuels which lead to job creation, an increase in tax revenues, while contributing to Green Growth city development. The city should raise tax rates in regard to the use of fossil fuels and motorized private vehicles. Manage revenue as a special account for sustainable transport not only for public transport systems, but also for clean fuels/vehicles. Furthermore, it will be critical to reinvest city budgets and bus fares from passengers towards the reinforcement of overall infrastructure development and management systems related to the operation of BRT system.

Revenue can also be generated from parking fees, traffic congestion charges, land development taxes, real estate taxes. The city should get loans for sustainable transport projects from multilateral development banks as well.

The World Bank's Da Nang Sustainable City Development Project (SCDP) aims to expand the access of city residents to not only improve drainage, wastewater collection and treatment services, but also to strengthen the arterial road network, in selected areas of Da Nang. The project was approved in April 2013 and will finish by June 2019. The total project cost is 272.20 million USD. The Clean Technology Fund (CTF) is a multi-donor trust fund created in 2008 as part of the Climate Investment Funds (CIF) to provide scaled-up financing for the demonstration, deployment, and transfer of low carbon technologies that have a significant potential for long term greenhouse gas (GHG) emissions savings. CIF resources amount to approximately 4.5 billion USD with contributions from Australia, France, Germany, Japan, Spain, Sweden, United Kingdom, and the United States.

**6. Role Design and Collaboration Mechanism**

Above all, institutional supports from the central government should be secured. It is essential to persuade the central government to revise/ improve the existing institutional/ legal frameworks to improve efficiency and the effectiveness of transport in the city. Vertical integration with the central government has to be set up in terms of improving policy cooperation and the coordination for transport development through the following areas: 1) Ensure BRT focused public transportation budget support; 2) Integrate transport and land use; 3) Manage demand of private vehicles; and 4) Support improving clean fuel and low-carbon vehicles.

Transport investments have to be coordinated based on systematic financing mechanism. It is significant to specify the basic frameworks and priorities to coordinate public and private investments into sustainable transport development in the short/mid/long-term. In addition, there is a need to mobilize public funding at all levels (international - including ODA and climate-related funds - national and local) to support green public transport. It will be essential to leverage private finance through

the appropriate design of markets and the creation of consistent incentives. Thus, the city must develop a PPP mechanism for public transport. In particular, a BOT (Build-Operate-Transfer) management system needs to be refurbished to attract private investors and to improve efficiency/effectiveness of related projects.

Third, multi-sectoral and horizontal integration has to be pursued by coordinating/ cooperating with other sectors such as energy, industry and land use, especially in developing related technologies, regulations, and institutions. To support this, it will be critical to set up departmental cooperation in the city government. Relevant departments such as the DOT (Department of Transport), the DOC (Department of Construction), the DOST (Department of Science and Technology) and DONRE (Department of Natural Resources and Environment) need to discuss common issues, find solutions and plan together by organizing a joint board. In addition, the city government should partner with the private sector for technical and financial cooperation.

Based on the above mechanisms, the collaboration and management structure would secure institutional support

**Figure 46.** Role design for promoting the sustainable transportation system in Da Nang City

<b>Special board for traffic safety</b> (in the city government)	<ul style="list-style-type: none"> <li>- Strengthen pedestrian-friendly transport policies</li> <li>- Raise public awareness</li> </ul>
<b>Public agency for clean fuels and low-carbon vehicles</b> (in the city government)	<ul style="list-style-type: none"> <li>- Foster related enterprises by providing them with financial and technical supports</li> </ul>
<b>BRT managing board</b> (in the city government)	<ul style="list-style-type: none"> <li>- Make overall BRT plans; implement</li> <li>- Coordinate public/ private investments</li> <li>- Manage routes and service quality</li> <li>- Construct infrastructure</li> </ul>
<b>BRT control center</b>	<ul style="list-style-type: none"> <li>- Real time monitoring: information collection and provision</li> </ul>
<b>Private bus companies</b>	<ul style="list-style-type: none"> <li>- Operate and maintain buses</li> <li>- Manage labors</li> </ul>
<b>Technology supply company and R&amp;D institutes</b> (local/ national/ international)	<ul style="list-style-type: none"> <li>- Develop/ supply related technologies</li> </ul>
<b>Evaluation Agencies</b>	<ul style="list-style-type: none"> <li>- Assess overall performance of the transportation system including BRT, and give feedback</li> </ul>

from the central government. In addition, it would coordinate transport investments based on systematic financing mechanisms; and pursue multi-sectoral and horizontal integration based on coordinating/cooperating with other sectors such as energy, industry and land use, especially in developing related technologies, regulations, and institutions.

## 7. Pilot Project Idea

The pilot would include test runs for adapting to public transportation with improvements for traffic safety and walkability. Operate public bus services in the partial routes to allow for stopovers at principal points in the city. In this way, citizens can experience the value of public transportation prior to the implementation of the BRT. Da Nang City can gradually support pilot projects by introducing activities such as widening sidewalks, increasing street lights, building up effective traffic lights (signals) and crosswalk and creating urban greenery space such as street trees.

### Box 9. Best Practice: Innovative land use planning integrated with transportation planning in Curitiba, Brazil

- Curitiba formulated a master plan in 1966 that integrated land use and transportation plans. It had decided to direct urban growth linearly by designating structural axes radiating from the city center. Major economic activities are concentrated along these corridors and the city appears to have a linearly formed downtown. At the same time, the city center was reinforced with high-density development. The structured corridors became major public transportation routes under a bus rapid transit (BRT) system that includes dedicated lanes and bus stops of nearly 500 meters. To realize this plan and guide linear urban growth, Curitiba implemented detailed zoning plans that reflect the master plan's strategic vision, geographical and geological constraints, water and wind directions, industrial profile, and urban cultural and social factors.
- Bus service in Curitiba reaches almost 90% of the city area, and all users may access public transportation services by walking less than 500 meters. Bus services run nearly every five minutes. To accommodate BRT routes and to fulfill transportation needs along the axes, the city designated functions to existing roads under its trinary road system. The five major axes now accommodate both dedicated BRT lanes and roads to access buildings. To avoid concentrated traffic in the city center, a previous mayoral administration transformed selected streets in the city center into pedestrian walkways on which cars are prohibited. Integration between land use planning and transportation planning are as follows.
  - Low Density (mainly residential use) - High Density (commercial, business, residential use) - Structural Axis - High Density (commercial, business, residential use) - Low Density (mainly residential use).
  - One way Road - One way Road on the Axis - BRT (Dedicated Lanes) - One way Road on the Axis - One way Road "Trinary Road System" in Curitiba.
- Through these measures, Curitiba's spatial growth and urban land use patterns have been efficiently controlled and defined. Traffic is diverted from the city center or the axes thanks to an effective mixture of land use planning and a well-conceived public transportation network. Because housing, service facilities, and job centers have been incrementally developed along the axes and linked to the BRT system, the distances between homes, jobs, and schools have shortened. Bus ridership as a share of all commuting trips reaches 45% and 70% of these bus trips bypass the downtown area. As a result, the city has reduced car emissions and traffic congestion.
- Reduced car emissions have decreased air pollution, which threatens public health. Curitiba now has one of the lowest rates of ambient air pollution in Brazil. Emissions of greenhouse gases that cause climate change have declined.

Source: World Bank, Ecological Cities as Economic Cities, 2010

## 2.3 STRATEGIC INITIATIVE 3

### Green Industrialization to Increase Productivity and Resource Use Efficiency

#### Rationale and Objectives

Da Nang needs to strengthen productivity and efficiency in industrial energy use, focusing on manufacturers who are high consumers of energy. This contributes to the development of related industries, technologies, and green jobs and improves energy/resource efficiency in industrial production. The city can also enhance enterprise competitive power through energy/resource savings which are needed for production and for reducing production costs. At the same time, the city needs to make efforts to improve industrial environmental management in industrial parks by efficiently managing environmental pollution caused by industrial hazardous substances. This can be achieved through an enhanced regular monitoring system for overall industrial waste founded on an established regulatory scheme.

This can lead to the improvement of recycling industrial waste and by-products based on waste-to-resource, closely connected with setting up a waste management system at industrial parks through private sector involvement. More importantly, this reform can also help reduce negative impacts on the environment and public health by lessening illegal discharge of industrial waste without proper treatment. Overall objectives are described as below:

#### ***Objective 1: Improve resource/ energy use efficiency in industrial production and create related markets and jobs while generating an industrial symbiosis network in industrial parks***

- Outcome:
  - Manage overall industrial production to minimize losses in energy/ resource use (save the production costs by reducing the total amount of energy, water, and other key inputs for production). Mitigate energy and water resource loss from industrial production, contributing to the preservation of natural resources and resilience to climate change.
  - Promote networking among industries for energy/resource efficiency and waste management among enterprises and factories, leading to the establishment of an EIP Eco Industrial Park.
  - Increase earnings & productivity (esp. energy-intensive sectors) and develop related industries and technologies, contributing to the boosting of local revenue.

- Monitoring indicator examples.
  - Number of green jobs created by the Energy Audit (EA) system and industrial networking (Eco Industrial Park, EIP).
  - Performance of improving industrial energy efficiency (energy-intensive enterprises; occupied enterprises in industrial parks): Industrial energy saving amount and rate.
  - Performance of improving industrial water efficiency: Industrial water saving amount and rate including water recycling (reuse).
  - Rate of green building retrofit for energy saving.
  - Performance of waste-to-resource among enterprises and their economic gains. Recycling byproducts such as industrial waste water/gas/ heat, sludge etc.

#### ***Objective 2: Promote cleaner production systems and networks for industrial resource circulation and internalize socio-economic costs generated from environmental pollution driven by industrial production***

- Outcome:
  - Improve the performance of industrial waste management by increasing the coverage of green infrastructure and waste treatment measures based on industrial waste-to-resource (Reduce management costs for mitigating environmental pollution, contributing to the development of related industries/ technologies and job creation).
  - Mitigate environmental pollution (air, land, and water) caused by industrial production and the illegal discharge of industrial hazardous waste.
  - Improve public health and the quality of lives of communities by reducing pollution driven by industrial production and related waste generation.
- Monitoring indicator examples
  - Waste water treatment facilities of industrial parks and other factories): number, capacity
  - Industrial/hazardous solid waste treatment facilities (in industrial parks): number, capacity
  - Environmental pollution related statistics (air, land, and water, especially in neighboring areas around industrial production areas including IP): Before and after developing treating facilities and EIP
  - Industrial waste generation amount: Industrial solid waste, waste water, waste gas (including GHG, air toxics).
  - Treating ratio (amount) of industrial waste (compared with generation amount): Industrial solid waste, waste water, waste gas (including GHG, air toxics).
  - Regulations complied by industrial parks

- Public health related statistics; Rate of illness related to industrial disasters; main diseases affected by poor environment; people who suffered from environment-related illnesses (e.g. asthma, allergic rhinitis, and atopic eczema).

***Objective 3: Integrate strategic planning for the high-tech park into other development plans including the master plan for construction***

- Outcome: Develop a conceptual master plan which will fit into the overall current construction plan with the aim to achieve targets outlined in socio-economic development plans.
  - Promote innovative industries, thereby creating new jobs with higher added value and improving the competitiveness of the local and regional economy.
  - Increase urban-rural linkages by creating markets for high quality agriculture products and services.
  - Promote the experimentation and application of eco-technology and enhance the city's green space system, contributing to low carbon green city development.
- Monitoring indicator examples
  - The master plan should have key planning components from the GG-CDS.
  - Number of jobs created in innovative green industries.
  - Increase in foreign direct investment in the city.
  - Increase in average income per capita.
  - Direct sale of agricultural products and the number of jobs created in green agricultural production.
  - Increase in the total area of green space.
  - Number of green buildings constructed and number of projects applying eco-technology.

***Objective 4: Mobilize and attract resources to improve local human resources to contribute to the current socio-economic development orientation - make Da Nang a high-tech information driven city in Vietnam***

- Outcome: Establish a knowledge management platform to support research and business functions, Support scientific endeavors while improving the quality of life in urban and rural areas.
- Monitoring indicator examples: government budget (%) to be dedicated to R&D human resource development, Land use planning (%) for building R&D, and incubating centers.

**Key Program1: Improve Industrial Energy Efficiency in Production Processes through Energy Audits**

**1. Background**

Da Nang needs to set up a system to improve industrial energy efficiency in order to deal with rapid economic development and energy shortage problems. The system will focus on finding out about industrial energy loss in industrial production and applying innovative solutions for energy savings to improve overall efficiency and productivity. In addition, a system is needed for mitigating GHG emissions and related air pollution generated from industrial production in order to contribute to improved environmental quality. Develop enterprise competitive power regarding industrial energy savings while generating employment opportunities.

**2. Expected Outcome**

- Increase economic gains by improving the efficiency of energy-intensive enterprises through overall audits on production processes and related innovation. Such audits will contribute to the improvement of the competitive power of enterprises as well as a reduction in production costs which are closely connected with energy security. Develop related industries/ technologies to create a new market generated from green businesses and jobs.
- Encourage enterprises to manage their overall industrial production and to reduce the loss/ waste of energy, thereby reducing the negative impact of environmental pollution on public health. Develop a comprehensive response to climate change by mitigating GHGs from energy-guzzling industrial production.
- Improve the quality of life of urban residents through reduced air pollution caused by less energy consumption.

**3. Main Concept and Principles**

**An Energy Audit (EA)** is defined as “a systematic, documented verification process of objectively obtaining and evaluating energy audit evidence, in conformance with energy audit criteria and followed by communication of results to the client.”<sup>53</sup> The objectives of an industrial energy audit vary from one plant to another. However, it is usually conducted to understand how energy is used within the plant and to find opportunities for improvements and energy saving. Sometimes, energy audits are conducted to evaluate the effectiveness of an energy efficiency project or program.

The type of industrial energy audit conducted depends on the function, size, and type of industry, the depth to which the audit is needed, and the potential and magnitude of energy savings and cost reduction desired. Based on these criteria, an industrial energy audit can be classified into two types: 1) a preliminary audit (walk through audit) and a detailed audit (diagnostic audit). An overview of the procedure for a detailed industrial energy audit is shown in the following Figure 47. A preliminary audit (walk-through audit) contains some of the same steps of the procedure shown, but the depth of the data collection and analysis might be different depending on the scope and objectives of the audit. The three main steps are 1) energy audit preparation, 2) execution, and 3) reporting.

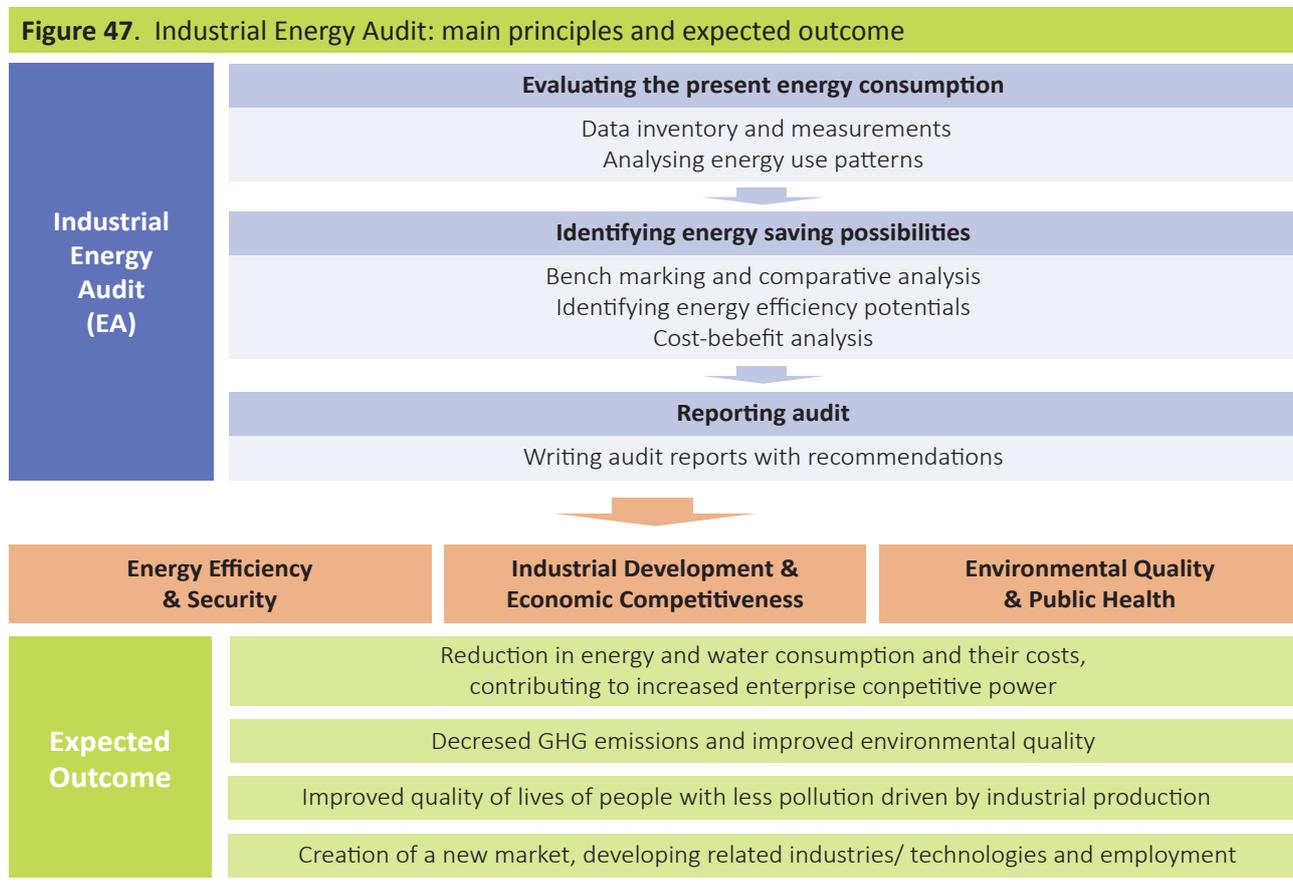
#### 4. Major Tasks and Process

##### 4.1. Major tasks

The Industrial Energy Audit program includes the following major tasks: 1) Organizational set-up; 2) Expert cultivation; 3) Examination of industrial energy consumption; 4) Implementation of EA pilot projects for enterprises with high energy use; and 5) Setting up institutional system for ESCO (Energy Service Company). It is important to build up not only a promoting system to

support industrial EA, but also supportive institutions are needed for financing in order to implement relevant pilots and full-scale programs in an effective and efficient way.

- **Strengthen the capacity and function of public entities for EA to conduct an audit and to promote the ESCO industry**
  - Enhance the role of existing public entities for EA in Da Nang such as the Da Nang Center of Efficient Energy and Technology Transfer Consultancy (under the Department of Science and Technology) and the Da Nang Center of Development Consultancy & Industrial Encouragement (under the Department of Trade and Industry).
  - Set up overall system and proper guidelines.
  - Conduct EA with advanced technologies for energy saving and efficiency Supervise and manage the private consulting and technology supply companies for EA.
- **Foster experts on EA (by the public entity)**
  - Provide training programs for EA.



- Manage and operate the certificate system to train EA experts.
- Employ professional workers with a certificate of qualification in EA related organization such as public agencies or private consulting companies.
- Support the development of private companies for EA, connecting with new markets.
- **Examine the present condition of industrial energy consumption**
  - Encourage enterprises to report amount of energy used.
  - Set up a database on energy-intensive industries in accordance with classification (e.g. steel, chemistry, paper, and textile industries, etc.).
- **Conduct pilot EA programs for energy-intensive industries by using the following steps:**
  - EA Preparation<sup>54</sup>
  - EA execution: 1) Review/ analyze the production process and identify energy loss factors: Determine where, when, why, and how energy is being used, 2) Energy Flow Analysis: Investigate energy flows of production process, 3) Measure & Verify: Discover energy loss factors and provide enterprises with improved methods for energy-saving, 4) Energy and Mass Balancing: Production cost per unit, 5) Comparative Analysis: what energy flows in production process are like (related to standards of equipment design), 6) Suggest solutions or provide proper schemes for energy-saving, energy & GHG reductions, etc., 7) Identify EMOs (Energy Management Opportunities): efficiency & intensity of energy system; suggestion of 4 - 5 implementing methods (per process and facility), 8) Assess the benefits: Energy saving costs (including amount and rate) and reduction in GHG emission (CO<sub>2</sub>) (against investment cost and payback period); post implementation assessment.
  - Post EA activities to apply the improvement for energy savings to those industrial processes and facilities (ESCO system to be used in this step)
- **Set up the institutional system for ESCO (Energy Service Company) to implement the improvement solution from the EA**
  - Encourage ESCOs to invest in energy-saving facilities and equipment for customer enterprises based on EA results. Generate their profits through

energy saving costs.

- Make energy-users (enterprises) payback through energy reduction costs without financial and technical burdens.

#### 4.2. Process

- **Phase 1: Develop supportive policy measures for Energy Audit (the 1<sup>st</sup> half of the 1<sup>st</sup> year)**
  - Improve national and sub-national regulatory and institutional devices to frame and execute EA for energy-intensive enterprises.
  - Develop technical and financial mechanisms to apply energy-saving improvement schemes (such as ESCO system).
  - Strengthen the function of public entities specialized in EA.
- **Phase 2: Establish a database of industrial energy use (the 2<sup>nd</sup> half of the 1<sup>st</sup> year)**
  - Grasp the current condition of energy use in enterprises in accordance with industrial classification.
  - Categorize and prioritize energy-intensive enterprises to make the EA.
- **Phase 3: Develop pilot programs for industrial EA (the 2<sup>nd</sup> year)**
  - Select some energy-intensive enterprises and conduct the EA.
  - Apply improvement schemes for energy savings (e.g. set up related facilities/equipment with innovative operations based on the ESCO system).
- **Phase 4: Transform the pilots into full-scale programs after monitoring and evaluation (the 3<sup>rd</sup> year)**
  - Conduct an evaluation of the overall performance of EA.
  - Develop operational manuals to share guidance and know-how with other energy-intensive enterprises.
  - Exchange information and techniques among internal/external collaboration networks.
  - Promote full enforcement of industrial EA.

**5. Financial Mechanism**

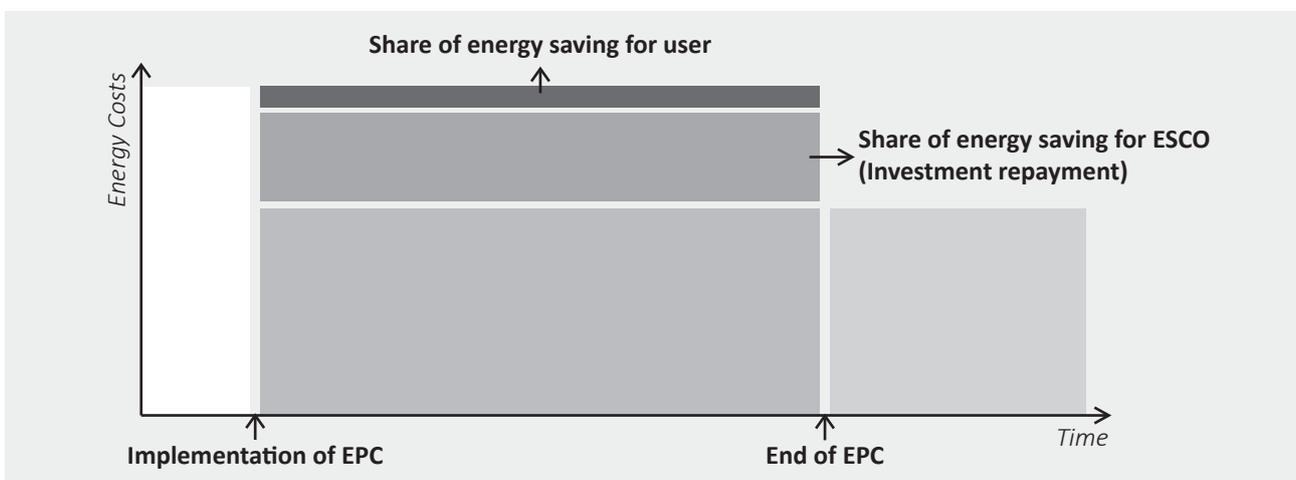
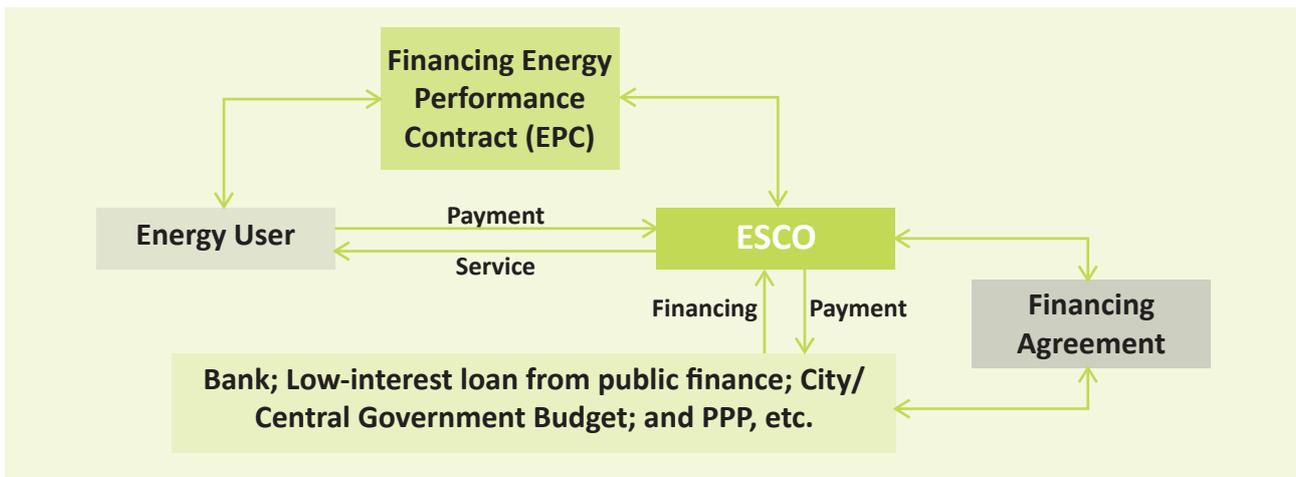
An **Energy Service/Savings Company (ESCO)** is a commercial or non-profit business providing comprehensive energy solutions including designs and implementation of energy savings projects, retrofitting, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management. **ESCOs offer energy efficiency improvement services** including a guarantee of energy savings. The remuneration of ESCO is linked to the projects' performance (concept of performance-based contracting), which means ESCO's payment is directly linked to the amount of energy saved. While ESCOs are not a policy instrument per se, they are often discussed among policy instruments because they are, similar to policy tools, important vehicles to capture energy-efficiency potential. The business model they use, energy performance contracting, helps to overcome a number of market barriers.

**The Clean Technology Fund (CTF)** is a multi-donor trust fund created in 2008 as part of the Climate Investment Funds (CIF) to provide scaled-up financing for the demonstration, deployment and transfer of low carbon technologies that have a significant potential for long term greenhouse gas (GHG) emissions savings. CTF resources amount to approximately 4.5 billion USD pledged by contributors (i.e. Australia, France, Germany, Japan, Spain, Sweden, and others). The CTF supports a selected series of investment plans that meet the criteria of significant GHG emissions savings, demonstration potential at scale, development impacts and implementation readiness.

**6. Role design and collaboration mechanism**

The city government has to allocate an annual fixed amount of funds for the industrial energy audit program. Based on the developed guidelines, the Department of Industry and Trade (DOIT) should submit the Decision for

**Figure 48.** Operation mode and contract arrangement for shared savings in utilizing ESCO system



Source: <http://www.worldenergy.org>

approving annual industrial EA. DOIT needs to set up an overall support system for industrial EA to develop related technologies and facilities and financing.

To support this, it is necessary to create the guidance for key energy users (enterprises) and state budget agencies in order to implement the articles of the “Act on Efficient and Effective Energy Utilization.” Also, it is essential to encourage enterprises to participate in EA founded on market-based incentives. It needs to set up cooperation for the EA among related departments such as the DPI (Department of Planning and Investment), DOST (Department of Science and Technology), DONRE (Department of Natural Resources and Environment),

and DOIT through inter-departmental coordination with regular and continuous consultation. At the same time, there is a need to enhance cooperation between the central and city government in order to promote EA as one of the key programs for green industrial development through innovative related institutions, regulations and policies.

In addition, it will be important to establish close partnerships among the city government, businesses, R&D institutions, and international development organizations in developing related technologies. There is a need for cooperation with experts in ESCOs so as to develop training programs specialized in EA to foster qualified human resources.

**Figure 49.** Role design for promoting Industrial Energy Audit in Da Nang City

<b>Public Entity for EA</b> (in the city government)	<ul style="list-style-type: none"> <li>- Make up overall system/ guidelines</li> <li>- Manage related process</li> <li>- Train human resources</li> <li>- Set up database on industrial energy use; conduct EA</li> </ul>
<b>ESCO</b> (Energy Service Company)	<ul style="list-style-type: none"> <li>- Conduct industrial EA to enterprises with high energy use</li> <li>- Invest into energy-saving facilities and equipments with technoloy supply (application of EA results)</li> </ul>
<b>Enterprises</b> (with high energy use)	<ul style="list-style-type: none"> <li>- Report amout of energy used</li> <li>- Participate in industrial EA</li> <li>- Apply energy conservation measures through ESCO</li> <li>- Payback the cost through energy reduction</li> </ul>

**7. Pilot Project Idea (Appendix 6)**

Industrial Energy Audit for enterprises with high energy use in Da Nang

**Key program 2: Establish the Green Industrial Symbiosis through Eco Industrial Park (EIP)**

**1. Background**

Da Nang needs to establish a system to improve environmental management through symbiosis networking at industrial parks in the city, with a focus on promoting industrial waste and by-products-toresource through networking among enterprises at industrial parks, resulting in a reduction in costs for production and waste management. In addition, there is a need to mitigate environmental pollution through exchanging by-products and co-disposing industrial waste among enterprises; and developing technologies, enterprises, and jobs related to industrial symbiosis of resource sharing

and environmental management, thereby contributing to economic gains.

**2. Expected Outcome**

- Increase economic gains by improving energy/ water/resource use efficiency and industrial waste (by-products)-to-resource through overall audit and innovation of production process; Reduce the costs for industrial production and waste management and get additional sales of products made from recycled materials, creating related technologies as well as employment opportunities.
- Encourage industries to manage/ treat industrial solid waste, and waste water/ gas generated from production and mitigate environmental pollution in land, water, and air. Make the city more livable by improving the quality of lives of urban residents and their surroundings.

### Box 10. Best Practice: Industrial Energy Audit Program in Korea

- Institutionalize industrial energy audit of energy-intensive establishments on a regular basis - every 5 years, in order to deal with high oil prices and climate change (based upon the revision of Rational Energy Utilization Act).
- Public enterprise specialized in energy audits: Korea Energy Management Corporation (KEMCO).
- Subject of energy audits: energy-intensive enterprises using over 2,000 TOE (Tonnee of Oil Equivalent) per year.
- Progress results of industrial energy audit in Korea.

Division	2007	2008	2009	2010	2011	Total
Number of business establishments	383	420	559	545	469	2,376
Energy consumption of subject establishments (TOE/year)	9,373,271	6,878,185	11,090,762	8,087,743	9,372,395	44,802,356
Energy saving potential (TOE/year)	429,013	549,333	710,412	479,840	438,800	2,607,399
Energy saving rate (%)	4.6	8.0	6.4	5.9	4.7	5.8
Energy saving cost (million USD)	153	273	351	240	235	1,252
Investment cost	294	338	655	530	502	2,369
Investment payback period (year)	1.9	1.4	1.9	2.2	2.1	1.9
GHG reduction potential (tCO <sub>2</sub> /year)	1,086,377	1,463,397	1,754,496	1,184,438	1,080,153	6,568,861
Number of improvements	3,523	4,008	5,262	5,009	4,072	21,874

### 3. Main Concept and Principles

The concept of Eco Industrial Parks (EIP) was first described at the United Nations Conference on Environment and Development (UNCED), Rio de Janeiro in 1992. EIPs are a promising strategy to promote sustainable industrial development and to improve the industries' environmental performance in terms of management of materials, energy and waste. The EIPs provide substantial benefits for participating companies, for the neighborhood and for the region. The commonly accepted international definition is as follows: "An eco-industrial park or estate is a community of manufacturing and service businesses located together on a common property. Member businesses seek enhanced environmental, economic, and social performance through

collaboration in managing environmental and resource issues."<sup>55</sup> The key principle is that the transformation process of existing industrial areas/parks/clusters into eco-industrial parks involves various aspects, such as infrastructure development, planning, estate management, and capacity building with main relevant activities as shown in the figure below.

- **Principles of Industrial waste management and waste-to-resource**
  - Set up a database on industrial waste with the aim to improve waste-to-resource and to deal with environmental pollution driven by industrial production: including information on discharging wastewater (daily living waste water, water for

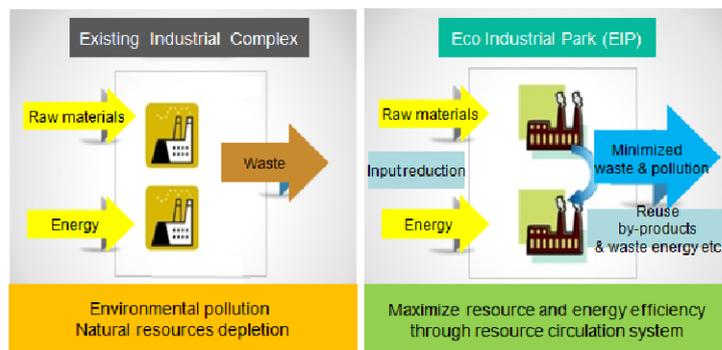
industrial sanitation, cooling equipment/steam), waste gas and solid waste.

- Setting up of Common Effluent Treatment Plants (CETPs), including sewerage systems, disposal systems, recycle/reuse and waste management, including measures for clearing up wild dump sites and for the management of hazardous wastes as well as solid waste.
- Construct close networks among enterprises/factories occupied at industrial parks by sharing

not only the centralized treatment facilities but also by-products for recycling such as waste water/gas/heat and sludge generated from the production processes and networking related to infrastructure and information on managing both input resources and output waste among nearby factories.

- Link the treating system of industrial parks with public waste treatment systems at the city level in terms of collection, transfer, and processing, in order to prevent enterprises from discharging them into the environment without proper treatment.

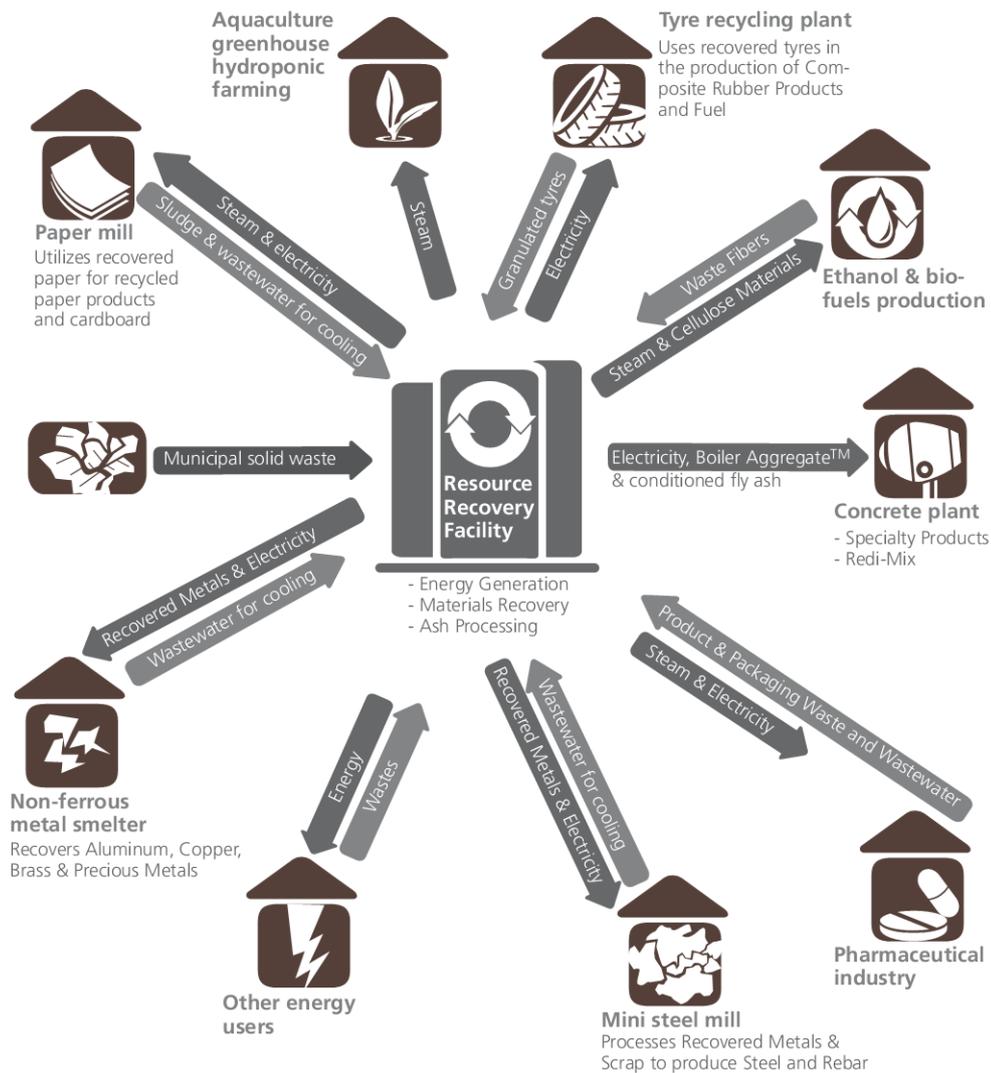
**Figure 50.** Comparison between existing industrial complex and EIP



**Figure 51.** Relevant activities for transformation process of the existing industrial complex to an Eco Industrial Park (EIP)



Source: <http://www.ecoindustrialparks.net>

**Figure 52.** Resource recovery in an Eco Industrial Park (EIP)

Source: Sustainable Urban Energy: A Sourcebook for Asia

#### 4. Major Tasks and Process

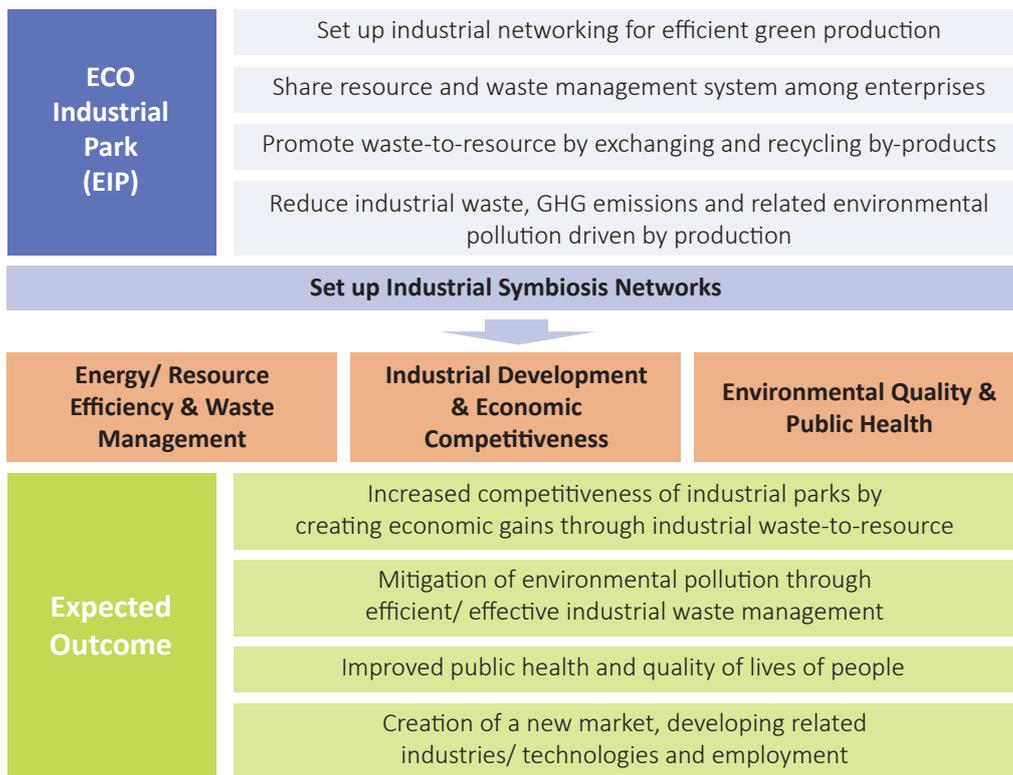
##### 4.1. Major tasks

The EIP program includes the following major tasks:

1) Setting up resource circulation mechanism; 2) Arrangement of meetings/forums to facilitate; 3) Pre-inspection of resource/waste management on industrial parks and pilot selection; 4) Building up EIP networks (design and implementation); 5) Technical development and commercialization; and 6) Monitoring and Evaluation. In order to carry forward the program more smoothly, a relevant regulation and incentive system should be aligned to encourage enterprises to actively participate in greening existing industrial parks into EIPs. Details of major tasks are described as follows:

- **Establish resource circulation mechanisms**

- Develop the organizational structure for the EIP system in Da Nang: There should be an EIP managing board in the city government and an EIP center in each industrial park.
- Align proper environmental regulations and green industry standards for industrial parks in terms of waste management and waste-to-resource in accordance with national legal/ institutional revision.
- Establish an incentive system to encourage industrial parks to make an EIP (e.g. related subsidies and tax deduction, etc.).

**Figure 53.** Eco Industrial Park (EIP): main principles and expected outcome

- Set up and regularly update the database of the industrial resource and waste situation by conducting investigations in close collaboration with industrial park management boards.
- Develop a system for regular meetings and forums to facilitate and coordinate EIP networking among enterprises through information exchanges. Organize related meetings/ forums at each industrial park. Provide occupied enterprises at industrial parks with training / capacity building programs for EIP as a symbiosis network for resource circulation. Appoint experts as coordinators to work on discovering specific EIP projects in specific industrial parks based on the evaluation of technology and business value.
- **Conduct pre-inspection on waste management at industrial parks and select pilot programs based on the results (result-based implementation)**
  - Set up the database on overall waste information at industrial parks.
  - Make thorough inquiries on EIP potentials in accordance with industrial classification.
  - Choose appropriate pilots considering by-product features and the current situation of waste management at industrial parks.
- **Set up EIP networks among enterprises/factories at industrial parks**
  - Design the symbiosis network among enterprises.
  - Implement EIP design and networking ideas: Collaborate in improving energy efficiency through district energy systems and green building retrofit, etc. Share tangible/ intangible resources such as materials, water, energy, infrastructure, logistics/ shipping, and related information, and reduce waste and pollution through recycling industrial by-products. Construct and share related facilities/ equipment to treat industrial hazardous waste including solid waste, waste water/gas/dust, and chemicals.
  - Provide technical/financial/institutional supports to set up the EIP.
- **Carry forward related technical development and commercialization:** Cooperate with experts of local, national, international R&D institutions. Mobilize related funding for technical commercialization by utilizing policy funds from the central and city government or by promoting low-interest loans.

- **Conduct M&E (Monitoring and Evaluation) on a regular basis by selecting indicators reflecting characteristics of each EIP:** Planning: suitability and concreteness. Promotion: achievement of target. Exchange and cooperation (number of forums, coordinators). Establishment of a database; portion of private investment → Outcome: execution of business expenses; commercialization; patent application; GHG reduction; sales, employment → diffusion: public relations (broadcast, newspapers, academic journals and etc.) → In addition, the training of professional manpower, raising public awareness, and promoting city brand image as an ecoindustrial city, etc.

**4.2. Process**

- **Phase 1: Develop supportive measures for the EIP (the 1<sup>st</sup> half of the 1<sup>st</sup> year)**

- Improve the administrative capacity of national and sub-national institutions to frame and execute green industrial development focusing on the EIP.
- Develop core financing mechanisms directed towards investment and mobilize the private sector, including PPP management of and support for related technology development.
- Organize the EIP Center at the municipal level as a supportive agency with participants. The city

government (Department of Industry and Trade (DOIT), Department of Science and Technology (DOST), and Department of Natural resources and Environment (DONRE); R&D Institutes; Enterprises.

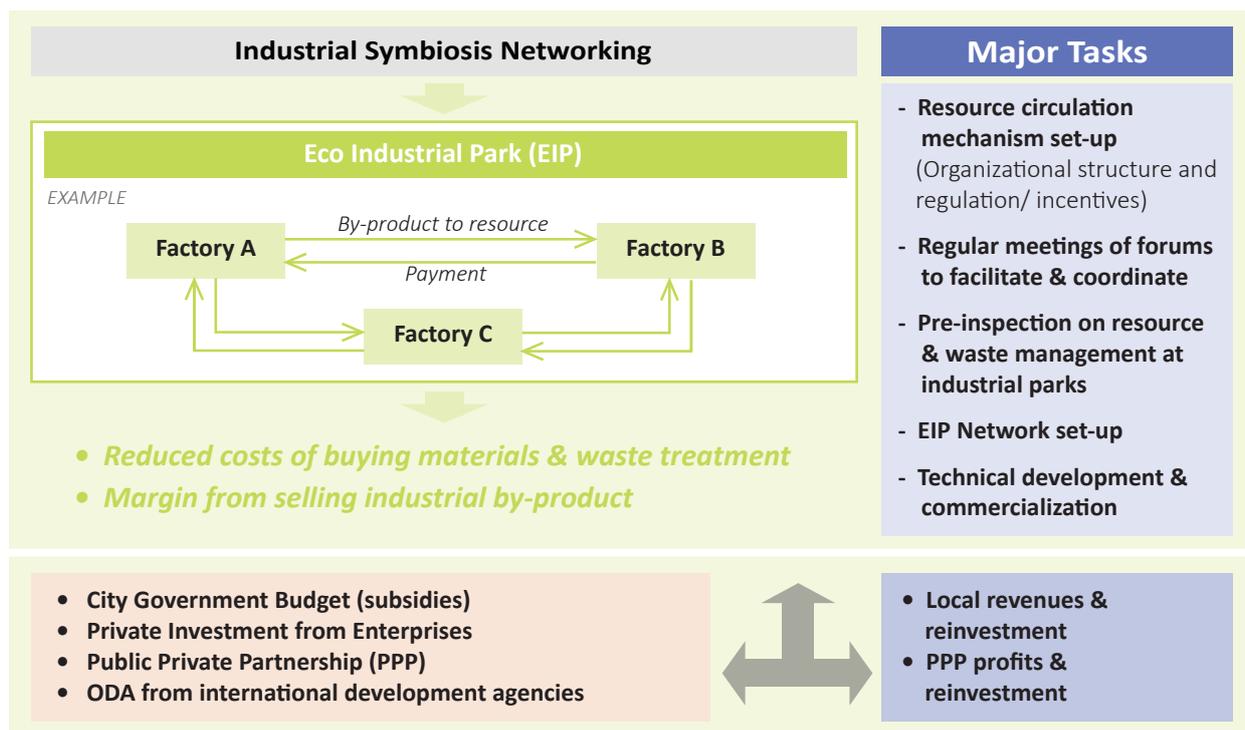
- **Phase 2: Develop pilot programs for EIP in Da Nang (the 2<sup>nd</sup> half of the 1<sup>st</sup> year)**

- Select appropriate candidates based on features and the current situation of environmental pollution of IPs.
- Establish centers for resource/waste circulation in each selected industrial park.
- Upgrade infrastructure for improved environmental pollution control and revise relevant policies of existing industrial parks for green industry. Network infrastructure for resource/waste circulation among enterprises/ factories at newly established industrial parks, with technical support from the EIP Center.

- **Phase 3: Transform the pilots into full-scale programs after monitoring and evaluation (the 2<sup>nd</sup> year~)**

- Conduct evaluations on the performance of management and operations. Provide feedback

**Figure 54.** Financing component and financial flows in the Eco Industrial Park (EIP) program for Da Nang



for improving overall operations with the aim to increase economic gains through energy/resource efficiency and the mitigation of environmental pollution. Develop operational manuals to share related guidance and know-how for potential EIPs.

- Exchange related information and technologies among internal/external networks.
- Promote full enforcement of EIP with commercialization.
- **Phase 4: Disseminate EIP models to the other industrial parks (the 3<sup>rd</sup> year~)**
  - Identify and develop EIP models appropriate to specific features of factories at industrial parks. Establish investment plans for dissemination.
  - Carry forward commercialization: Auditing inputs of network companies, share reasonable profits, contracting, marketing, and regulations, etc.

**5. Financing Mechanism**

Earning economic profits from saving production costs based on sharing industrial resources through waste/by-products-to-resource, the cost reduction from reusing and recycling by-products would be reinvested into developing facilities/equipment. The city government should give some EIPs financial support, such as subsidies which serve as an economic incentive in order to encourage

industrial symbiosis networks among enterprises. Specify the basic frameworks and priorities for coordinating short/mid/long-term investments into the EIP for green growth oriented industrial development functioning as a PPP mechanism. Mobilize ODA funds as an important option.

*The Vietnam Industrial Pollution Management Project of the World Bank* aims to improve compliance with industrial wastewater treatment regulations in four of the most industrialized provinces in Vietnam. There are three components to the project. The project was approved in October 2012 and will finalize by September 2018. The total project cost is 58.85 million USD. Da Nang can utilize this project fund to transform the existing industrial zone into EIP in terms of improving environmental management based on industrial symbiosis networking.

**6. Role design and collaboration mechanism**

The Department of Industry and Trade (DOIT) needs to hold the authority to supervise and enforce environmental regulations. DOIT and the Department of Natural Resources and Environment (DONRE) have to cooperate and decide the division of roles regarding environmental management in industrial production for 6 industrial parks. It will be essential to enhance the roles of DOIT in environmental management as much as supporting industrial production itself. The city should establish a system for coordination and cooperation among related departments such as the DPI (Department of Planning and Investment), DOST (Department of Science and Technology), DONRE, and DOIT in order to share

**Figure 55.** Role design for promoting the Eco Industrial Park (EIP) in Da Nang City

<b>EIP managing board</b> (in the city government)	- Provide institutional and financial supports - Planning and overall management
<b>EIP Center</b> (at each industrial park)	- Design and operate EIP as a consultative group among city government, companies, R&D institutes, and experts, etc.
<b>Technology supply company and R&amp;D institutes</b>	- Develop/ supply related technologies to improve EIP
<b>Enterprises</b> (occupied at industrial parks)	- Participate in regular meeting and forums and exchange related information with other enterprises and experts - Design and set up industrial symbiosis based on waste-to-resource
<b>Evaluation agencies</b>	- Assess overall performance and provide feedback

policies and specific tools with regular and continuous consultation. Collaborative partnership among public-private actors should be improved. City government, businesses, R&D institutions, and international development organizations have to cooperate and support related technology development. The city should mobilize

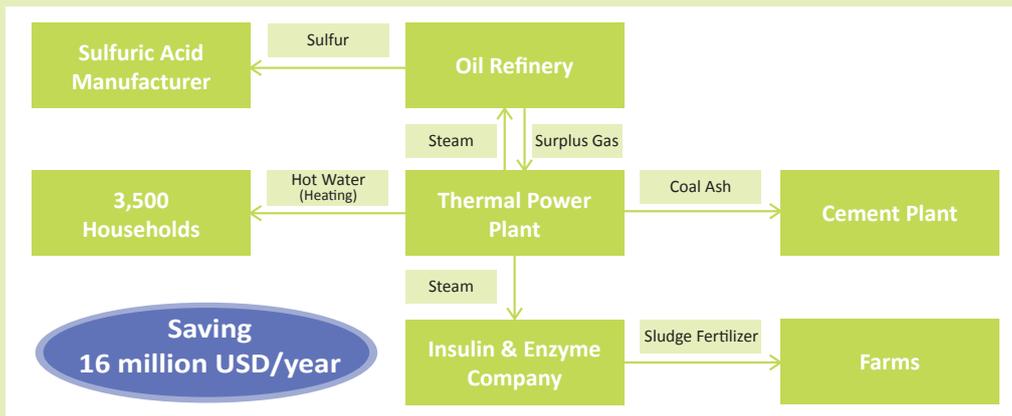
PPP and ODA to invest in the prioritized areas for improving environmental management at industrial parks. Also, the EA training programs should be developed and provided for by private-public-partnerships to foster qualified human resources.

**Box 11. Best Practices: Kalundborg City (Denmark) and Ulsan City (Korea)**

**EIP in Kalundborg City, Denmark**

In Kalundborg, Denmark, an industrial symbiosis network links a 1500MW coal-fired power plant with the community and other companies. Surplus heat from this power plant is used to heat 3,500 homes in addition to a nearby fish farm, whose sludge is then sold as fertilizer. Steam from the power plant is sold to a pharmaceutical and enzyme manufacturer. The reuse of heat reduces the amount of thermal pollution discharged to a nearby fjord. Additionally, a by-product from the power plant’s sulfur

dioxide scrubber contains gypsum, which is sold to a wallboard manufacturer. Almost all of the manufacturer’s gypsum needs are met this way, which reduces the dependence on open-pit mining. Furthermore, fly ash and clinker from the power plant is utilized for road building and cement production. The industrial symbiosis at Kalundborg was not created as a top-down initiative, but instead evolved gradually. As environmental regulations became stricter, firms were motivated to reduce the cost of compliance, and turn their by-products into economic products.

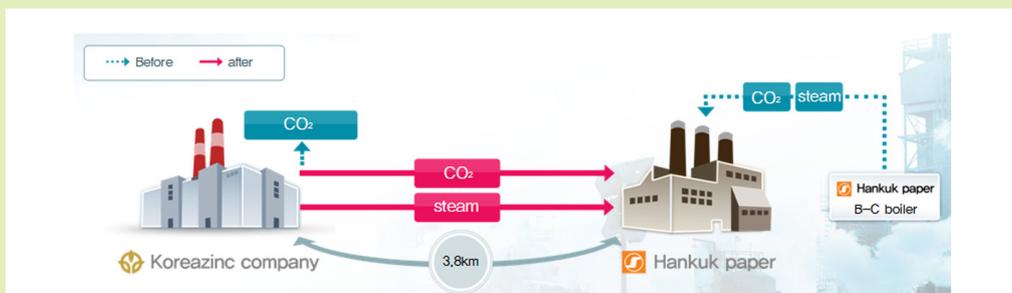


**EIP in Ulsan City, Korea**

CO<sub>2</sub> & Steam Network between Paper Company and Zink Smelting Factory

- Input (Initial Investment)
  - Facility investment in team and CO<sub>2</sub> pipes (total 3,872m): 22 million USD

- Output (Income)
  - Business scale: steam (50 ~ 80 tonne/hour), CO<sub>2</sub> (50 tonne/hour)
  - Reduction of CO<sub>2</sub>: 63,643 tonne/year equivalent to 0.7 million USD/year
  - Cost reduction from raw material & waste reduction: 6.6 million USD/year



Source: Korea Industrial Complex Corporation, 2013

## 7. Pilot Project Idea (Appendix 6)

Establishment of Eco-Industrial Park (EIP) Initiatives in Da Nang

### Key Program 3: Da Nang High-tech Park linked with Green Industry and Green Growth Goals of Da Nang

#### 1. Background

As a new, emerging market of Asia, Vietnam is well positioned to attract high value-added industry through the Da Nang High-technology Park (DHTP). In order for the DHTP to achieve success as a newcomer to high-tech industry projects, it must first secure value chain and proper positioning in the industry structure by analyzing Vietnam and Da Nang's industrial circumstances and socio-economic trends. Furthermore, the strong and weak attributes of the city must be analyzed so that special business opportunities for the high-tech industry can be identified based on this analysis. DHTP provides the key strong assets to support high-technology industry including all processes ranging from support, development and commercialization of research and education technologies to their distribution and consumption. Accordingly, it is necessary to analyze the characteristics and demands of people who live in the city, including producers, managers and consumers as well as researchers. Through good urban environmental design that combines nature, culture and industry, DHTP will lead to the development of a new urban cultural paradigm. Therefore, it is necessary to consider mixed-use site planning and diverse scales, and flexible housing to respond to future changes and demand. Also, it is necessary to support the sustainable development of a future green city where green technology will be realized.

#### 2. Expected Outcome

- A new economic position will be created for all sized businesses and types of industries in connection with other industry clusters and research institutions in Vietnam.
- Global competitiveness of the national and regional economy will be strengthened and the foundation for the vitalization of foreign investment attraction will be developed.
- A vibrant business city will be developed based on professionalism and creativity.
- Innovation based knowledge industry and high-tech industry clusters should be developed to attract the next generation growth engine industries.

- A low carbon green city will be developed which integrates nature, culture, eco-friendly technologies, and innovative industries into urban design.

#### 3. Main Concept and Principles (see Appendix 8 for detailed consulting paper)

- Gateway city of Southeast Asia for all
  - New economic position for win-win for all sized businesses: DHTP will secure open diversity covering many scales for all processes of industry, types of industry, and finance.
  - Center of international exchange in Vietnam and Indochina: The DHTP will strengthen the global competitiveness of the region by providing top level infrastructure and attracting reputable enterprises and research institutions. DHTP will form an active exchange with global high-tech industry clusters to form a base of industry expertise for SE Asia R&D and business networks.
  - A vibrant business city should be developed based on professionalism and creativity: DHTP will improve the innovative capability of the city by improving the environment's core factors including the market, production, technology and professionals, and maximizing the synergistic effects.
- Innovative base of knowledge industry combining high-technology and industry
  - Strong center for production to consumption. In addition, a center for technological development to commercialization: The DHTP will create an organic linkage between research and production to maximize synergistic effects through interaction between the research and production functions, as all processes of high-technology are spatially clustered and circulated.
  - Outpost of convergence industry leading to the next generation Vietnamese economy. DHTP will be developed into an industrial complex facilitating high-technology convergence by flexibly responding to changes in high-tech convergence conditions.
  - Knowledge industry eco-system to support start-up businesses. DHTP will lead sustainable development as the center of knowledge-based industries by arranging functional areas such as industry production, research & development, production support facilities and living areas through flexible connections.

- Sustainable value-oriented future green city
    - Green model city which will use innovative renewable energy technologies. DHTP will be a core element of the eco-city by using an eco-traffic system, green buildings, and the utilization of renewable energy systems.
    - Park city harmonized with technology, nature, and industry: The DHTP will form a new concept of a creative urban environment through the convergence of high-tech bio-agriculture, botany, research & development, tourism, culture and art.
    - Test bed to develop a low carbon green city (Evolving Test-Bed): DHTP will develop as an industrial center for 21<sup>st</sup> city innovation with creativity, innovation and flexibility.
- 4. Major Tasks**
- **Development of a sustainable urban eco-system through the mixed use of land**
    - Business and commerce: The site will be divided into an international complex site, central business site, business complex site, and general commercial site by considering the surrounding circumstances.
  - **Industrial and supporting facilities: The cluster will be planned by considering the hierarchy of space** and the phase of technological development. Develop a strategy-based on specialized industries by cluster.
  - **Parks and green space:** Link with the surrounding natural environment such as the green space and parks in order to realize the principles of a future green city development.
  - **Development of a cluster as a spatial unit based on the combination of functions to form a selfsufficient urban community**
    - **Setting up of spatial hierarchy considering regional conditions:** The core venues of the walking area network and streets will be considered.
    - **Set up of tenant facility’s features, size and industry by hierarchy of space:** Select the industries by considering hierarchy of space and technology development process; Establish specialized industries by cluster through high-technology trends, Vietnam’s convergence technology trends, and strategic industry selection.
    - **Formation by 4 Convergence Specialized Industries (InT, BeT, BaT, GeT) and Core Clusters.**

**Figure 56.** Digital Media City (DMC) case of Seoul (1)

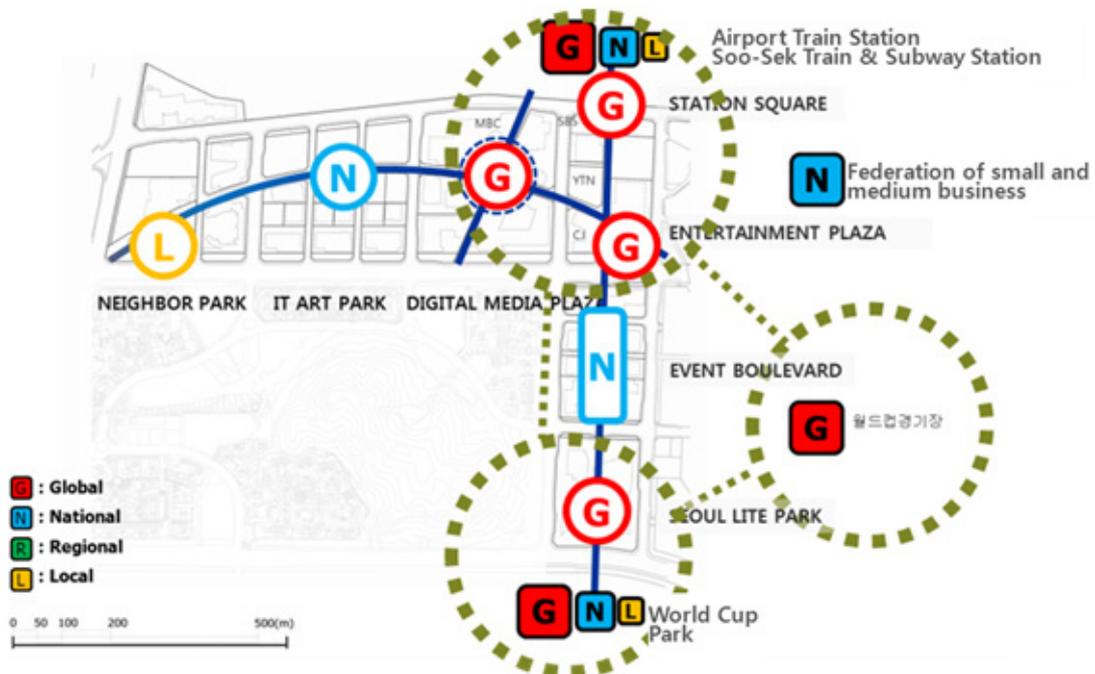


Figure 57. Digital Media City (DMC) case of Seoul (2)

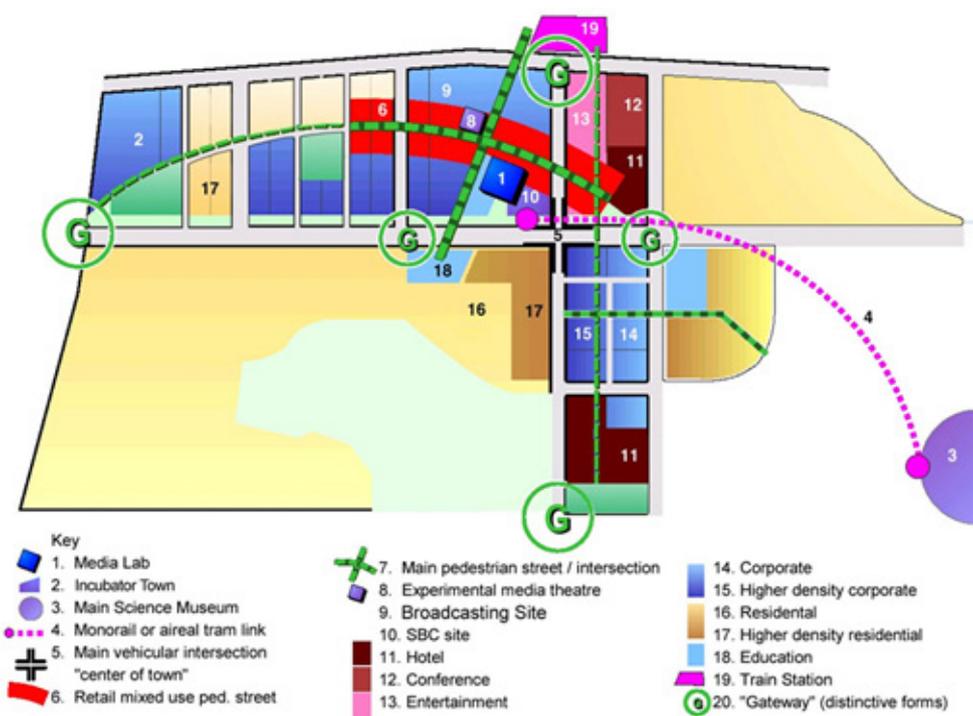
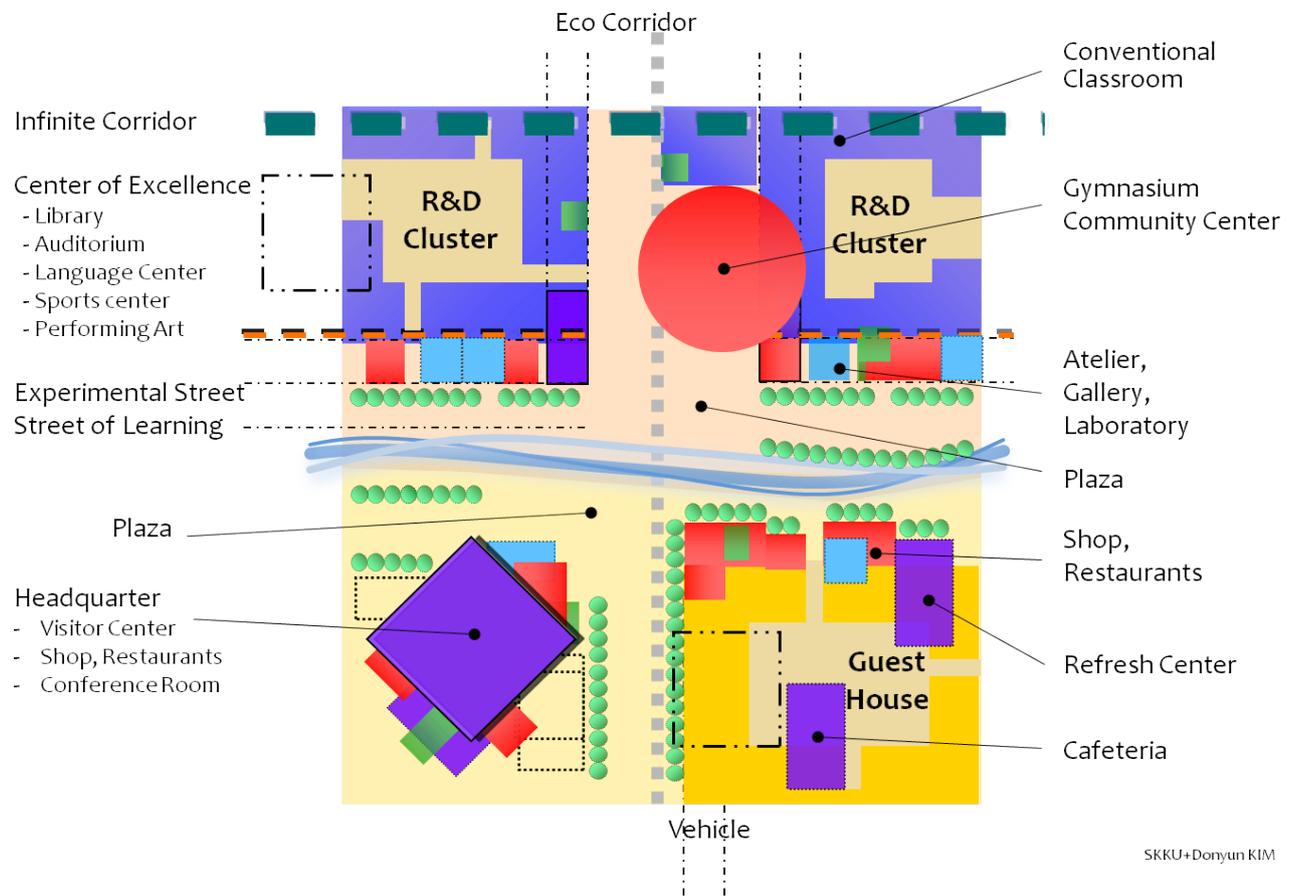


Figure 58. Example of the application of land use principles



- **Site classification**
  - Site for business and commerce:
    - Review of suitability for introduced functions
    - Considerations for business and commercial sites
    - Industrial site: A segmented layout plan by site size will be made.
  - **Supporting facility site:** This site will be developed near the park and green space with the aim to support diverse activities and to provide the convenience of rest areas. The neighborhood living facilities and service facilities will be provided for the support of industrial facilities.
- **Block Planning:** The blocks will be divided by setting the basic unit size such as small size, medium size, and large size, through applying a diversity of conditions such as features of the road adjacent to individual blocks, invited industry and block sales.
- **Place Making**
  - **Place making by place type**
    - Points of place: Apply good quality design as the symbolic place of DHTP. Develop the landmark connecting with the cluster features, surrounding conditions and buildings.
    - Street place: Develop special streets by designating main streets in DHTP.
    - Zone place: Leading function of supporting the DHTP industrial complex.
  - **Walking and public transport-centric street system**
    - Bicycle network: Network buildup connected with the green axis, minimizing conflicts with the vehicle traffic. Installation of supporting facilities such as bicycle spots and public bike rental zones where park and public transports converge.
- Public transport (circulating bus) network buildup in zones: Initial phase: Operating public transport and shuttles for tenant companies. In the long term: Operating the region’s whole circulation network such as the public transport, park points and walking in congested areas.
- **Parking lot:** The location for the public parking lot will be reviewed with the zone’s outside area and intensive line area from a long-term perspective.
- **Street revitalization:**
  - Sidewalk formation based on the 3D master plan.
  - Middle sidewalk: Realization of the DHTP’s 24-hour area which creates an attractive external environment. The style and exterior of the building’s lower part should be linked with the sidewalks.
  - Open-air café: Improve the city’s sidewalks and utilization of the green axis’ adjacent to supporting facilities.
  - Public transport zone and convenient square facility: Improve user convenience by developing a public square and a comprehensive public transport system.
- **Park points:** Special image created by establishing the hierarchy by the city’s parks and by making a differentiated park plan connected with the surrounding areas.

- **Develop differentiated and creative infrastructure**
  - **High-tech infrastructure:** Providing the IT infrastructure that continues to supply the future of high-tech infrastructure.
  - **Green infrastructure:** Introduce green infrastructure for green growth city development.

**Table 8.** Comparison between urban infrastructure and science city infrastructure

Urban infrastructure		Science city infrastructure	
<b>General urban infra</b>	Roads, water and sewage	<b>High-tech infra</b>	High-tech infrastructure (wireless telecommunication, digital media)
<b>Industrial infra</b>	Test bed, knowledge exchange, legal support	<b>Green infra</b>	Renewable energy such as wind, geothermal, solar, etc.
<b>Culture, art and education infra</b>	Museum, gallery, theater, art school	<b>Science infra</b>	Institute for Basic Science, core research facilities, science exchange facility

- **Science center infrastructure:** Develop a world class research science center which will be part of the industry cluster.
- **Target’s demand analysis**
  - **High-tech producer (to research):**
    - Target: Scientists, professors, researchers, university students, visiting researchers, experimenters, and test groups.
    - Needs: Attractive research environment /good research institute /diverse-sized laboratories / convenient and easy-to-access supporting facility/ creative resting space and exchange space.
  - **High-tech user (to do business):**
    - Target: Large companies, SOHO, entrepreneurs, investors, trade-relevant industry types, and media companies.
    - Needs: Human resources, exchange with research facilities, facilities for business, diverse business spaces, government support.
  - **Facility maker (to support):**
    - Target: Public servants, support service, start-up space lease, publishers, consultants, angel investors.
    - Needs: infrastructure for movement and exchange/Various community space / Events / Relevant government offices / Research-

auxiliary facility / culture support facility.

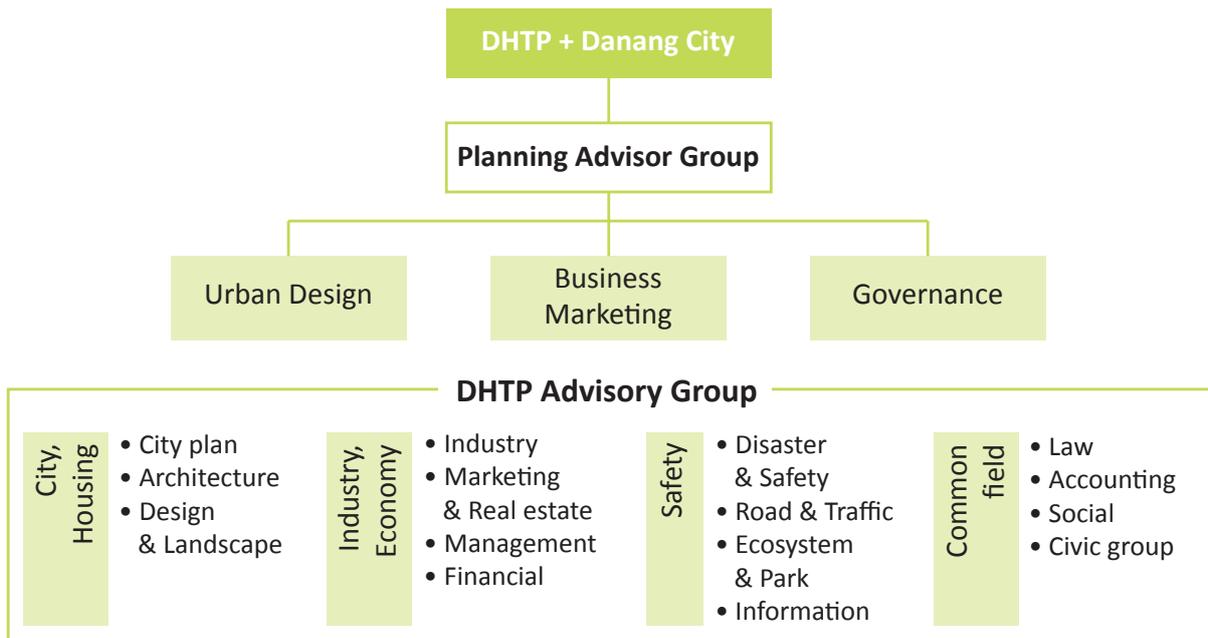
- **Facility user (to live):**
  - Target: Scientists’ families / foreigners / students / foreign students / entrepreneurs; consumers / visitors.
  - Needs: Pleasant home environment / sufficient infrastructure / good quality education, medicine, culture facility / leisure facility / resting and socializing space.

**5. Financing Mechanism**

Industry type will be chosen by classifying it into core functions, recommended functions and general functions.

- **Core functions:** Compulsory facility to be constructed by the government because of low profitability. Companies or institutes whose move-in is symbolic and which can encourage similar industries.
- **Recommended functions:** Companies or facilities that are included in the core function fields, which can represent the corresponding industry field or encourage similar industries but must be led by the private sector.
- **General functions** as the general downtown functions being indirectly related to the core functions, are mainly the general companies and facilities to be constructed or supplied by the private sector.

**Figure 59.** Role design of promoting DHTP (Da Nang High-Tech Park)



Source: A consulting paper of High-tech Park Conceptual Master Plan, 2013

The industries that will play the key role in DHTP's realization and high-technology development will be selected and then the justification for the public sector will be provided given the land price's discount or incentives.

- **Inviting industry and non-inviting industry standards, and the classification standards** of the core industry and relevant industry in the inviting industry will be presented.
- **Classification by facility's feature (leading facility / general facility):** By classifying by leading facility and general facility, the cluster formation's core performers will be sorted. It is important to invite the leading facilities by giving benefits.
- **Classification by facility's publicity (public facility / profitable facility):** Depending on whether the project aims to improve the public benefits or whether the project has the purpose to make profits, the publicity status will be determined.
- **Classification by project subject (public /semi-public / private):** According to the project's features by project subject, the limitations will be supplemented and the public support base will be established. The project subject will cover the important functions in determining the land's supply price or supply method.

## 6. Collaboration Mechanism

First, it will be critical to measure participation and utilization by companies. The utilization of human resources refers to cultivating professional personnel who will contribute to the local development of the company through cooperation with the local community using the

human resources of private businesses. The utilization of physical resources means using the facility with high connectivity with local society such as the building's lower part and open public area, and other operating facilities. Program support would contribute to the community through the program, which can improve the region's social and cultural values.

Second, the development of the area management system & city campus is for maximization of synergistic effects through the plan's initial large-scale development. Development of a system that links industry, the academy research institute, and private spheres would lead DHTP's success. An institute that coordinates functions and role allotment with other industrial complexes in Da Nang is critical while encouraging private participation and market autonomy. Distribution and expansion of DHTP development results should be a following step.

From the initial phase of the plan, the Urban Development Cooperation, DHTP Team, relevant research institutes, and related government offices will carry out the planning and project execution by allotting roles based on Da Nang's reliable leadership and delegation of the policies, functions, overseas marketing and function reinforcement. The DHTP Advisory Group will consist of a pool of experts by field (e.g. urban design, business and marketing, governance), and will choose advisors according to consulting details to provide synthetic and integrated consulting in the last step of planning.

## 7. Pilot Project Ideas

(Based on the consulting paper for strategic master planning of HPT) HTP master planning capacity building and feasibility study through city to city cooperation. (to be conducted in December) (See Appendix 8).

## Box 12. Best Practices

### Convergence of R&D cluster

- One-North, Singapore: Bio medical, IT and media industry - focused R&D hub
- Sophia-Antipolis, France: Information and telecommunications, medicine, services, and distribution field's public research institutes and private research institutes.
- Finland Oulu: High-tech industry's research institutes such as IT, BT, S/W.
- Kista, Sweden: Mobile communication, wireless Internet field's R&D - focused cluster.
- Successful cases of R&D centric industrial convergence zone in big cities like Seoul.

### IT cluster

- Zhongguancun, China: Advanced science technology and industrial technology - focused science and technology cluster.
- Hsinchu Complex, Taiwan: Computer and semiconductor - focused IT industries such as computers and peripheral devices, telephones and optical electronic engineering.
- Pudong complex, Shanghai China: Ultra precision electronic computer software field

## 2.4 STRATEGIC INITIATIVE 4

### Utilize Integrated Water Resource Management (IWRM) for an integrated eco-system based approach, which ensures resources are available for future development opportunities

#### Rationale and Objectives

Threats from climate change and the subsequent impacts on local water systems are two of the biggest issues that Da Nang must address to ensure both socio-economic and green growth development opportunities are a viable option in the future. IWRM would focus on encouraging cost-savings for the city over the long-term by ensuring efficient resource use; ensuring sufficient water resources are available in Da Nang City in the future; offsetting the negative impacts of climate change; improving the resilience of citizens through ensuring jobs are maintained (e.g. fisheries); and mitigating the potential for conflict between different stakeholders. To implement IWRM strategies throughout the region, changes should be made locally, as the city government will bear the costs associated with a ‘development as usual’ approach, which will undermine local green growth potential. The implementation of the recommended program may make Da Nang and the VGTB basin a model for improved water management throughout Vietnam, which will have a positive impact on all aspects of development and green growth in the future.

#### ***Objective 1: Coordinate research, data collection, and management to maximize government resources in Da Nang City and Quang Nam Province to improve decision-making***

- Outcome: Improve coordination and decision-making to better mobilize and allocate resources to ensure green growth and enhance project implementation.
- Monitoring indicator examples: The presence of a central data network and organizing body; number of departments contributing to and utilizing data.

#### ***Objective 2: Integrate land-use planning with natural resource management policies and objectives, while taking the impacts of climate change into consideration***

- Outcome: Land use plan will be integrated into a basin management plan, which will result in development strategies that include the adoption of buffers, maintenance of the impervious versus pervious surface ratio, and the adoption of low impact development (LID) strategies

- Monitoring indicator examples: Projects implemented; Number of participating agencies.

#### ***Objective 3: Better integration of monitoring and evaluation indicators and processes for water management to improve feedback and reporting***

- Outcome: Develop locally viable indicators to improve monitoring and evaluation to ensure more transparency in development, and to strengthen EIA processes.
- Monitoring indicator examples: Transparent monitoring and evaluation indicators to ensure compliance with standards, as outlined in newly developed River Basin Management Plan.

#### ***Objective 4: Promote ecological and water literacy. Focus on benefit sharing, related to maintaining eco-system services, climate change mitigation, adaptation, and disaster risk reduction***

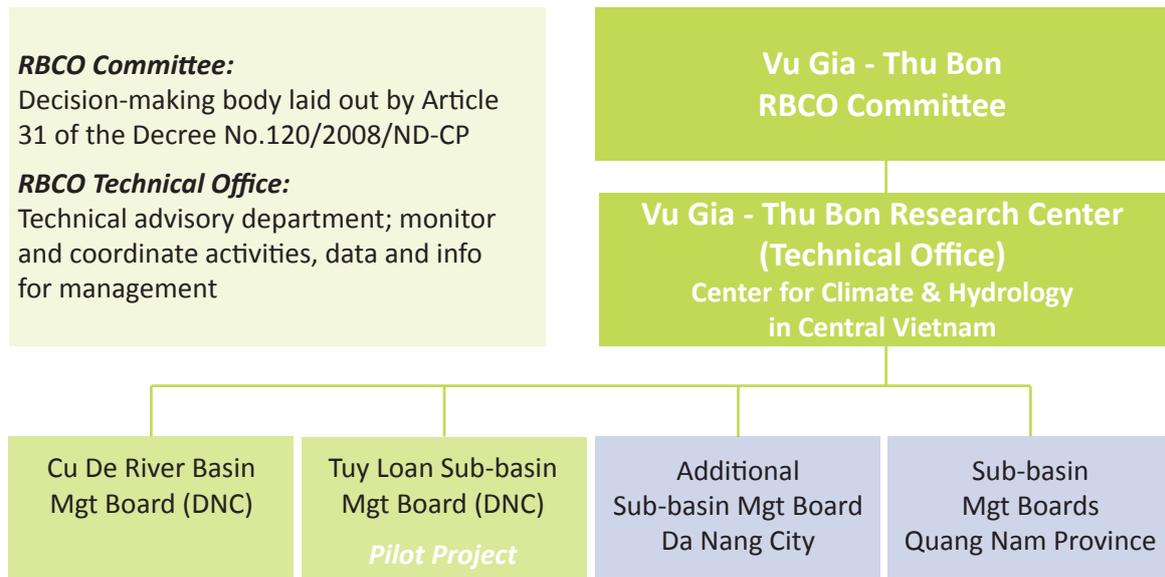
- Outcome: Integrate strategies, both formal and informal, to build the capacity of the local citizen, government staff, and the business community. Incorporate bottom-up, participatory strategies that safeguard eco-system services, and ensure a livelihoods approach to increase local resilience.
- Monitoring indicator examples: Number of programs to promote literacy; less environmental degradation as a result of human activities (e.g. littering, blocking drainage systems, etc.); local income/living standards measured using indicators beyond GDP.

#### **Key Program: Establish River Basin Coordination Organization (RBCO) to optimally manage water and natural resources throughout the Vu Gia - Thu Bon (VGTB) river basin**

#### **1. Background**

Currently, water management in Da Nang and the VGTB basin is heavily qualitative, and there are no strict quantitative management controls or mechanisms for integrated management. Each sector plans and implements strategies separately. As a result, flooding impacts are exacerbated in downstream areas in the wet season; dry season water scarcity is increasingly apparent in Da Nang City; the impacts of salinization are growing more serious; and money is wasted through the implementation of uncoordinated policies and programs that sometimes unintentionally undermine long-term eco-system health and resilience. In order for IWRM to be realized, there must be a mechanism in place that includes a system for adaptive management and ongoing monitoring. However,

**Figure 60.** Multilateral governance structure for IWRM



Source: Decree No. 120/2008/ND-CP

currently there is no single organization with the power and technical capacity that is capable of ongoing monitoring and evaluation to ensure effective planning and management in the VGTB basin.

The establishment of a mechanism to sustainably manage local water resources is essential, in order to realize the green growth potential in the region. According to current national law, this should be done through a ‘River Basin Coordination Organization’ (RCBO). A RBCO is a governance mechanism that is the primary organization in charge of water management at the basin level, in order to achieve IWRM. To date, there have been many hurdles in the VGTB watershed to previous attempts to start a River Basin Organization (RBO), which is similar to an RBCO but under the jurisdiction of MARD.

**2. Expected Outcome**

- **Ensure water resources are available for future economic growth**, including for both industrial and tourism development.
- **Improve coordination and enhance management processes through multilateral governance and multi-sectoral engagement** to avoid future conflict and ensure local cost savings for infrastructure development and resource management.
- **Improve technical capacity** through locally based strategies, in order to manage water resources to maximize resource potential and develop a basin

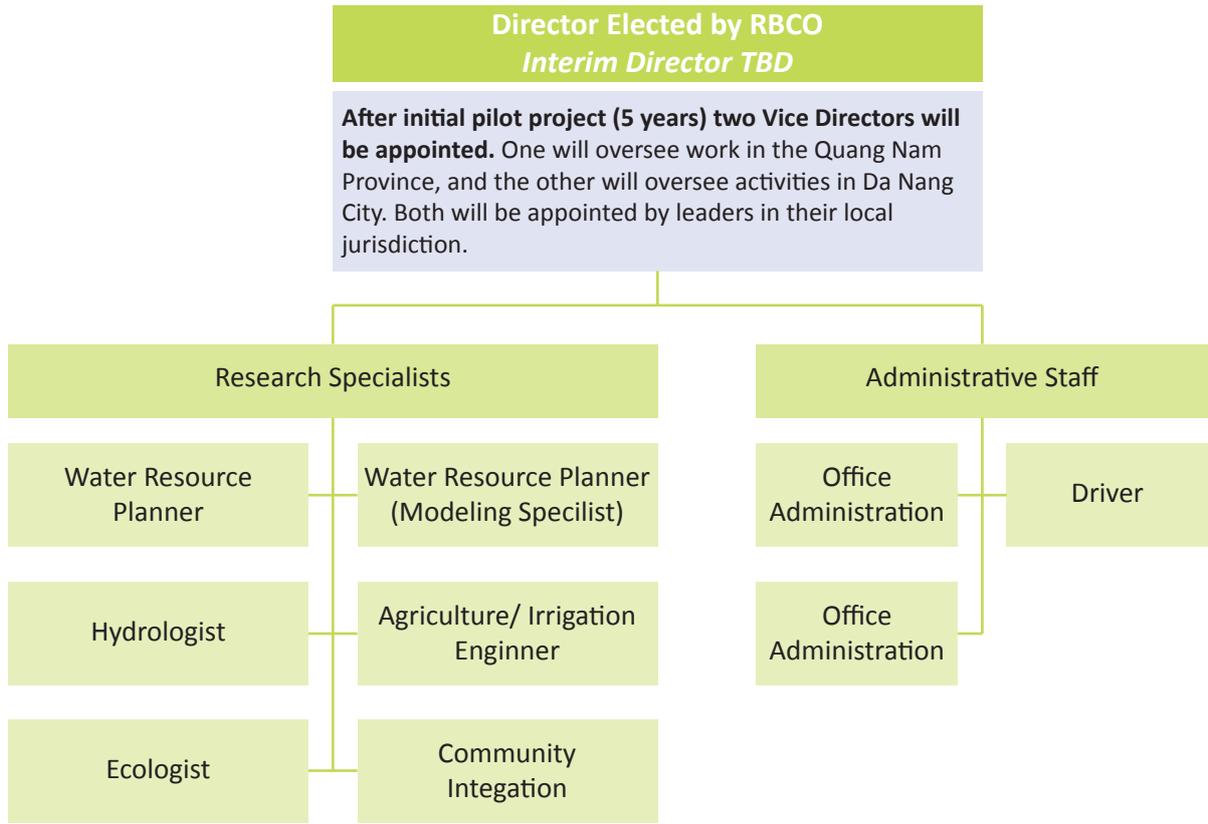
management plan.

- **Improve mechanisms to establish and implement other green growth strategies**, such as green space, ecotourism and agriculture programs.
- **Establish mechanisms for community-based environmental management** that will improve environmental literacy and maintain important ecosystem services that the most vulnerable in society are reliant upon (e.g. fisheries, agriculture).

**3. Main Concept and Principles**

According to the current national law (Decree No. 120/2008/ND-CP), RBCOs operate under MONRE, and must be made up of two different organizations: the River Basin Technical Office and the River Basin Committee. In the past, establishing both organizations has proven to be difficult. However, these challenges may be overcome because this strategy and subsequent proposal were developed utilizing a participatory approach (Appendix 7). The primary goal of the VGTB Research Center is to act as an autonomous organization to provide sound technical advice for decisions made related to water management. The Research Center will be housed in the Center for Climate and Hydrology in Central Vietnam and operate under MONRE. The success of the RBCO Committee and newly established VGTB Research Center will translate into water management strategies that offset the impacts of climate change, ensure water is available for future use, and mitigate potential conflict through

**Figure 61.** Proposed organizational structure for VGTB Research Center



ensuring IWRM strategies are implemented. In order to be successful, the VGTB Research Center must fulfill its primary purpose through a combination of bottom-up and top-down activities to optimize governance. Ultimately, the VGTB Research Center will be able to answer all basic scientific questions posed by local leaders and the RBCO Committee, in order to ensure decisions are in the best interest of the region.

The newly established VGTB Research Center will coordinate water management throughout the region. This program will ensure local participation and coordination through the establishment of Sub-Basin Management Boards (e.g. Tuy Loan). At the sub-basin level, locally based Management Boards will be responsible for improving environmental literacy, ensuring the local capacity to meet the livelihood needs of the local citizenry, and to work with the local community to ensure national and regional policies are implemented in the local context. Local activities will be overseen and coordinated by the VGTB Research Center and integrated into management plans. In turn, the Sub-Basin Management Board will be responsible for holding one community meeting every six months, and developing an annual report on the current situation that will include proposed solutions to local challenges. The Tuy Loan Sub-Basin Management Board will be established as a pilot project. During the

pilot phase, the Research Center will develop and author a tool-kit to facilitate participation in local water resource management activities. Based on its experience in the Tuy Loan sub-basin, this model may be expanded upon in the future. Through working with Sub-Basin Management Boards the VGTB Research Center will have access to a broad range of local data and information, which will help guide decision-making processes, and ensure there is a dialogue between top-level and community-based authorities on issues surrounding water resources. After the initial pilot project, a Management Board can also be established in the Cu De basin, in order to ensure optimal management of Da Nang’s water resources.

To ensure success, coordination is essential. Therefore, the proposed organizational structure is outlined in Figure 63. The development of the Research Center will ensure that the VGTB RBCO will be functional, and can make the necessary decisions to oversee and guide basin activities related to water resources in the future. The implementation of this project will be successful because of its multifaceted, scalable approach, and will ensure the successful implementation of IWRM in the basin.

in order to **demonstrate cost-savings associated with improved water management. This project will work to develop a policy that promotes benefit-sharing through a PES scheme.**

- Complete a demand management strategy and basin management plan for the VGTB basin, which will be an essential document for water resource management in DaNang. The basin management plan will ensure that water will be managed for multiple uses, including minimum instream flow requirements.

#### **4.2. Process for the Implementation of the VGTB RBCO Committee & Research Center**

- Phase 1: Establish RBCO and gain approval for the VGTB Research Center (the 1<sup>st</sup>-2<sup>nd</sup> year)
  - Develop proposal and present to Quang Nam and Da Nang leaders/ stakeholders.
  - Submit proposal to MONRE for approval & initial financing.
  - Hold official meeting with Quang Nam Province and Da Nang City stakeholders.
- Phase 2: Establish VGTB Research Center and conduct strategic planning (the 2<sup>nd</sup>-3<sup>rd</sup> year)
- Phase 3: VGTB Research Center will conduct additional activities & develop VGTB Basin Management Plan; RBCO Committee will provide oversight & make decisions (~the 6<sup>th</sup> year)
- Phase 4: Determine next steps to continue IWRM activities and regional support through the established RBCO Committee and VGTB Research Center (the 6<sup>th</sup> year~)

#### **5. Financing Mechanism**

There is funding available by the national government under MONRE, if Quang Nam Province and Da Nang City officials are in agreement on the pathway forward to establish an RBCO. If MONRE approves the proposal, it will provide the start-up funding necessary to carry out initial activities to improve governance. After the initial start-up period, the RBCO Committee will meet twice a year with the VGTB Research Center, in order to review and approve management plans and allocate funding. This will follow the framework laid out in Decree No.120/2008/ND-CP.

Additionally, IWRM will continue to be a key item on the global agenda, as the results of climate change are felt around the world. This will ensure additional financing opportunities. Analysis has demonstrated that this is especially relevant in Da Nang City. Therefore, it may be assumed that there will be resources available in the future for well-designed projects. As discussed previously, international organizations have provided support for activities related to IWRM in the past, and have shown they may continue to do so in the future.

Fiscal feasibility has been one of the primary hurdles to establishing an RBO in the VGTB river basin in the past. Therefore, it is important to diversify financing mechanisms. The activities of the RBCO may promote innovative approaches to management, which will encourage creative capital investment schemes, which value the services provided by nature and integrate them into the cost-benefit analysis of decision-making processes. This will ensure long-term cost-savings, streamline costs associated with effective water management, draw attention from outside investors, and is a fundamental aspect of green growth. In addition, there also needs to be a locally based, sustainable revenue source to ensure that the RBCO is successful into the future. ODA projects often do not include a cost-recovery mechanism, which is essential to ensure investments are sustained into the future. Therefore, it is important to begin to implement a strategy where the activities of the RBCO are funded by beneficiaries within the VGTB system. This will help pay the salaries of staff, and fund some of the organization's activities that will help offset the negative consequences of ongoing development in the basin. Potential funding mechanisms may include a percentage or a rate based on business revenue (e.g. tourism, industry, service, etc.) and a rate for raw water exploitation for enterprise, which may be adjusted according to the enterprise and its projected environmental impacts. (Rate =  $K(a)$ ,  $a$  = fixed priced (e.g. 0 - 500 VND/m<sup>3</sup>,  $k$  = classification coefficient based on water use (e.g. industry, agriculture, mining).

However, a sustainable financing mechanism will require research, and a feasibility study to ensure that the strategies suggested are possible. This will be addressed as a component of the strategic planning process for the VGTB Research Center. By ensuring that there are incentives to preserve water resources, it guarantees that they will be there in the future to make the green growth agenda a reality in Da Nang.

#### **6. Best Practice and Pilot Project Ideas (Appendix 6)**

#### 4. Major Tasks of the VGTB Research Center and Key process

##### 4.1. Major Tasks

Major steps to build the VGTB research center would be described as follows,

- **Steps to Improve Governance:**

- **Work with Quang Nam Province and Da Nang officials to plan and implement a kick-off workshop**, which will be designed to mitigate conflict, and **culminate in a signed agreement between QNP and Da Nang.**
- Utilize a participatory approach for strategic planning that will guarantee organizational sustainability.

- **Steps to Improve Technical Capacity to Implement IWRM:**

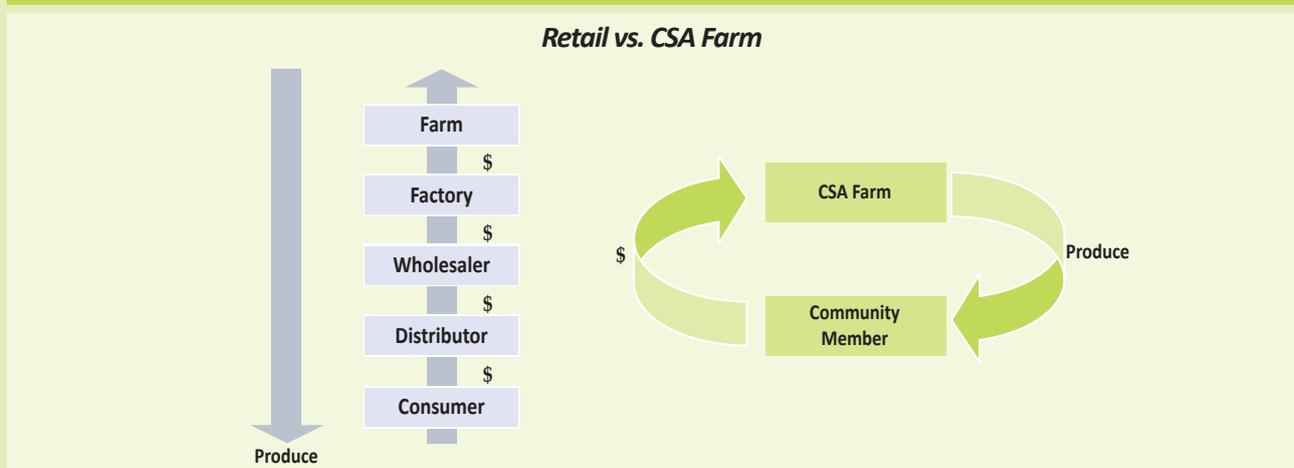
- **Review all projects currently related to water resource management in the VGTB basin, and assess additional data and information necessary to meet the objectives outlined in the strategic plan.**
- Provide technical assistance to **Sub-Basin Management Boards** (e.g. Tuy Loan pilot project), and help **facilitate additional opportunities for meaningful participation at the local level**, which will allow the Research Center to collect additional information and build local capacity.
- Identify and **pilot a benefit-sharing project** (e.g. the Cai River) that prioritizes eco-system services and soft-infrastructure uses (e.g. mangrove restoration, stream buffers, LID strategies, etc.),

### Box 13. Community Supported Agriculture (CSA)

CSA concept: CSA is an alternative, locally based economic model of agriculture and food distribution. CSA refers to a particular network or association of individuals who have pledged to support one or more local farms, with growers and consumers sharing the risks and benefits of food production. CSA members pay fees (labor, fees for animals, etc.) at the onset of the growing season for a share of the anticipated harvest. Once harvesting begins, they receive weekly/ monthly shares of harvests.

Community Supported Agriculture (CSA) generally focuses on the production of high quality foods for a local community, often using organic or biodynamic methods. The CSA uses a shared risk membership-marketing structure. This kind of farming operates with a much greater degree of involvement of consumers and other stakeholders than usual - resulting in a stronger consumer-producer relationship. The core design includes developing a cohesive consumer group that is willing to fund a whole season's budget in order to get quality food.

Figure 62. Comparison between CSA system and retail farms



Source: Business and Technology, Mark Cahill

## 2.5 STRATEGIC INITIATIVE 5

### Develop a Competitive Green Agricultural Village linked with Green Production and Ecotourism based on strong Urban-Rural Linkages

#### Rationale and Objectives

The rapid urbanization and agricultural land loss have required that the city create high value added agricultural production, accelerate rural industrialization linked with competitive tourism and service industries, as well as develop high quality living environments. Da Nang City has the potential to develop competitive local products with high quality and food safety. Rural areas, such as HoaVang, have potential to become socio-economic and cultural centers to attract financial and human resources with diverse cultural resources, high-tech parks areas, and surrounding tourism infrastructure. Green agricultural village development would play a key role to mobilize resources to enhance clean agricultural development activities as well as eco-tourism while updating value chains of green production with better quantity and quality.

**Objective1: Green agricultural production geared towards markets and consumers with high productivity and better quality of products, based on strong urban-rural connections and high demands from urban areas and the tourism industry**

- Outcome: Improved competitiveness (in price / quality / communication / safety) of agricultural development to contribute to rural industrialization while directly supporting increasing demands from new tourism and urban areas (esp. high end consumers).
- Monitoring indicator examples: Increased production under VietGAP, Increasing rate of expanding values chains (direct sale), difference of price between local green agricultural (i.e. Hoa Vang) production and market price.

**Objective 2: Local community driven agricultural tourism & service development, utilizing valuable local assets while protecting the environment, satisfying demands for local quality food, and returning socio-economic benefits to rural areas.**

- Outcome: Local products and various local activities related to agricultural production based tourism to strengthen the relationships between urban consumers and rural suppliers, and contribute to job creation and labor restructuring.

- Monitoring indicator examples: Job creation related to agricultural tourism; number of environmental protection projects as a part of green village development initiatives; the number of local community members involved in tourism services; increase in agricultural product sale related to tourism; the number of tourists who attend local festivals; the increase in awareness about the responsibility of the community to build green rural areas.

**Objective 3: Integrate basic social and environmental service development into green agricultural village development planning with a focus on increasing resilience to climate change impacts, such as flooding**

- Outcome: Improved water supply system to support agricultural development and tourism services. The improved water supply system will also contribute to water savings, climate change resilience, better accessibility to basic services in green agricultural village, and will lead to poverty reduction linked with overall agricultural development programs.
- Monitoring indicator examples: Application of new technology to reduce water leaks (i.e. dripping system, reduced recovery costs for household and agriculture after flooding and soil erosion).

#### Key Program: Green Village Development linked with Green Production and Tourism

##### 1. Main concept and principles:

Main concepts and principles of developing green village to be linked with green production and ecotourism are described in details as follows,

- **Establish a long-term strategy to increase the portion of Green Agricultural production among overall other agricultural activities while promoting green agriculture in market:**
  - Step by step application: start with Green Agricultural Development at the preliminary level and gradually move to a high level of Green Agricultural production.
  - Facilitate incentives from the government to gradually increase households involved in green agricultural activities among overall agricultural activities.
  - Diversify value chains of green production gradually - increase proportions of direct sales based on CSA (Community Support Agriculture).

- Diversify green production- first focus on easy crops such as rice, then gradually find appropriate products in local contexts.
- **Develop and strengthen local agricultural cooperation activities to support green agricultural production focusing on the following:**
  - Gradual increase in the number of people who join green agricultural development activities such as seeding, harvesting, commodity development, and delivering.
  - Quality standards for green agricultural production using locally adoptable criteria to encourage more farmers to join. Gradually increase consistency in the quality of harvested products among farmers.
  - Develop a joint effort to bring marketing and branding among participating farmers to promote “locally produced green/safe products of Da Nang.”
  - A potentially link with financial organizations and institutions to develop micro financing functions.
- **Develop an integrated project to increase overall productivity and marketability of key agricultural product to directly serve increasing demands from tourism and urban areas, focusing on:**
  - Conduct tests to identify needs to change kinds of key agricultural products, which is appropriate for different topology and climate.
  - Strengthen supporting infrastructure such as food storage, irrigation, and harvesting facilities.
  - Develop and diversify processed products (comestible) and push marketing to increase commodity value.
  - Diversify a marketing communication strategy targeting various urban areas, tourism services (high-end resorts and guest houses), using direct sales or formal value chains.
- **Develop green village tourism strongly linked with the sales of agricultural products and the experiencing of locally driven activities and festivals. This would also contribute to differentiating the eco-tourism of Da Nang from neighboring cities and provinces**
  - Focus on sales of green agricultural productions bundled with other local production (fruit, vegetables and high value added processed products). Develop various processed products

considering market trends.

- Develop agricultural experiencing programs and related educational programs, which can be linked with local festivals and neighboring tourist attractions.
- **Develop a pilot program to structure and distinguish three different agricultural activities**
  - Three different groups: farmers who mainly work on commercial agricultural activities; a group to be involved with overall productivity improvement and infrastructure development activities; and a group dedicated to developing advanced agricultural activities.
  - Select appropriate pilot programs to support commune/ward levels based on loans and grants in cooperation with the city government.

## 2. Major Tasks and Process

### 2.1. Major tasks

Major tasks in building green villages that focus on sustainable green agricultural production and eco-tourism are described step by step as follows:

- **Create a differentiated Green Agricultural Product based on CSA (Community Supported Agriculture):**
  - Develop small-sized green agricultural activities, organizing small groups of farmers (e.g. start with 1 hectare involving currently active farmers in Hoa Vang), focusing on rice first.
    - Gradually increase the portion of green production in overall products.
    - Achieve quality consistency among participating farmers (quality to be classified); later
    - categorize the quality of rice and vegetable and differentiate prices (A,B,C).
    - Improve quality with small fund development for irrigation retrofitting and testing bio fertilizers.
    - Gradually develop high-value added, marketable processed products such as fruit juices to be sold, linked with green village tourism.
    - Enhance current value chains and gradually establish direct service for specific customers (hotels, high end service) and non-specific consumers in urban areas.
- **Pilot Initial CSA**

- “Da Nang Safe Food”: Set up a CSA with “Da Nang Safe Food” members of which would register to have accounts and send money according to the number of registered accounts they hold (e.g. 1 account to get 2 units of rice packages regularly or on the special occasion) → “the farmers group“ send safe vegetable or rice based on the agreed schedule (e.g. TET)
- Diversify CSA channel with cooperatives and schools. Neighboring hotels in Da Nang, high-end services, schools and large cooperatives who want to make a social contribution to rural development at the same time to be provided with safe agricultural products and experiences.
- **Developing Marketing Strategy targeting two groups:**
  - Firstly, promote “**Da Nang Green Village**” as a major supplier of green production to retailers and other tourism services while developing a “**Safe Local Food of Da Nang**” brand to be linked with the “**Da Nang Green Village**” promotion;
  - Secondly, develop two way marketing: i) direct marketing for non-specific urban communities and ii) direct marketing for cooperate, making lots of effort to develop a sister relationship so that the cooperative would be one of the best long term customers.
- Set up tailor made delivery system to increase value of products by using differentiated materials for special customers; devXeloping various sizes for delivery; and setting up drying place, low temperate storage, and processing.
- Develop sale package (both on-line and off-line): green agricultural rice + Processed commodity with high values (e.g. fruit juice) + other local specialties
- **Develop a “Urban-Rural Exchange Project for Green Village Development” linked with other rural development programs**
  - Landscape improvements with the renovation of unused houses or government buildings with little uses to be renovated and develop a tourism information center connected to commune buildings, culture halls. Renovation of old houses and government buildings to develop a tourism information center.
  - Develop facilities for educational programs and tourism that offer nature experiences. When the number of visitors or CSA members increases. Develop nature education program involving local communities.
  - Develop a web page to support CSA and direct sales, upscale agricultural tourism. Set up a tourism development committee in charge of nature education and accommodation and increase sales of high-value added processed products linked with

**Figure 63.** Green Village Development role design and collaboration mechanism



- tourism services.
- **Community - driven “Agricultural Experiencing Activities” development linked with green agriculture development CSA - Target urban members first, followed by urban communities**
    - Develop nature and agriculture experiencing program with local communities and tourism development committees: Urban communities or tourists participate in green agricultural production and participate in rice or vegetable processing: rice cakes, fruit based products (i.e. fruit juice).
    - Develop nature and cultural experiencing education.
    - Develop harvesting festival targeting CSA members and big cooperatives.
  - **IT based business development and creating supplier-consumer communication to support direct sale**
    - Direct sale platform development to be supported by:
      - CSA membership online application and registration, and member’s annual payment for green agricultural products. This would target urban customers.
      - On-line direct sale: green agricultural products, local specialty, and processed foods.
    - Website to be used for the Effective Marketing and Promotion of Nature Experiencing Program. Educational tourism registration and application; promotion of programs by season / products / activities.
    - Strong urban-rural (supplier-consumer) communication for building transparency and trust among CSA members with an agricultural activities diary, shared among CSA members; effective marketing.
  - **Develop a sister relationship between companies/ schools and the agricultural village to establish long-term customers. This would contribute to the sales of green production**



- Develop a sister relationship with service industries, companies and schools to provide certified green agricultural products and services;
  - Linked with tourism services with a focus on high end services targeting tourists;
  - Linked with schools who need environmental education as well as organic, safe food;
  - Linked with cooperatives who want to make social contributions as a part of CSR(Cooperate Social Responsibility Activities) by buying safe and clean agricultural products and sharing with other.

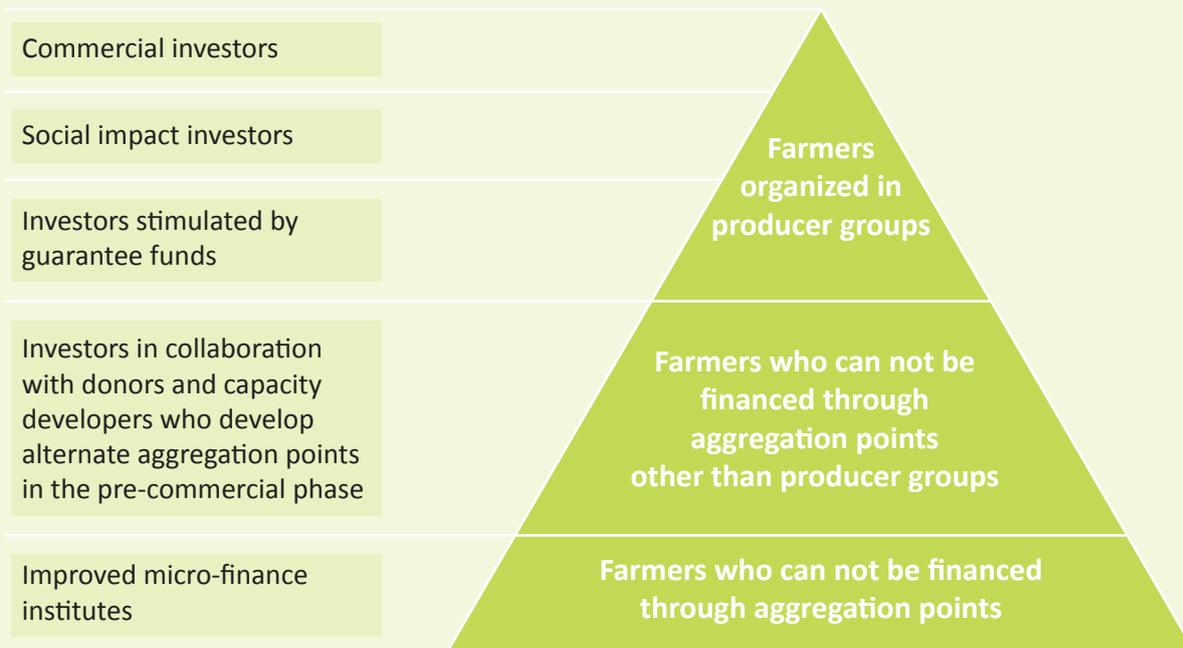
**Box 14. Innovative financing for green agricultural development**

In many cases, financing farmers directly is not a viable option due to the high transaction risks and costs. Unfortunately, most microfinance institutions do not provide alternative options and the majority of small farm holders are hardly serviced by any of the lending institutions. As a result, their capacities to become integrated into and strengthen their positions in the value chains are severely constricted. In this context, it is critical to engage in partnerships with the private sector whereby innovative green agricultural development financing mechanisms can be of tremendous help. Innovative funding mechanisms need to be embedded in wider value chain development strategies that involve the use and development of aggregation points (i.e. points in the chain where private actors can reach out to green agricultural farmers as a group, thus reducing the risks and transaction costs of working with smallholders). An aggregator may be a producer organization or a cooperative, a collection

hub, a warehouse, an input provider or any other intermediary that can liaise between value chain actors, lenders and groups of smallholders.

Before investing in smallholders becomes a viable option in the business models of commercial and impact investors, investments need to be made in activities that belong to the pre-commercial phase of value chain development for green agricultural development. These include identifying possible aggregators and strengthening them, seeking relevant actors to co-invest in and make use of these aggregators, and the testing and supporting of the scaling up of improved microfinance models (see box). The active involvement of commercial and impact investors is important if smallholders are to make a successful transition from the pre-commercial to the commercial phase. Inclusive development is a process of co-creation.

**Figure 65. Inclusiveness of various sources and mechanisms of financing for smallholders**



- Contracting long-term direct sale: Green agricultural village sell accounts and sends agricultural products according to numbers of account that cooperatives/schools purchase.
- Focus on relationship building and maintaining: Cooperatives activities (i.e. social responsibility promoting activities) to be linked with village improvement program involving landscape improvement; and other exchange programs to provide education program and harvesting festival.
- **Develop a mechanism for long term benefit sharing among participating farms**
  - Provide various jobs in charge of direct sales, experiential environmental education, agricultural experiencing, and tourism services.
  - Use profits from tourism and experiential education programs as the basis for overall development of the village such as village infrastructure development (esp. irrigation systems) Develop village scholarship program for local communities.
  - Set up a village cooperative fund and set up financial and non-financial stakes.

## 2.2. Process

- **Phase 1: Initial set up and capacity building**
  - Set up Green Agricultural Village Development Committee:
  - Three working group categories:
    - Group 1 in charge of agricultural tourism including experiential education;
    - Group 2 in charge of commercial agricultural development related to direct sales;
    - Group 3 in charge of infrastructure development for productivity improvement and advanced technology applications (long-term planning group);
  - Initial costs to be linked with available local funds or other financial mechanisms involving relevant programs such as the ADB clean agricultural production program.
  - Education program development with a focus on visiting successful cases within Vietnam: farmers and business leader to see successful pilots in neighboring areas.

- **Phase 2: Develop pilot programs**

- The city government develops a supportive program such as “green village development,” asking districts / communes to do funding applications.
- Districts and communes to develop project proposals and apply for loans or grants from city government.
- The government evaluates projects and selects some projects for loans or grants. Loans target commercial farmers and grant targeting village ( who would have some matching fund) where leaders have the capacity for implementation.
- Implementation, followed by the monitoring of the city government. Awards will be given.

- **Phase 3: Transform the pilots into full-scale programs after monitoring and evaluation**

- **Phase 4: Disseminate green agricultural village model to the others**

## 3. Financing Mechanism

Green village development and operation flows are described below. It is critical to strengthen urban and rural relationships based on mutual trust to develop sustainable financial flows for the programs. Starting from the small development funds would lead to bringing more multi-sectoral investment at various stages of the programs, which must be basis for overall village development, competitive green production and eco-tourism.

## 4. Collaboration mechanisms for key supports

First of all, roles among different stakeholders need to be designed with consideration of their characteristics. Village leaders should be centered in overall program development while business leaders have separate roles from overall village development, with a focus on CSA and direct sales. Customer relationship management needs to be centered in green village development programs. Delivery management groups will need to be developed. Marketing & brand management group will be developed according to different target groups. District leaders will work with city governments (i.e. DOCT) especially concerning marketing of local tourist attractions. Information sharing and program exchanges among districts and neighboring areas should be regular activities.

Regarding key institutional supports, the city government will facilitate developing supportive programs with available grants and loans in coordination with financial organizations and the central government. Coordination among districts and different departments (especially DARD, DOCT) will focus on marketing on agricultural village development and green production. It is essential that the government arrange pilot program awards and coordination between central government and city government to upscale successful pilot models. Information sharing between districts and the city needs to be ensured while the city government will promote the pilot to the central government.

In order to ensure key infrastructure and technical supports, irrigation systems, drying facilities, and low temperature storage are required while a cost-effective production delivery system and management should be developed and up-scaled. In addition, an IT platform for marketing and direct sales will be the basis for ensuring sustainable business development with marketing and brand strategy development. Capacity building for brand management is identified as an essential step to expand green production in Da Nang. Quality control and grading information, and monitoring system standardization are required, especially to meet the demands of the expanding markets. Appropriate technology is needed to test seeds according to different climate and topologies as part of a long term strategy to up-scale green production and green village development.

#### **4. Collaboration mechanisms for key supports**

First of all, roles among different stakeholders need to be designed with consideration of their characteristics. Village leaders should be centered in overall program development while business leaders have separate roles from overall village development, with a focus on CSA and direct sales. Customer relationship management needs to be centered in green village development programs. Delivery management groups will need to be developed. Marketing & brand management group will be developed according to different target groups. District leaders will work with city governments (i.e. DOCT) especially concerning marketing of local tourist attractions. Information sharing and program exchanges among districts and neighboring areas should be regular activities.

Regarding key institutional supports, the city government will facilitate developing supportive programs with available grants and loans in coordination with financial organizations and the central government. Coordination among districts and different departments (especially DARD, DOCT) will focus on marketing on agricultural village development and green production. It is essential that the government arrange pilot program awards and coordination between central government and city government to upscale successful pilot models. Information sharing between districts and the city needs to be ensured while the city government will promote the pilot to the central government.

In order to ensure key infrastructure and technical supports, irrigation systems, drying facilities, and low temperature storage are required while a cost-effective production delivery system and management should be developed and up-scaled. In addition, an IT platform for marketing and direct sales will be the basis for ensuring sustainable business development with marketing and brand strategy development. Capacity building for brand management is identified as an essential step to expand green production in Da Nang. Quality control and grading information, and monitoring system standardization are required, especially to meet the demands of the expanding markets. Appropriate technology is needed to test seeds according to different climate and topologies as part of a long term strategy to up-scale green production and green village development.

## CONCLUSION

Da Nang City's Green Growth City Development Strategy (GG-CDS) is the first city-level development strategy in Vietnam and probably in the Asia-Pacific region which aims to integrate green growth principles and approaches into the urban planning frameworks. The GG-CDS aims to catalyze new thinking and utilize innovative ideas to urban planning through integrated and multi-sectoral approaches. Main focus of the strategy lies in the effective use of local assets and social capital in order to improve the quality of life in the City of Da Nang. The GG-CDS also contributes to creating higher value added development for the City.

The GG-CDS has been developed through close consultations and active engagement with diverse group of stakeholders from Da Nang City. Especially through the leadership training with key officials in partnership with GGGI and UN-Habitat, vital inputs and major policy implications could be identified and reflected in the Strategy. Da Nang City officials and key stakeholders could get a sense of ownership and understand the importance of green growth approaches in urban development planning. A series of key green growth opportunities and programs of the GG-CDS were identified through these participatory approaches and is expected to tackle the manifold challenges associated with Da Nang City's rapid, urban development.

The GG-CDS applies main principles and concepts of the Vietnam Green Growth Strategy (VGGs) for the period of 2011 - 2020 which was officially approved by the Vietnamese government in September 2012. The strategic initiatives and programs were identified to promote local economy in the GG-CDS in selected areas such as water and waste management, housing, energy, and transportation, etc. The VGGs aims to increase economic competitiveness, protect ecological systems, while expanding employment opportunities for the Vietnamese people. The GG-CDS provides key policy implications, major sectoral issues and possible analytic framework to the Da Nang City government which are required to implement the programs and policies outlined in the Vietnam's Green Growth Strategy. The GG-CDS may provide inspiring examples of locally-driven urban development initiatives to build climate resilience toward climate change in Vietnam.

The GG-CDS also highlights the mobilization of capital investments and proper financial schemes along with international cooperation for technology transfer and human resource development which will eventually ensure the successful implementation of the GG-CDS

Da Nang and all across the Vietnam. A series of green growth programs proposed in GG-CDS, such as the development of low carbon public transport systems, the implementation of urban tree planting, the installation of biomass power plants, integrated water resource management schemes, etc. requires effective partnerships among public and private sectors especially from the international development organizations, inter-governmental agencies, and the private businesses. Experiences and researches on other green growth model cities introduced in the GG-CDS such as Portland, Oregon in USA or Curitiba in Brazil, would be quite helpful to find out best options in transfer of innovative technologies to Da Nang and to design proper land use schemes and clean energy or air/water quality monitoring systems, etc. Collective partnerships among city governments in Vietnam and active leadership from the central government shall be expedited as channels or frameworks to disseminate green growth oriented urban development planning schemes followed by sharing lessons and mobilizing financial resources toward the smooth implementation of VGGs.

Every city government in Vietnam and all across the Asia Pacific regions wishes to enhance its competitiveness and guarantee its sustainable future through stimulating job creation, decarbonizing production systems, reducing greenhouse gas emissions, while protecting the natural environment to maximize its value for the future generation. Green growth oriented urban development strategy can provide new thinking and innovative tools to the city governments to achieve these sustainable goals in effective manner. The GG-CDS for Da Nang is a pilot model for this. Vietnam is currently experiencing rapid economic growth and urbanization. A series of new challenges in urban planning have emerged in Vietnam. Reckless urban sprawl increases the gaps between urban centers and rural outskirts. Rapid concentration of population causes multiple issues of urban poverty. Inadequate access to the various infrastructures and basic services in the city may have more risk to widen the gaps between haves and have-nots. Vietnam's economic progress has led to high levels of per capita natural resource use and rising levels of greenhouse gases. There is desperate needs to create ecologically sustainable and socially equitable "green growth" cities in whole Vietnam. The GG-CDS encompasses these core elements of implementing green growth policy initiatives in city level, which, thereby, provides a new framework of green growth led city development strategy for the Vietnam which can be spreading out in other towns and cities in the country.

## END NOTES

1. This can be also connected with the development of related industries and jobs, which leads to cost-effectively dealing with increasing demand for industrial waste treatment in accordance with current industrial park development plans including the high-tech park and IT park.
2. During 8 - 12<sup>th</sup> April 2013 a survey has been conducted in collaboration with the Da Nang Institute of Socio-Economic Development, interviewing officials, practitioners and specialists in public departments/agencies, academia, and a private association.
3. Asian Cities and Climate Change Resilience Network (ACCCRN), "Da Nang City," [www.acccrn.org](http://www.acccrn.org) (retrieved on December 20, 2013).
4. The 2009 Vietnam Population and Housing Census: General Statistics Office of Vietnam, 2009
5. Department of International Cooperation and Science, Technology. "Solid Waste Management System in Da Nang City," Asia Pacific Workshop on Integrated Solid Waste Management, Osaka, Japan, April 19 - 20, 2012.
6. Burkhard von Rabenau, 2012, Da Nang Development Policy Discussion Paper.
7. S. Chandler, P. , Walter, G. "About the Recycling Industry for Urban Mining- from Product Responsibility as an Integral Raw Material Management in Munster Waste Management Days, eds. Gallenkemper, K. Gell Beck, S. Rotter, M. Kranert, M. Nelles, Münster 2011.
8. Copenhagen Clean Tech Cluster, "Waste Management: Making the Most out of Waste," <http://www.cphcleantech.com/media/2114608/affald.pdf> (retrieved on December 20, 2013).
9. Leachate is any liquid that in passing through matter, extracts solutes, suspended solids or any other component of the material through which it has passed.
10. On the other hand, waste has been growing rapidly in accordance with urban growth, leading to much higher demand for solid waste management. In this context, the city has to consider introducing the PAYT (pay-as-you-throw) system, e.g. the volume-based waste disposal scheme by utilizing economic incentives to encourage people to reduce their waste generation voluntarily.
11. Da Nang People's Committee, "Feasibility Study for Improvement of Public Transportation in Da Nang City 2008 - 2015," August 2009.
12. Waste has been growing rapidly in accordance with urban growth, leading to much higher demand for solid waste management. In this context, the city has to consider introducing a PAYT (pay-as-you-throw) system, e.g. a volume-based waste disposal scheme by utilizing economic incentives to encourage people to reduce their waste generation voluntarily.
13. Regarding EPR (Extended Producer Responsibility) to share or expand companies' responsibility for product treatment by including environmental costs of waste in the production process and design. It is necessary to make relevant regulations to encourage recycling in practice. Also, the unified indication system for classifying recyclable waste needs to be specifically established.
14. In addition, there has been little PR for observing regulations, making people and businesses still unaware of their responsibility to participate in waste management and environmental protection. It is necessary to overcome these limits through building up regulatory and institutional mechanisms as well as raising public awareness.
15. Asian Development Bank (ADB), Public-Private Partnership Handbook, September 2008.
16. The routes can be planned and coordinated to ensure greater connectivity to various places. Also, BRT should provide speedy and reliable services through exclusive bus lanes, thereby encouraging a modal shift from private vehicles. Attention should also be paid to feeder systems for BRT or Metro lines in the future, and efforts should be made to interlink informal transport operators (like motor taxi, which can reach outlying residences in informal development areas in urban peripheral) with the formal system. Fares should be set at rates that accommodate all members of society. Conversely, the price of using private vehicles should be higher than that of public transport.
17. Agricultural products and tourism in rural areas can be developed through a virtuous circle driven by the improved transport network. This means more consumers and tourists can easily access the local products and services, leading to revitalization of

rural economy with socio-economic connectivity between urban and rural areas.

18. The city government has encouraged using clean fuel for vehicles by providing subsidies to transport companies from the central government budget, aiming at standardizing bus and replacing existing taxis to use bio-gas. Also, the city has studied the use of diesel with EURO 4 standards in order to reduce emissions and imported new technologies to meet the required standards.
19. At the national level, policy makers should remove fuel subsidies and increase taxes on vehicle, thereby increasing overall cost of ownership. At the local level, policy makers should introduce demand-side management measures. Fiscal reform at the national level is not sufficient to manage the traffic volume in local circumstances. A portfolio of planning, regulatory and economic instruments is needed at the city level. The number of private vehicles can be directly controlled by restricting license plates. The use of motorized private vehicles including cars and motorbikes can be rationalized by road planning that restrict the accessibility of cars, letting users pay for using roads via congestion charges or restricting cars with license plates ending in specific numbers to enter the city center in rush hours. In addition, parking spaces in the city center can be limited through land use planning.
20. Report on Assessment of Da Nang Industrial Parks using Eco-Industrial Park Criteria, VPEG Project, 2013.
21. Ibid.
22. While DOT is the main department responsible for BRT, DOC recently updated the BRT in their Construction Master Plan after the approval of the People's Committee. Based on integrated land use and transport planning, the high development density along the public transportation routes should be ensured and measures should be applied to enhance the drainage system as well as to control flooding at certain points along the future BRT and Metro routes. Additionally, land use in other areas should be taken into consideration in deciding the rest of routes, in order to make the city more compact by avoiding uncontrolled urban sprawl.
23. COD is a measure of organic pollutants in surface water like rivers and lakes. COD is therefore a useful unit of measuring water quality. COD is expressed in millilitres per litre, indicating the amount of oxygen taken per litre of solution.
24. This makes it difficult to transfer to other types of power, especially electricity, so it is not so practical to apply to industrial and commercial use. Even though the city has been applying solar energy for water heating for both residential and industrial facilities, this is very limited due to high prices for generating power. Links with the national grid should be established through available regulations and appropriate pricing mechanisms for solar energy.
25. There is a lack of databases on renewable power potentiality and related information. This is the reason why it is difficult for investors and enterprisers to collect, analyze information, and evaluate feasibility of projects prior to deciding their investment. In line with this, there is limited information on renewable energy models for various types of manufactures and service industries. The cooperation between public management in central and regional/local level is not consistent and community awareness on renewable power is very limited. The policy mechanism to support investors is not strong yet due to shortages in equipment, technologies, operation and maintenance.
26. According to the State of Environment Report in 2011 of Da Nang City, out of 98 enterprises registering as hazardous waste generation sources, only 16 signed contracts for collection and treatment of hazardous waste, which is about 218.81 tonnes per year. Some examples can be pointed out as follows: Textile industry and leather industry in relation to dyeing and tanning products; Paper and pulp industry in relation to bleaching processes and related water emissions; Chemical and plastics industry, depending on the type of chemicals produced; and High-temperature processes such as in the cement and steel industry, where the formation of by-products or emissions of metals.
27. Some examples can be pointed out as follows: Textile industry and leather industry in relation to dyeing and tanning products; Paper and pulp industry in relation to bleaching processes and related water emissions; Chemical and plastics industry, depending on the type of chemicals produced; and High-temperature processes such as in the cement and steel industry, where the formation of by-products or emissions of metals. Decision No. 2765/2012/QĐ-UBND dated on 12<sup>th</sup> April 2012 is "Approving the planning of safe vegetable areas of Da Nang City, until 2015 and expanding research in 2020" with total planning areas expected to expand up to 338.31 ha in 2020.
28. IWRM has been defined by the Global Water Partnership (GWP) as "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the

- resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems”
29. Eco-system services can be defined as the multitude of resources and processes that are supplied by eco-systems.
  30. Case Study: New York City (<http://ice.ucdavis.edu/node/133>)
  31. TEEB Manual for Cities: Eco-system Services in Urban Management ([http://www.teebweb.org/wp-content/uploads/Study%20and%20Reports/Additional%20Reports/Manual%20for%20Cities/TEEB%20Manual%20for%20Cities\\_English.pdf](http://www.teebweb.org/wp-content/uploads/Study%20and%20Reports/Additional%20Reports/Manual%20for%20Cities/TEEB%20Manual%20for%20Cities_English.pdf))
  32. Additionally, programs on strengthening the use of environmentally products products, encouraging people to reduce their use of plastic bags, saving electric energy, and replacing bio-products to supply clean agricultural products for market have been implemented. Additionally, promoting crop structure shift at inefficient production area or land affected by dry weather and climate change resulted in higher efficiency, soil improvement and higher income for farmers. The city has also focused on investment, improvement, management of irrigation infrastructure (dykes, stonnee embankments, dams, and lake) towards climate change adaptation.
  33. LID is an approach to land development (or re-development) that works with nature to manage storm water as close to its source as possible.
  34. The program brings benefits in improving the knowledge of chemical use for crop protection and intensive farming technique in rice production. ICM (3 decreases & 3 increases: decrease breed, decrease fertilizer, decrease pesticides; increase productivity, increase quality, increase economic efficiency) training has reduced production costs, improved production efficiency, and protected the environment and human health. In addition, Da Nang has decided not to develop cattle breeding in the inner-city, only concentrating on clean and biological safe industrial-sized farms.
  35. Investment Promotion Center for Central Vietnam, <http://centralinvest.gov.vn/Content/statistics-34.aspx> (retrieved on December 5, 2013).
  36. Da Nang Today, “Tourism Sector sees Significant Achievements,” November 5, 2013.
  37. City Development Strategy (CDS) Consultation Report, “Data of Health Care and Medical Treatment 2012” (June 2012).
  38. Ibid.
  39. Ibid.
  40. Ibid.
  41. Da Nang City Government, <http://www.danang.gov.vn>. (retrieved on December 20, 2013).
  42. In particular, Da Nang is focusing on implementing the new rural program, criteria of which are related to many sectors such as rural infrastructure systems, health, education, and culture (i.e. DARD making overall plan under the guiding framework of MARD and the People’s Committee of the City are coordinating with the DPI, DoF, DoST, the People’s Committee of districts). The construction department is responsible for planning the concentrated production areas coordinating with the relevant local governments. So far, the plan of specialized vegetable production areas to 2015 and orientation to 2020 have been completed. With water supply for industrial development and household activities, Department of Agriculture and Rural Development (DARD) and DAWACO have to coordinate to make sure adequate quantity of water supply mitigating impacts from climate changes as well as to monitor water coverage to support socio-economic development. The city government has deeply concerned agricultural and rural development of Hoa Vang District through program of new rural development (No. 18-CT/TU). Relevant agencies of the city have had close coordination and strong support for the district in conducting agricultural programs, especially through training agricultural production technology. Regarding specific agricultural development programs, the district has been actively cooperating with relevant departments of the city to propose policy for agricultural development (i.e. project of Truong Dinh shrimp breeding, Hoa Phuoc orchids planting, Bau Tram aquaculture, and “poor garden reform”).
  43. More practically, low impact development (LID) may be one method to deal with flooding and drainage in the future. Like IWRM, LID looks at local eco-systems and takes the entire system into account. For example, LID strategies utilize tools like additional green space to increase pervious surfaces to absorb storm water and harvest rainwater from rooftops during the wet season. This offsets costs and often saves local utilities money over the long-term by taking pressure off of the storm water and drainage systems. Current requirements do not specify how developers must invest in drainage systems, but

guidelines and incentives should be developed to promote LID strategies. The feasibility of a payment for eco-system services (PES) approach should be explored, to better adapt to climate change, and provide an alternative solution to deal with storm water. This may complement current strategies for urban green space development and simultaneously improve drainage in Da Nang. In addition, a PES scheme may provide incentives for upstream habitat rehabilitation, which will decrease downstream runoff and flooding, thus removing additional pressures on the drainage system.

44. City Development Strategy (CDS) Consultation Report, "Data of Health Care and Medical Treatment 2012" (June 2012).
45. Vietnam Ministry of Labour, Invalids, and Social Affairs, <http://english.molisa.gov.vn/>
46. A one stop shop is a business or office where multiple services are offered; i.e. customers can get all they need in just "one stop."
47. LCA is a technique to assess environmental impacts associated with all the stages of a product's life from-cradle-to-grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling)
48. PAYT is to charge household collection fees, either per unit or per weight, based on the waste collected (e.g. people purchase certain official plastic bags for unrecyclable waste, which contributes to separation at source and material recovery from recycling, and reduction of transportation costs for collection and disposal)
49. EPR is to share or extend the responsibility for the treatment of used products to producers (companies) to internalize the ecological costs of waste into design and production.
50. US Environmental Protection Agency (EPA), "Environmental Quality, Economic Development, and Social Equity" in the Guide to Sustainable Transportation Performance Measures, 2011.
51. Transportation Research Board Sustainable Transportation Indicators Subcommittee, 2008.
52. 1) Quasi-Public Management System: the city government to manage and supervise private bus companies as well as bus routes and service quality; Provide public subsidies to the companies, commensurate with the performance evaluation in order to expand routes and increase service quality of public transport; 2) Bus Management System (BMS): The BRT control center to support automatic information management based on application of ITS (Intellectual Transport System); 3) Flat Fare System with a basic rate applied within a certain distance (e.g. 10km) and then imposed additional charge on extra distances, i.e. distance-based fare, to help people move with small fare and improve both accessibility and mobility.
53. Ali Hasanbeigi, Lynn Price, Industrial Energy Audit Guidebook: Guidelines for Conducting an Energy Audit in Industrial Facilities, 2010.
54. Define audit criteria and scope Select audit team - Make an audit plan and a checklist - Conduct the initial walk through visit - Collect energy bills and available data/information - Preliminary analysis.
55. Ernest Lowe, Eco Industrial Handbook, The Asian Development Bank, 2001.



## GGGI

*Global Green Growth Institute*

**Address:** 19F Jeongdong Bldg, 21-15 Jeongdong-gil  
Jung-gu Seoul 100-784 Republic of Korea

**Tel:** +82-2-2096-9991

**Fax:** +82-2-2096-9990

## UN-HABITAT

*United Nations Human Settlements Programme*

UN-Habitat Vietnam Office

**Address:** Room 203, A2 Building, Van Phuc  
Diplomatic Compound 298 Kim Ma, Ba Dinh, Hanoi

**Tel:** +84-4-3823-7232 **Fax:** +84-4-3823-7227

