

Low Carbon Model Town Samui Island, Thailand

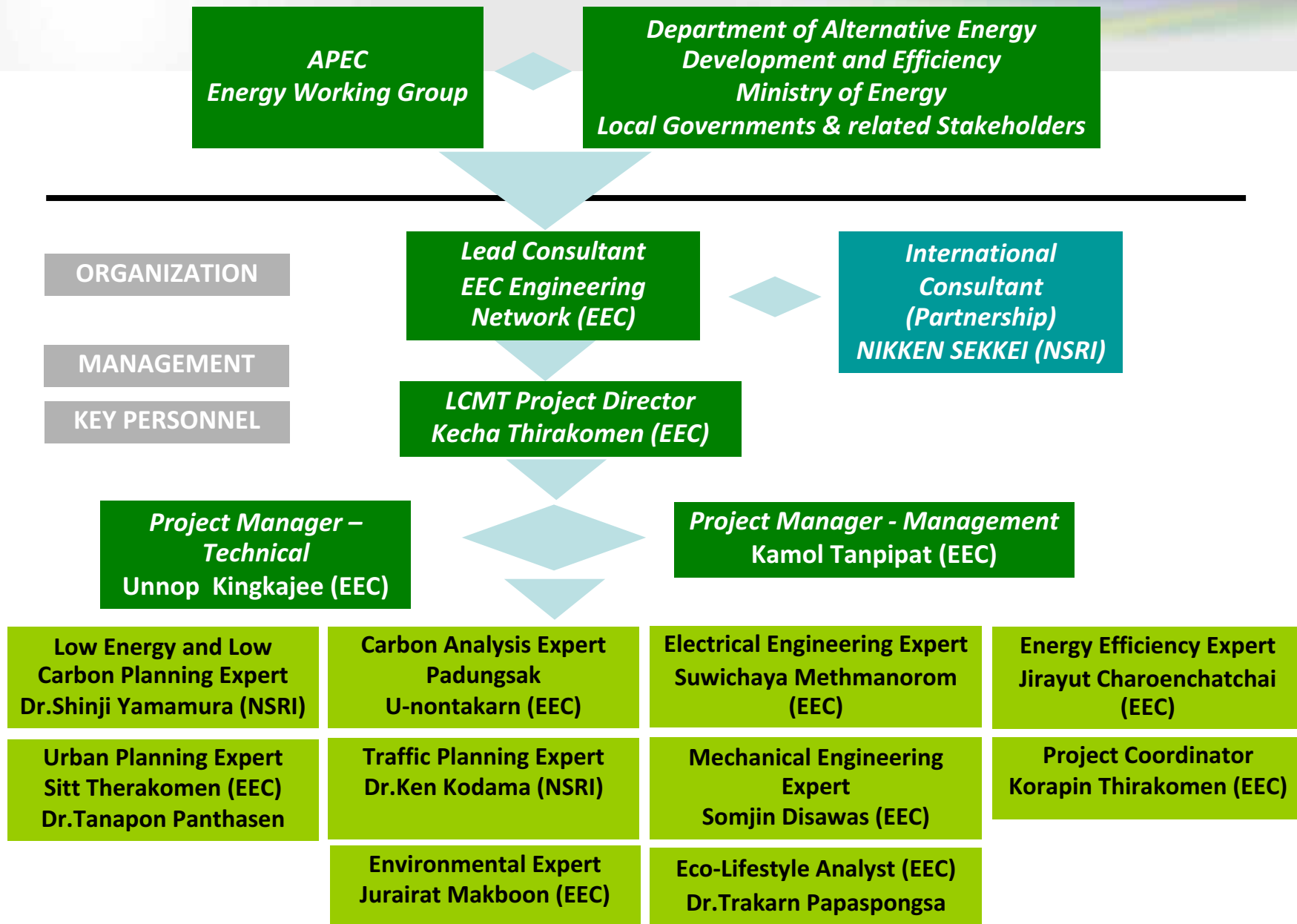


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LCMT Project Structure



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Feasibility Study of Low Carbon Development
For Samui Island, Thailand.

SAMUI - Projection



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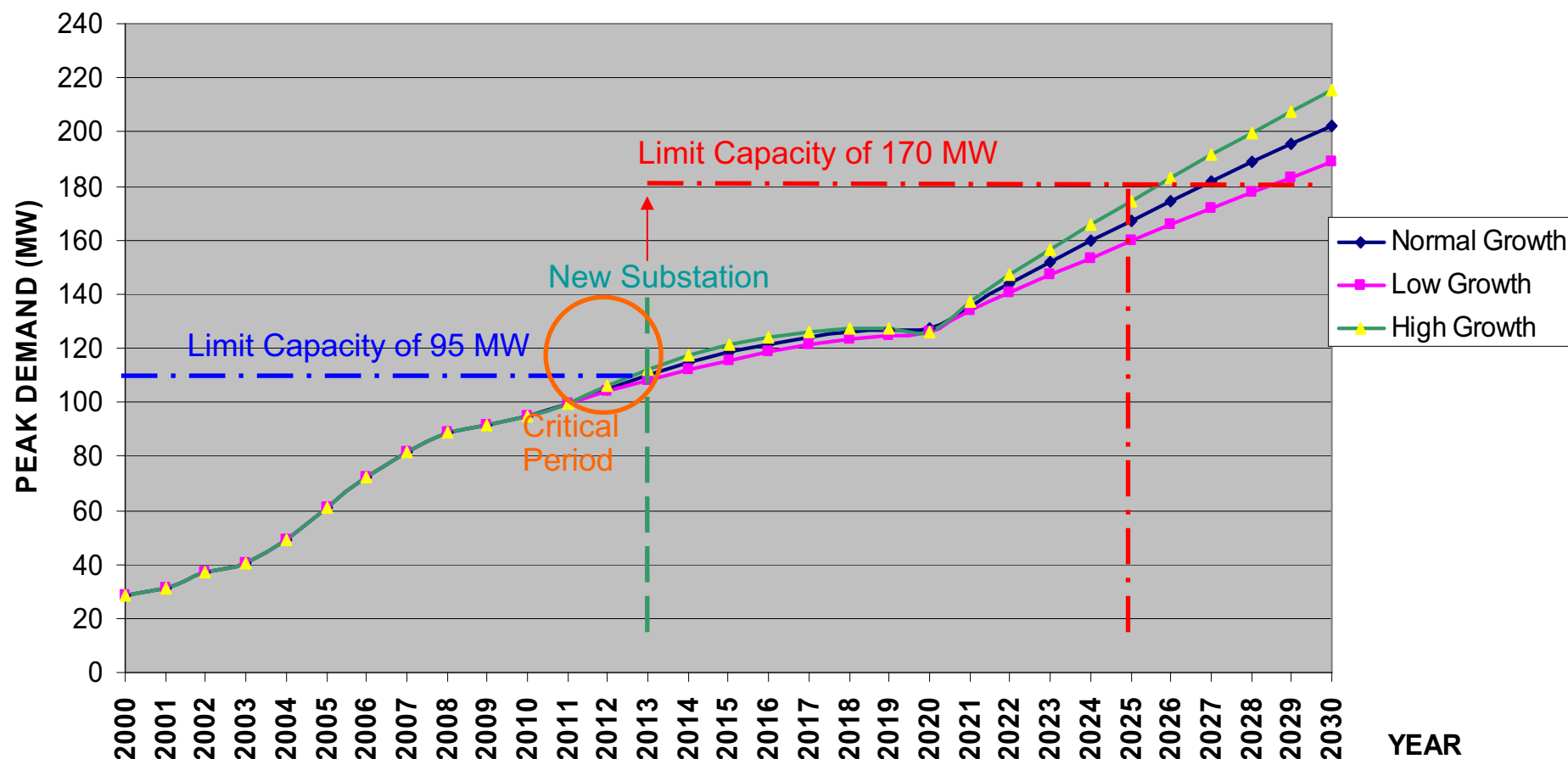


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Feasibility Study of Low Carbon Development
For Samui Island, Thailand.

Electricity Demand Projection

PEAK DEMAND FORCAST FOR SAMUI ISLAND (2000-2030)



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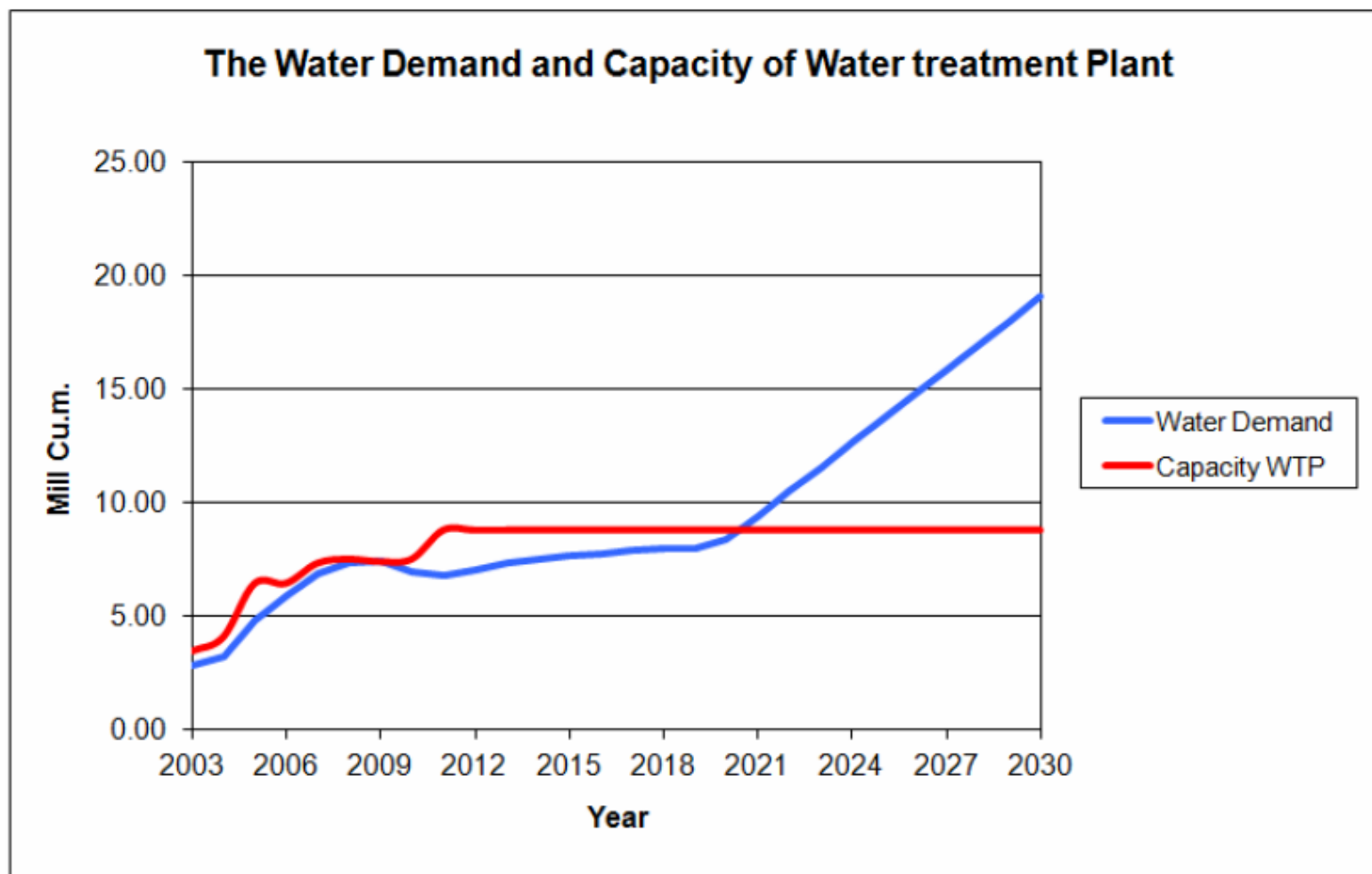
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New 115/33 kV
Substaion

Existing 115/33 kV
Substaion



Water Supply System



810,000 m³/month



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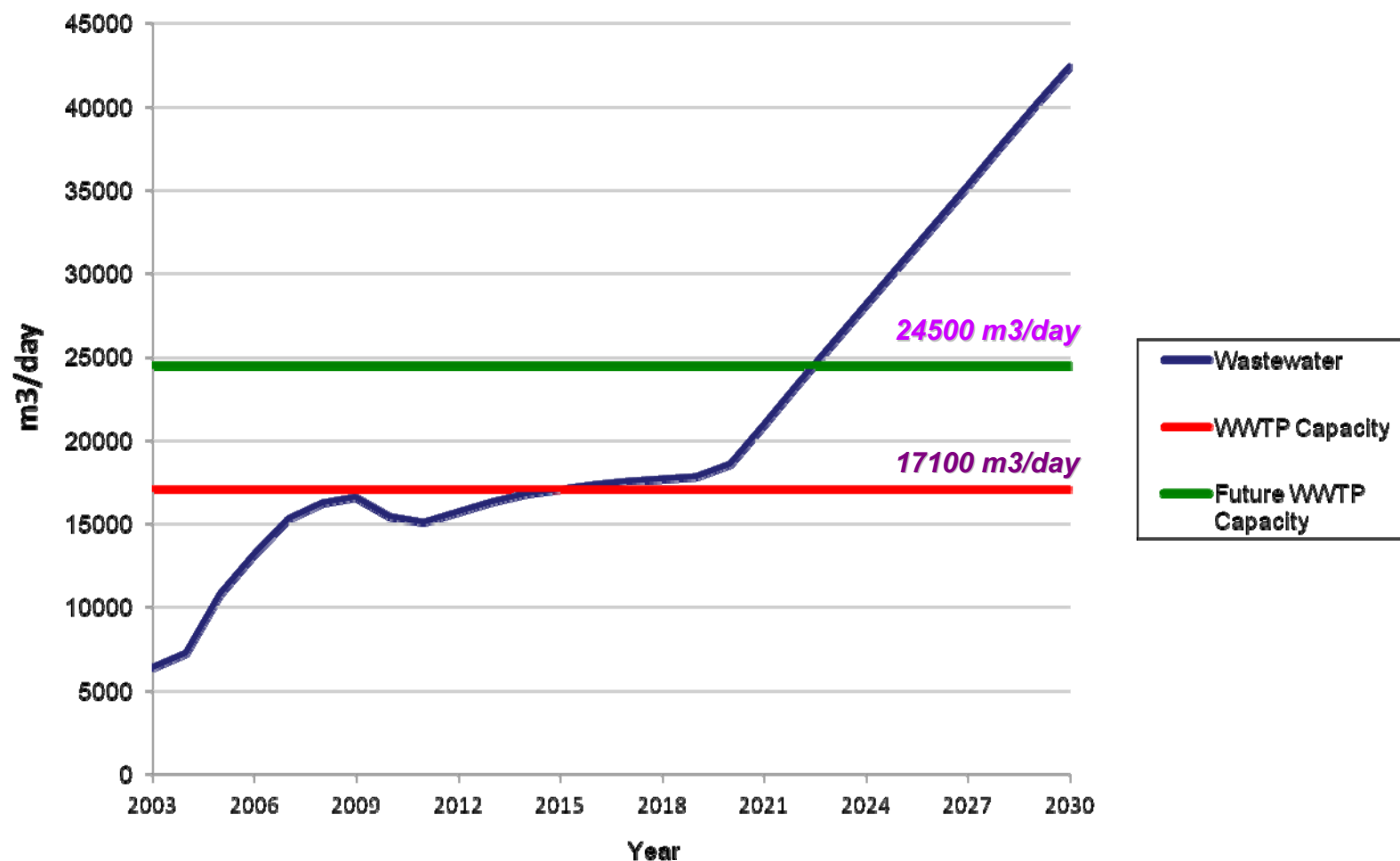


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Waste Water Treatment System

WWTP



510,000 m³/month



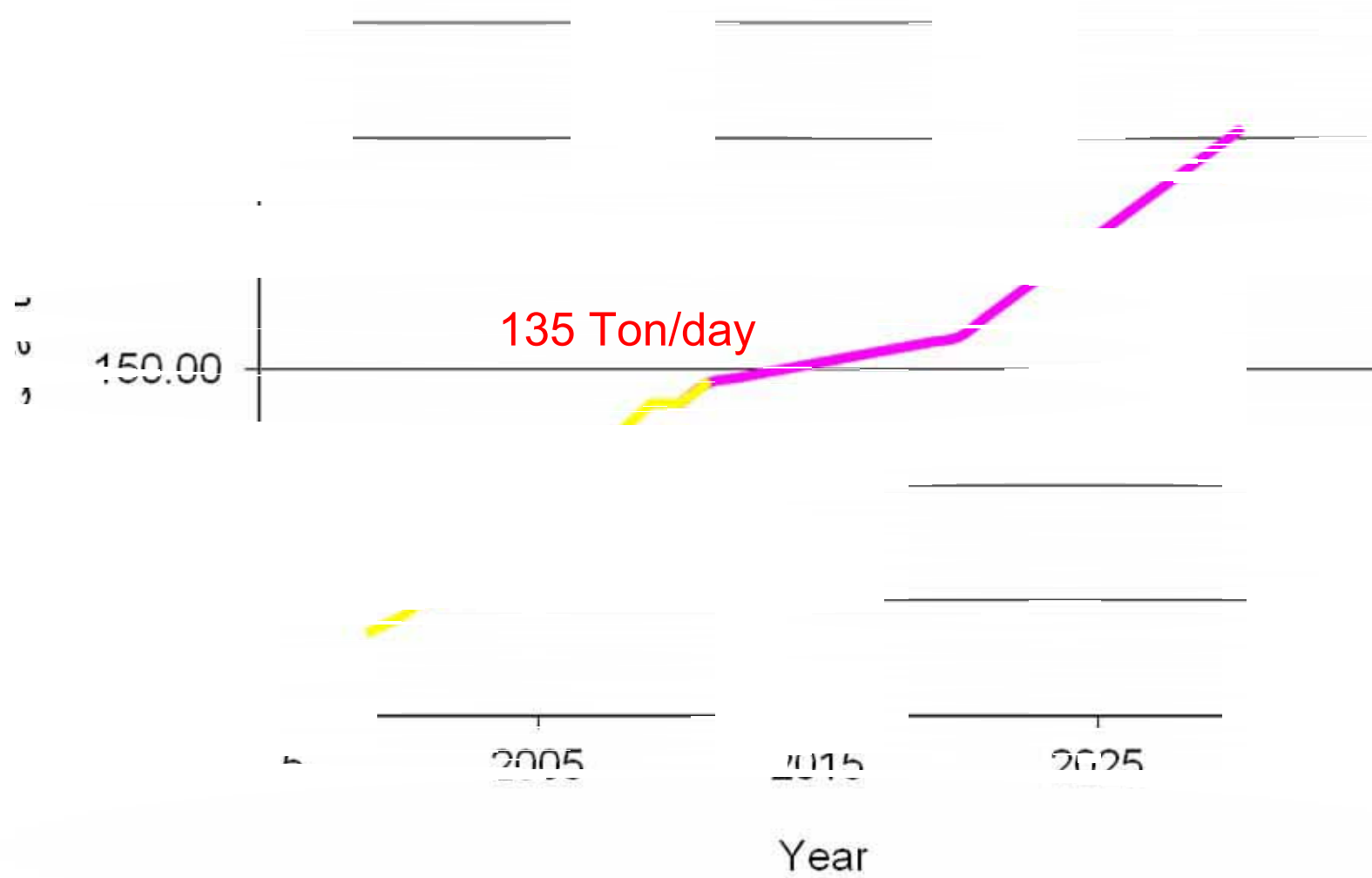
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Forecast For Samui Island (1988-2030)



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Low Carbon Strategy for SAMUI Island

High level vision

Carbon emission reduction target

Low Carbon measures



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LCMT Project Development Steps

1. Data Collection and information update
2. Prepare a Low-Carbon Strategy for *SAMUI* Island low carbon town development project
 - 2.1) Develop a **high-level vision**
 - 2.2) Define the CO₂ reduction and environmental **targets** of the low-carbon town
 - 2.3) Prepare a Low-Carbon **Guideline** for categories of low carbon town design challenges
 - 2.4) Select **CO₂ reduction measures** in each design category
3. Analyze CO₂ reductions and costs for the selected design measures
4. Prepare a report



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Low Carbon Methodology

High Level Vision – “People Oriented”

Social & Human Value



- Local culture and life-style well mixed with modern life-style
- Improve quality of life with eco-lifestyle
- Tourists satisfaction with low carbon lifestyle

- Natural resources well preserved and undamaged
- Green environment enhancement (green products)
- Low carbon emission for;
 - ☐ Hotels, resorts, schools, houses etc.
 - ☐ Transports etc.

Economic Value

- High value of land and economy
- Investment attraction

The First Low Carbon Island in Asia-Pacific

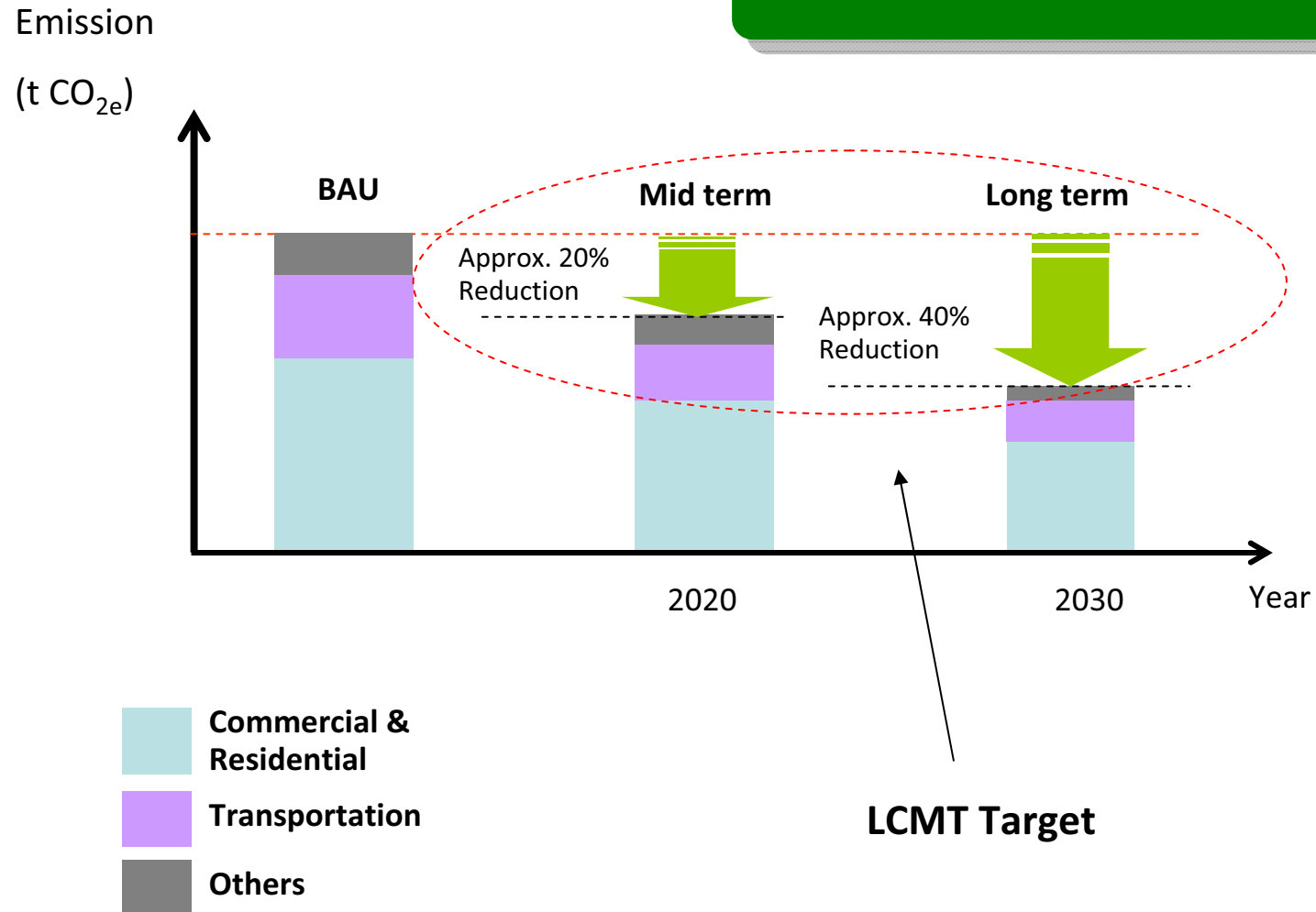
Environment and Resources Value



Low Carbon Methodology

Target Setting

SAMUI carbon Index



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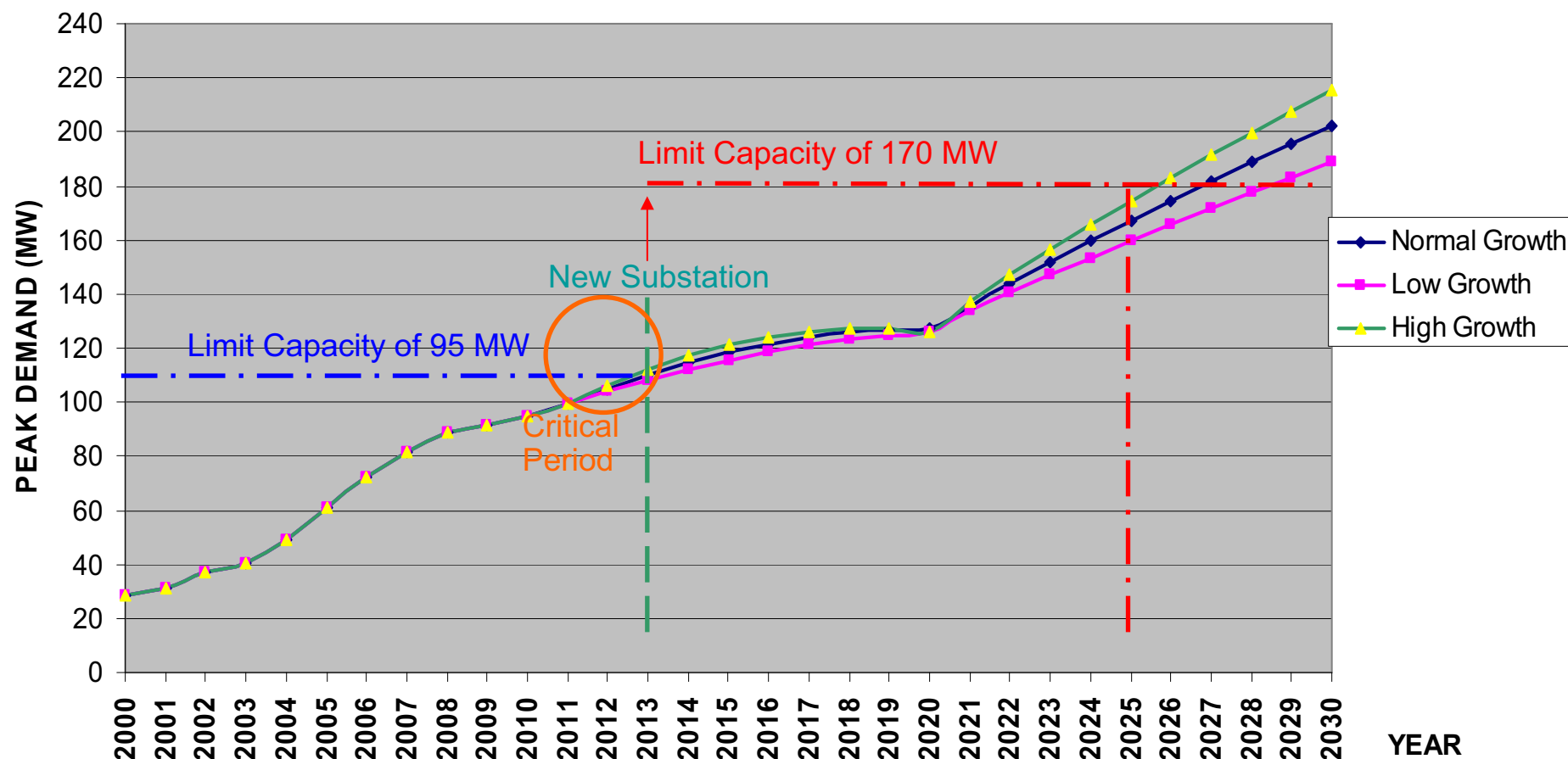


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Electricity Demand Projection

PEAK DEMAND FORCAST FOR SAMUI ISLAND (2000-2030)



Electrical Energy Consumption : SAMUI Island

BAU - Forecast : 2010 - 2030

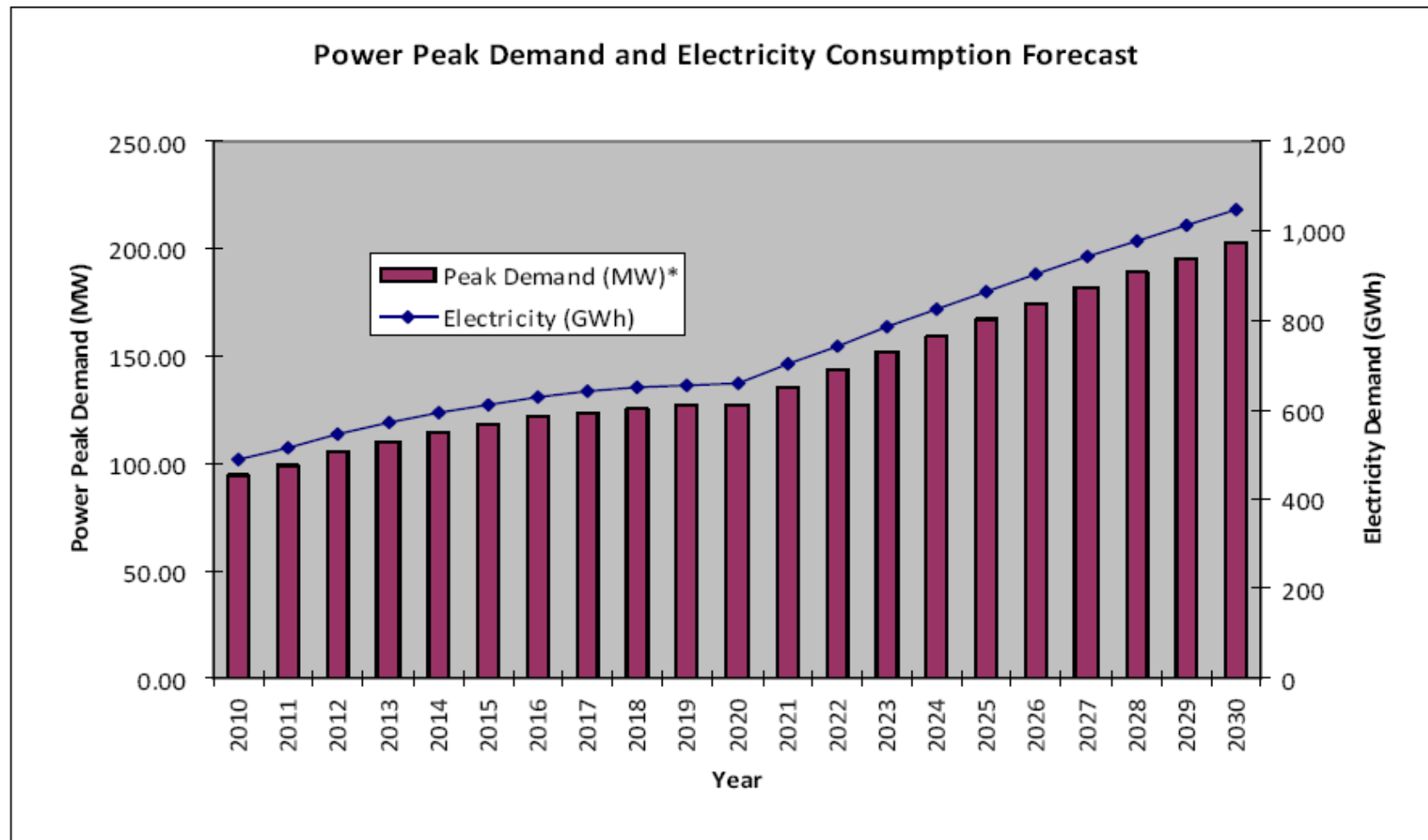


Figure 8 : Power Peak Demand and Electricity Consumption Forecast on Samui Island



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Fuel Consumption : SAMUI Island

BAU - Forecast : 2010 - 2030

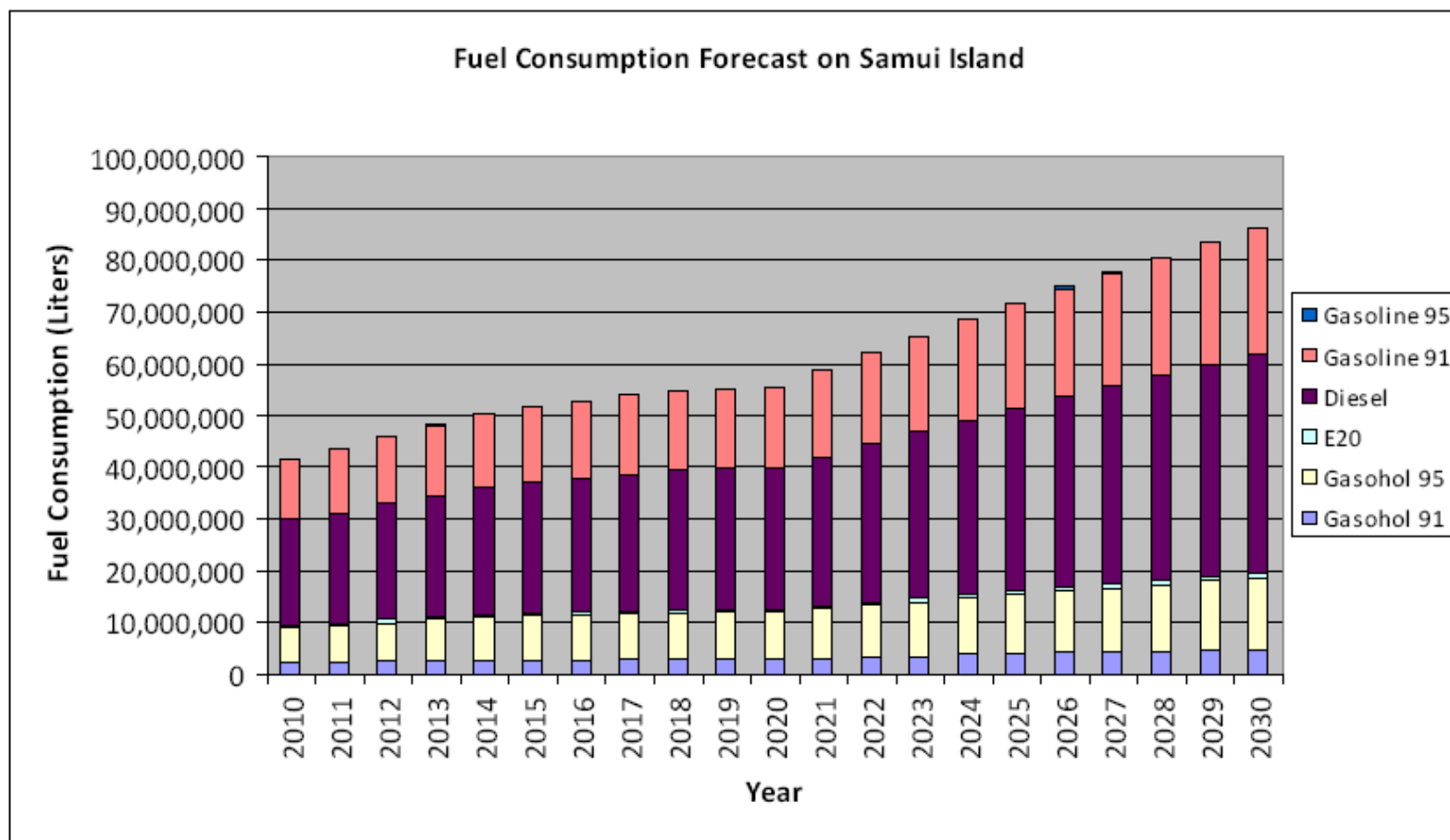


Figure 10 : Fuel Consumption Forecast on Samui Island

Carbon Emission : SAMUI Island

BAU - Forecast : 2010 - 2030

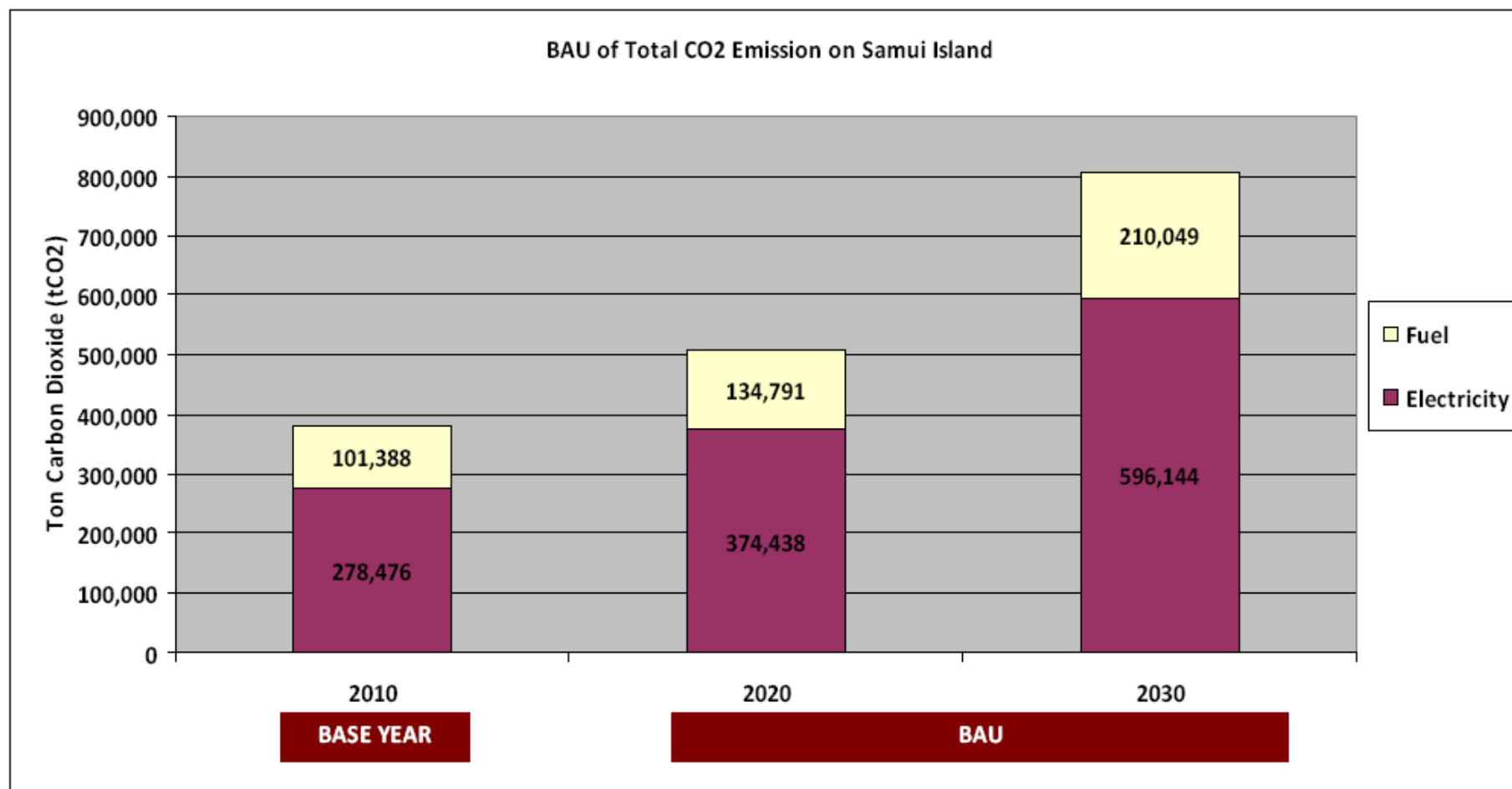


Figure 12 : Total Carbon Emission



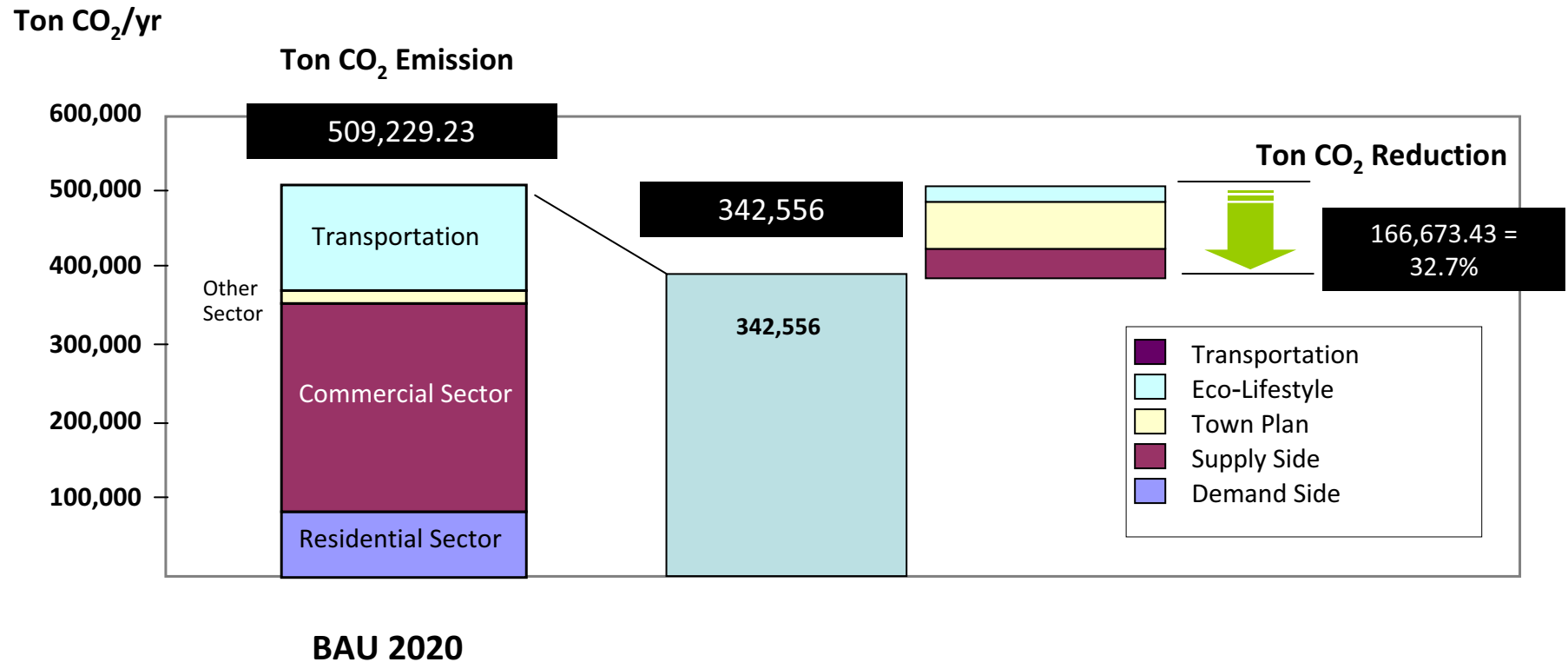
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Carbon Emission Reduction on Samui Island (Y2020)



As of Progress Report No.2 – September 2012, under discussion with DEDE



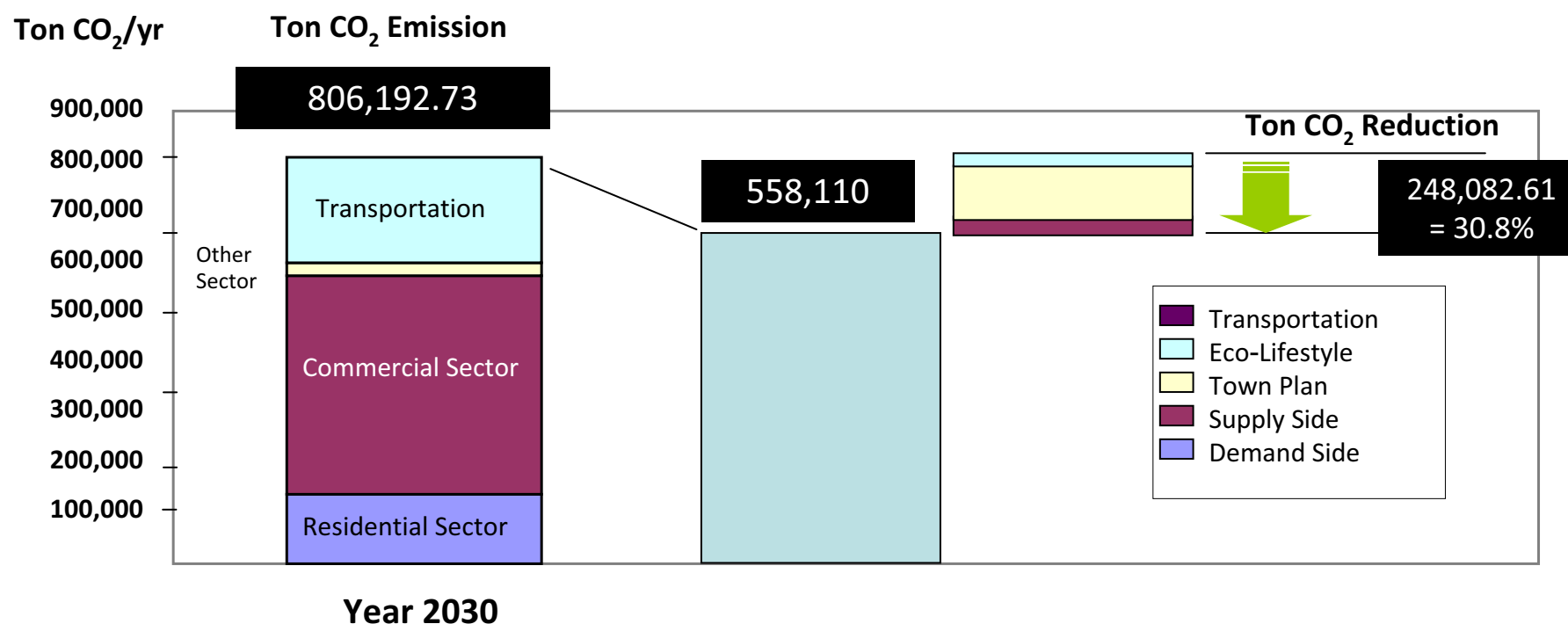
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Carbon Emission Reduction on Samui Island (Y2030)



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LCMT Measures for SAMUI Island

Categories	CO ₂ reduction (ton/y)	Investment (USD)	Remark
1. Town Planning	153,309	11,868,038	~ 356 MB
2. Transportation	On process	34,000,000	~ 1,020 MB
3. Area Energy Planning	28,390.82	57,000,000	~ 1,710 MB
4. Area Energy Management	On process	On process	
5. Renewable Energy	8,684.36	37,000,000	~ 1,110 MB
6. Untapped Energy Planning	17,389.06	33,380,000	~ 1,000 MB
7. Low Carbon Building	On process	On process	
8. Eco-life style	40,309.64	On process	
9. Environmental Planning	n.a	21,000,000	~ 630 MB
Total	248,082.61	193,708,038	~ 5,800 MB



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Feasibility Study of Low Carbon Development
For Samui Island, Thailand.

1. Town Structure Planning

- **Green Areas** : Forest, Orchards, Urban Plantation
- **Non-Green Areas**
 - : Sustainable Town
 - : Non-automobile Oriented Community

Initial analysis results

Amount of CO₂ Reduction = 153,309 tCO₂/y

Estimated Investment budget = 11,868,038 USD (356 M.Baht)



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1. Visualization and Adaptation of Green Areas

1.1 Forest

1.1.1 Protection of the existing Trees

Establishment of community forest conservation Network (Preserve 7 sq.km of forest)



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1. Visualization and Adaptation of Green Areas

Renovation of Kanchanapisek Conference Hall



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1. Visualization and Adaptation of Green Areas

1.1.2 Reforestation Programme (4 sq.km)



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1. Visualization and Adaptation of Green Areas

1.2 Orchards

1.2.1 Multistory Tree Garden (add 30,000 rai of medium height,
6,800 rai of low height)



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1. Visualization and Adaptation of Green Areas

1.2.2 Planting of economic and higher CO₂ absorption rate trees
(30,000 rai of Palm oil and pine tree : 8,000 rai of low height and 5,500 rai of Para rubber trees)



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1. Visualization and Adaptation of Green Areas

1.3 Urban Plantation

1.3.1 Development of Comfortable and Greenery Walk Pass and Street



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1. Visualization and Adaptation of Green Areas

1.3.1.1 Tree and Footpath



1.3.1.2 Plant on Steel Structure



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1. Visualization and Adaptation of Green Areas

1.3.1.3 Ficus Pulima wall



1. Visualization and Adaptation of Green Areas

1.3.1.4 Highway Trees (Route 4,169 – 8,333 trees)



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1. Visualization and Adaptation of Green Areas

1.3.2 Improvement of building envelope by using Bio-Facade



1. Visualization and Adaptation of Green Areas

1.3.3 Trees in Public Space and Airport



Public Space



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1. Visualization and Adaptation of Green Areas

1.3.4 Adding Trees in Resort Area



1. Visualization and Adaptation of Green Areas

1.3.5 Comfortable and Greenery Beaches



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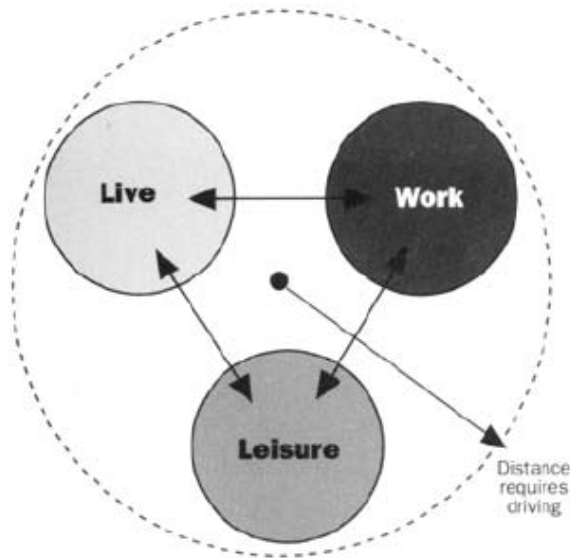


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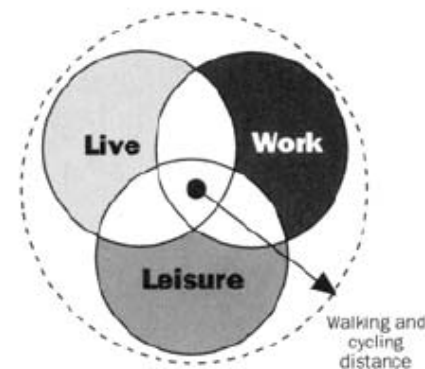
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2. Visualization and Adaptation of Non Green Areas (Sustainable Town)

Compact mixed-use nodes reduce journey requirements and create lively sustainable neighbourhoods



Zoning of activities leads to reliance on the private car.



Compact nodes reduce travel and allow walking and cycling.



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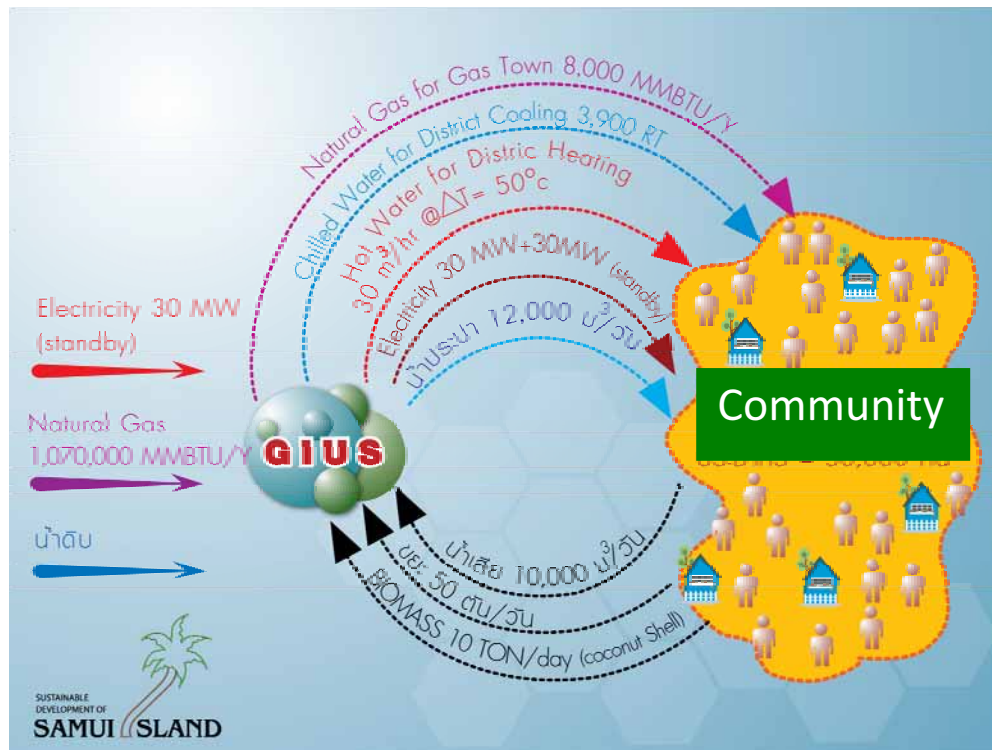
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GIUS Concept Design

Green Integrating Utility System (GIUS)

- Green Integrating Utility System (GIUS) is a concept that integrates all utility services, which needed for a community within one location
- GIUS should be placed near the community
- GIUS include electricity generation, city water production, waste water treatment and solid waste disposal
- District cooling generation system could also be integrated within the GIUS



Conceptual Design of Green Integrating Utility System (GIUS)
Mapping Energy Production and Consumption
Water and Waste Management

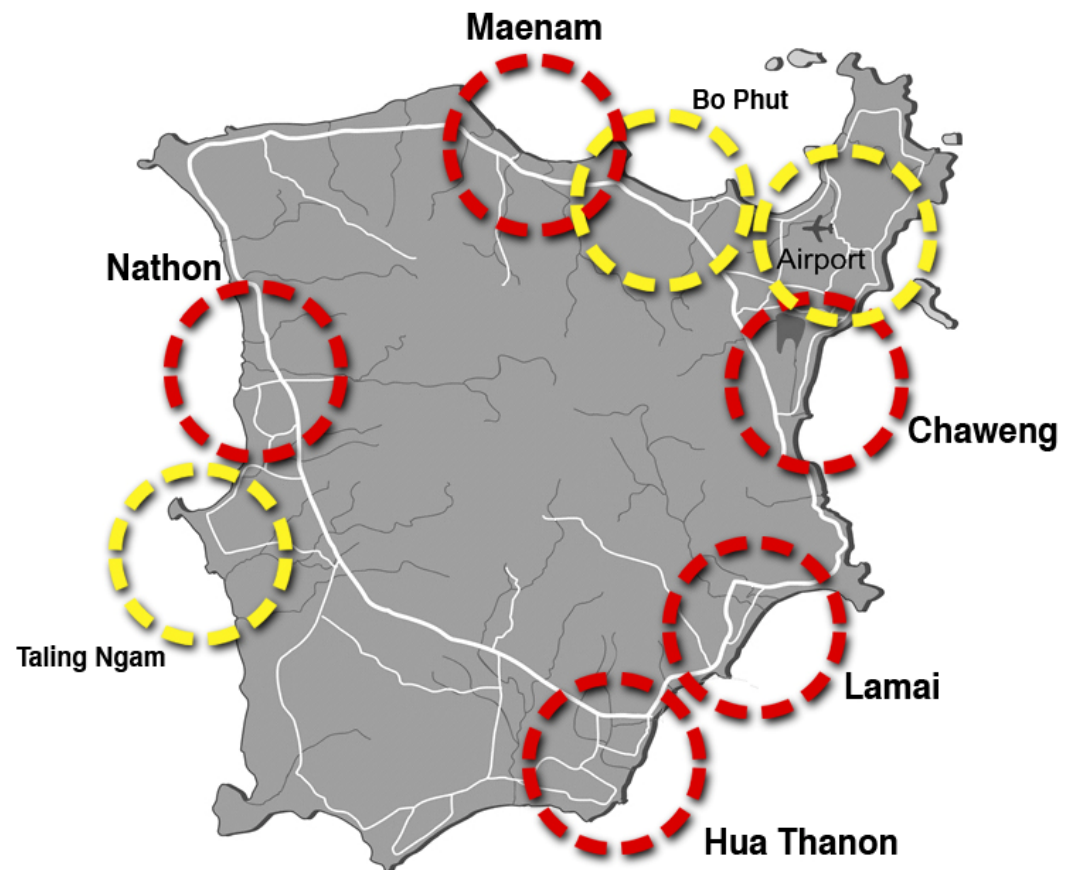
2. Visualization and Adaptation of Non Green Areas (Sustainable Town)

Communities in SAMUI Island

Existing Communities

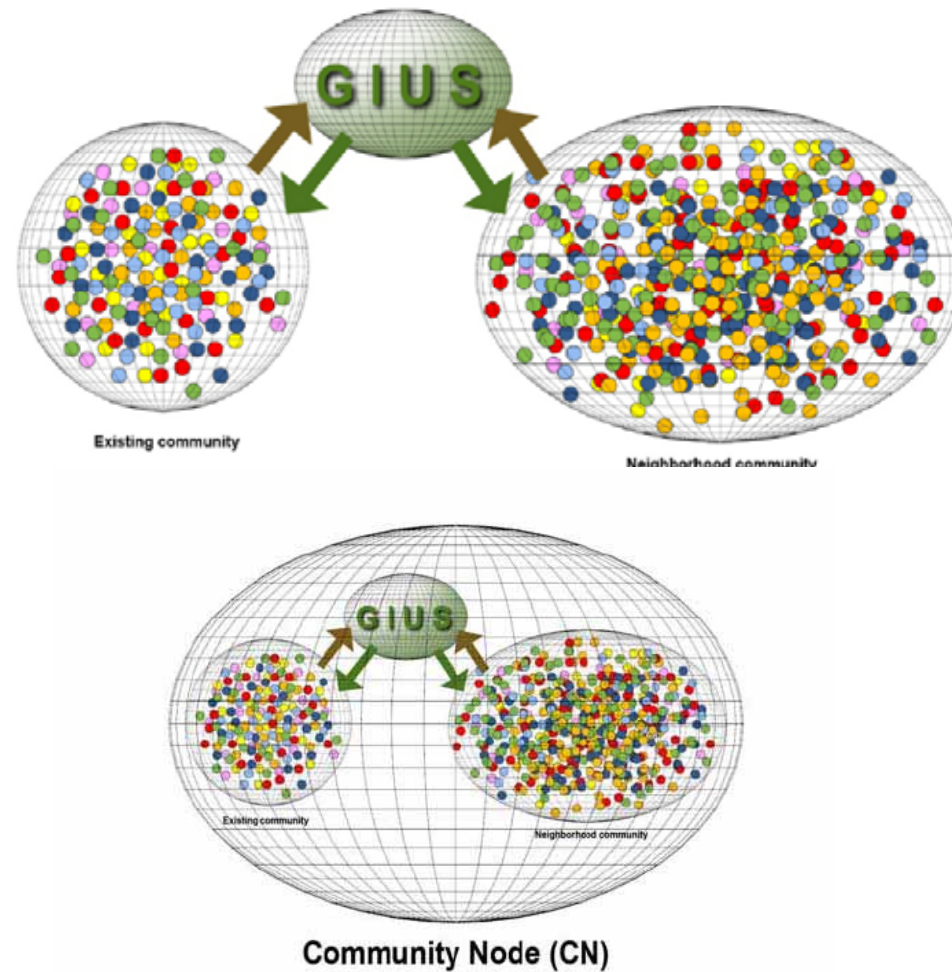
5 major communities

3 potential towns



2. Visualization and Adaptation of Non Green Areas (Sustainable Town)

Paring with G I U S



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2. Visualization and Adaptation of Non Green Areas (Sustainable Town)



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3. Visualization and Adaptation of Non Green Areas (Walkable Areas)



Before



After

Figure 1.2.2: Curb extension at electric poles provides more space for pedestrians and wheelchairs



3. Visualization and Adaptation of Non Green Areas (Walkable Areas)



Before



After

Figure 1.2.3: Improvement of Street Gutter on Chaweng 1 Road



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3. Visualization and Adaptation of Non Green Areas (Walkable Areas)



Before



After

Figure 1.2.4: Improving walking environments by providing a pocket park and shading



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3. Visualization and Adaptation of Non Green Areas (Walkable Areas)



Figure 1.2.5: Concept of Chaweng Beach Walking Street

3. Visualization and Adaptation of Non Green Areas (Walkable Areas)



An example of an electronic shuttle bus.



Bio-diesel shuttle bus services in KU displays an advertisement of its sponsor on the bus.

Figure 1.2.7: Examples of shuttle bus services



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3. Visualization and Adaptation of Non Green Areas (Walkable Areas)



Before



After



Before



After

Figure 1.2.8: Chaweng Beach Walking Street

3. Visualization and Adaptation of Non Green Areas (Walkable Areas)

Table 1.2.1: Schedule for Chaweng Beach Walking Street

Duration	Operation	Closing time (days)
16 July – 31 Aug.: High season	Closing everyday from 5pm to 3am.	22
1 Sep. – 20 Dec.: Low season	Closing on Fri. and Sat. from 5pm to 3am.	14
21 Dec. – 10 Jan.: Peak season	Closing everyday from 11am to 3am.	14
11 Jan. – 30 April: High season	Closing everyday from 5pm to 3am.	50
1 May – 15 July: Low season	Closing on Fri. and Sat. from 5pm to 3am.	10

Total closing days = 110 days per year



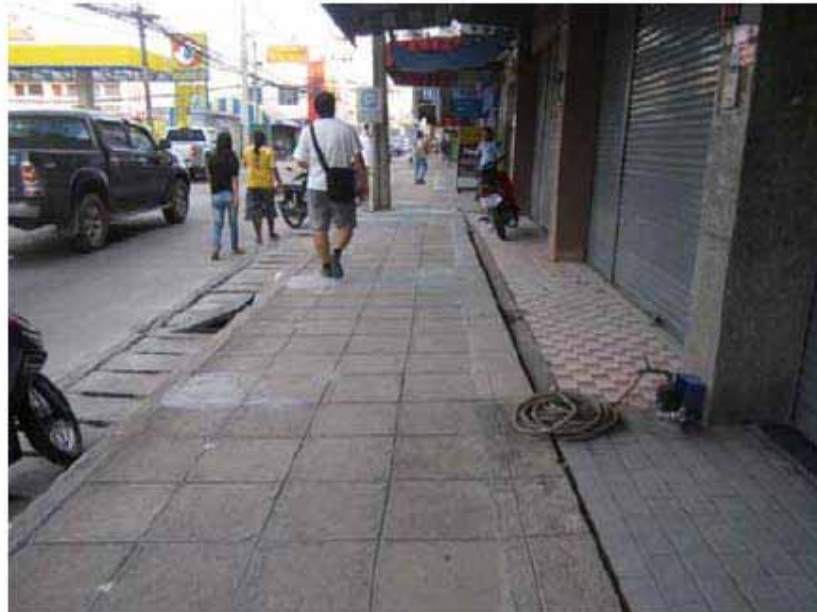
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3. Visualization and Adaptation of Non Green Areas (Walkable Areas)



Before



After

Figure 1.2.10: Physical Improvements on Walkway in Nathon Commercial area



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2. Transportation Planning

- **Public transportation promotion**
: 5 EVs, road improvement, bus stop
- **Preparation of infrastructure for EVs**
: Charging station
- **Introduction of EVs**

Initial analysis results

Amount of CO₂ Reduction = on process tCO₂/y

Estimated Investment budget = 34,000,000 USD (1,020 M.Baht)



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2. Transportation Planning

Basic policy for Reducing CO2 Emission in Transportation

1) Modal shift to public transportation

2) Shortening of travel distance

3) Use of fuel efficient vehicles

【Current】



Car

【Future】



Public Transportation



Petrol



EV / FCV



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1 – 1. Measures for Reducing CO2 Emission in Transportation

■ Measures toward low carbon island

- The measures against the problem about transportation planning has many overlap with the measure of low carbonation.
- Solving the problem about low carbon with the transportation planning problem is very important for the increasing value of Samui island.

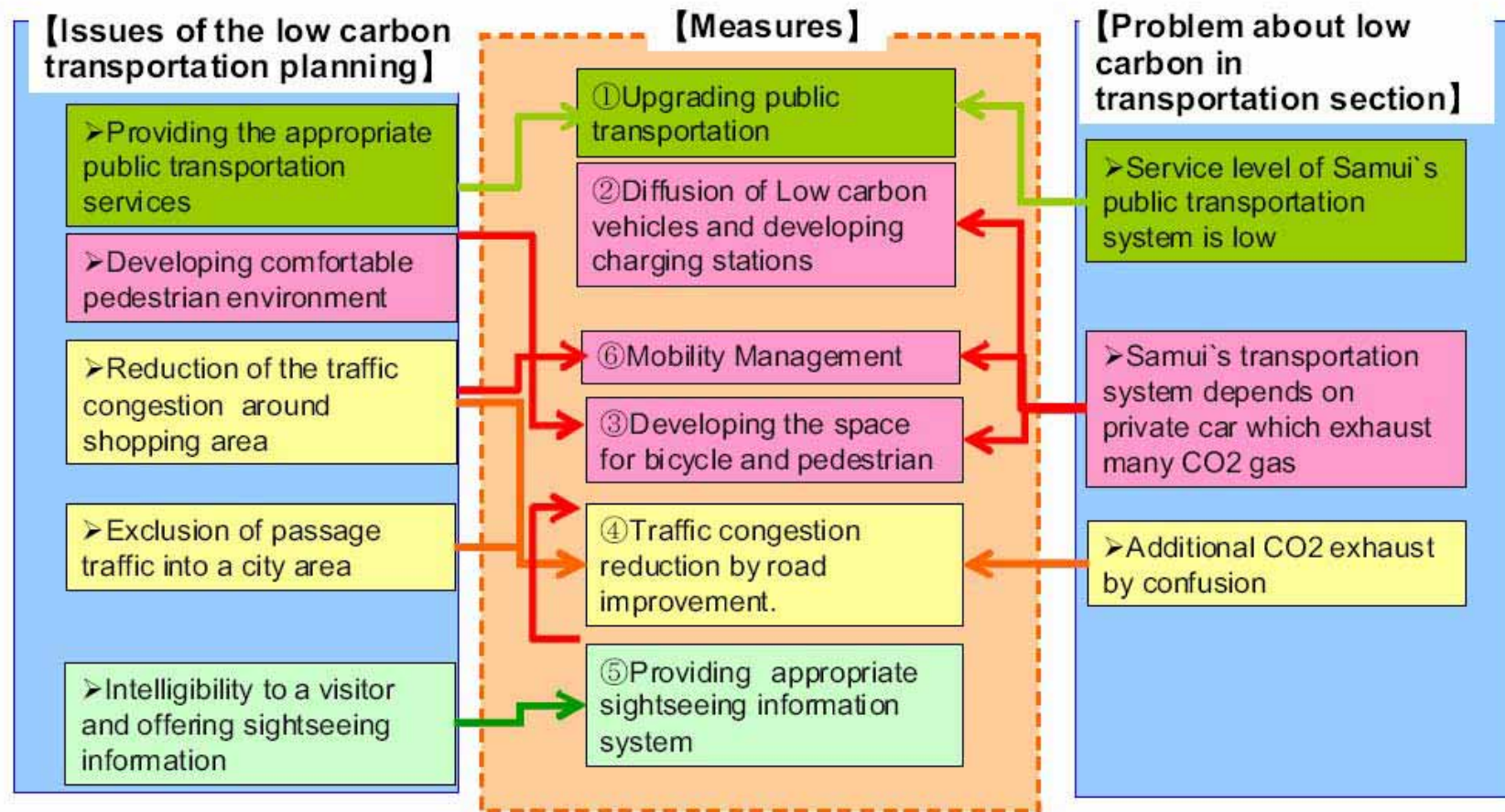
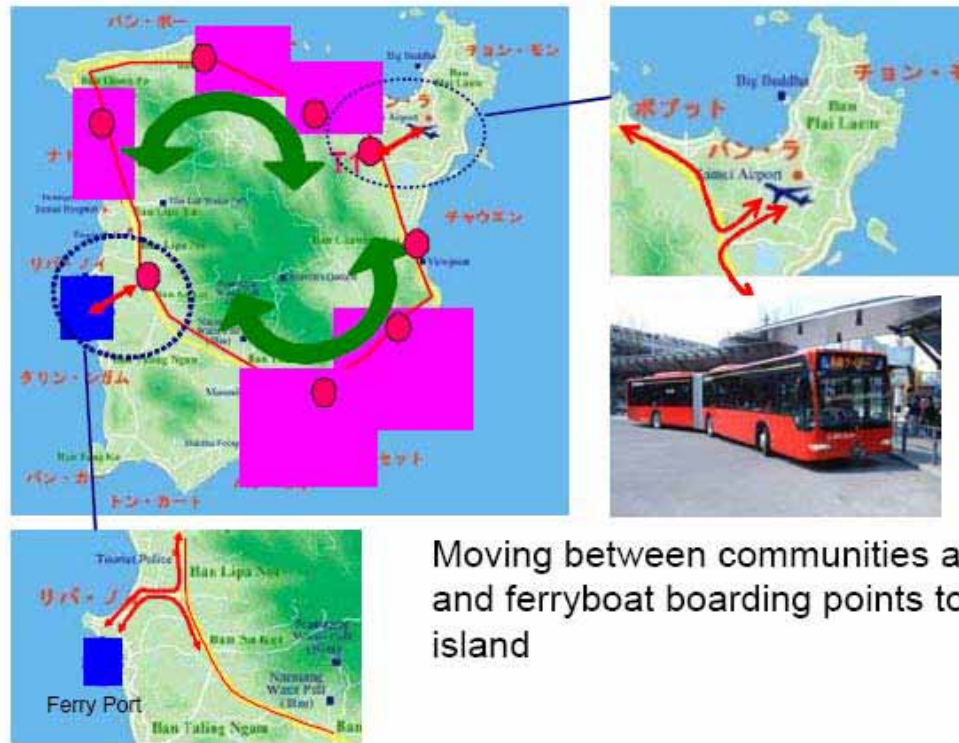


FIGURE 6-4 Basic policy for low-carbon transportation plan

2. Transportation Planning

■ Upgrading public transportation

- Truck bus roads using ring roads shall be developed
- The transportation system shall use large buses and coupled buses which can carry many passengers.



2. Transportation Planning

EVs bus, Trunk road improvement, Bus stop

Table Cost estimation of constructing the infrastructures for trunk bus route

Infrastructure	Amount	Cost of unit	Cost(million Bth)
Improvement of trunk road	50km	3,500Bth/m	175
Constructing bus stops	30bus stops	300,000Bth/unit	9
Introducing new bus*1)	5 units	25 million Bth/unit	75
Total			259

*1) Bus type: Hybrid coupled bus



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2. Transportation Planning

Charging Station

Table Cost estimation of constructing the infrastructures for trunk bus route

Infrastructure	Amount	Cost of unit	Cost(million Bth)
Quick charging station	10units	300,000Bth/unit	3



2. Transportation Planning

Introducing of EVs

Table Future number of low-carbon vehicle forecast (in 2030)

Unit: Vehicle unit

	Personal Vehicle		Public transportation Vehicle			
	Car	Bike	Taxi	Big Bus	Van	Mini Bus
Total	15,400	29,400	400	50	120	170
Coverage	5%	10%	5%	0%	5%	5%
No. of EV	800	2,900	20	0	6	10



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2. Transportation Planning

Introducing of EVs

Table Cost estimation of introducing EV

<Scenario 1>

EV	Amount	Price of unit	Cost per unit	Cost (million Bht)
Personal car	800	1.0million Bht/unit	0.5 milion Bht/unit	400
Bike	2,900	0.2 milion Bht/unit	0.1 milion Bht/unit	290
Taxi	20	1.0million Bht/unit	1.0 milion Bht/unit	20
Van	6	1.5 million Bht	1.5 milion Bht/unit	9
Mini bus*1)	8		1.5 milion Bht/unit	12
Total				731

*1) It is assumed that mini buses are replaced by vans when this estimation is updated.



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2. Transportation Planning

Introducing of EVs

Table Cost estimation of introducing EV

<Scenario 2>

EV	Amount	Price of unit	Cost per unit	Cost (million Bht)
Personal car	800	1.0million Bht/unit	0.3 milion Bht/unit	240
Bike	2,900	0.2 milion Bht/unit	0.03 milion Bht/unit	87
Taxi	20	1.0million Bht/unit	0.5 milion Bht/unit	10
Van	6	1.5 million Bht	0.75milion Bht/unit	4.5
Mini bus*1)	8		0.75 milion Bht/unit	6
Total				347.5

*1) It is assumed that mini buses are replaced by vans when this estimation is updated.



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3.Area Energy Planning

Initial analysis results

Amount of CO₂ Reduction = 28,390.82 tCO₂/y

Estimated Investment budget = 57,000,000 USD (1,710 Baht)



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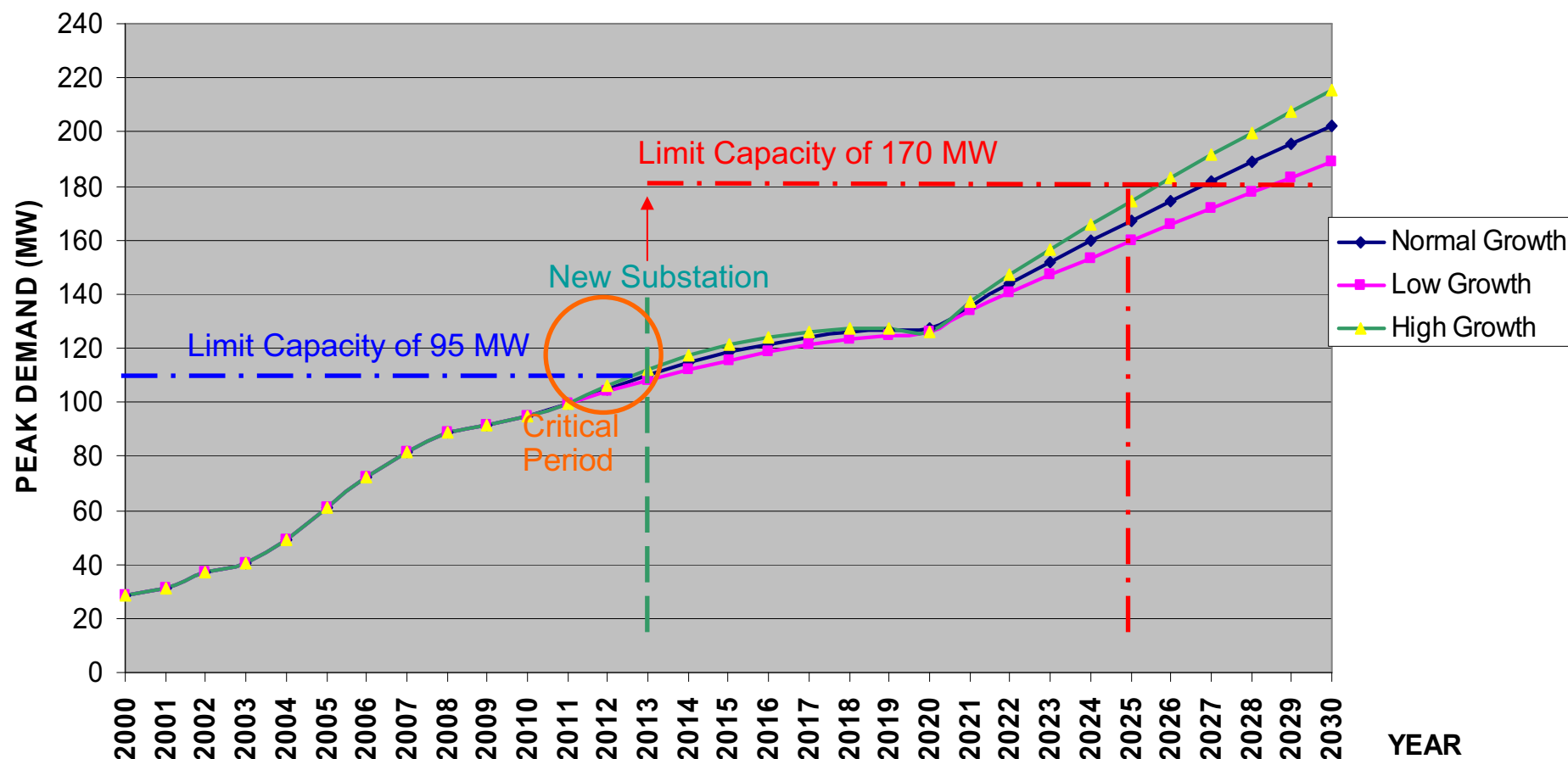


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Electricity Demand Projection

PEAK DEMAND FORCAST FOR SAMUI ISLAND (2000-2030)



3.Area Energy Planning

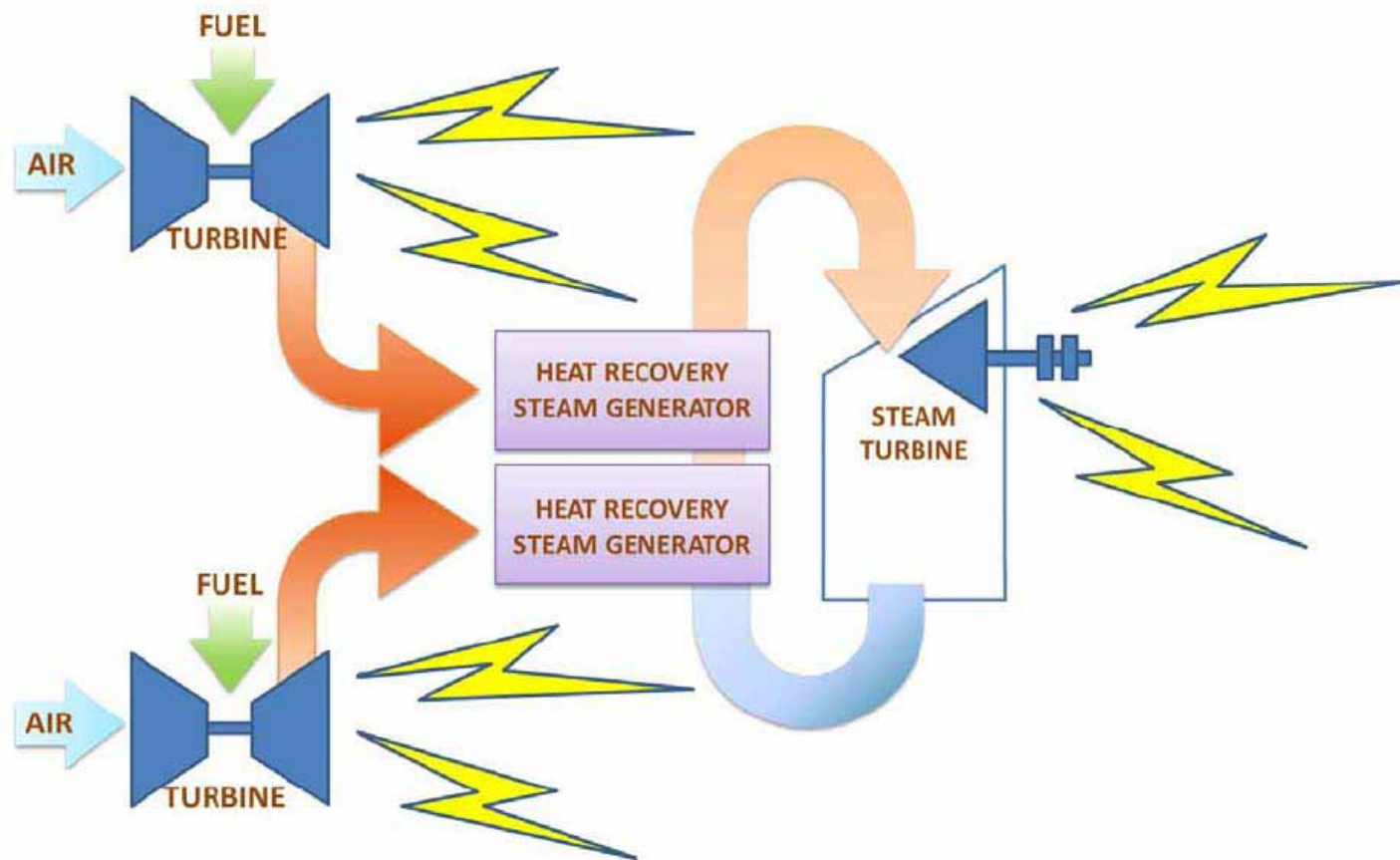
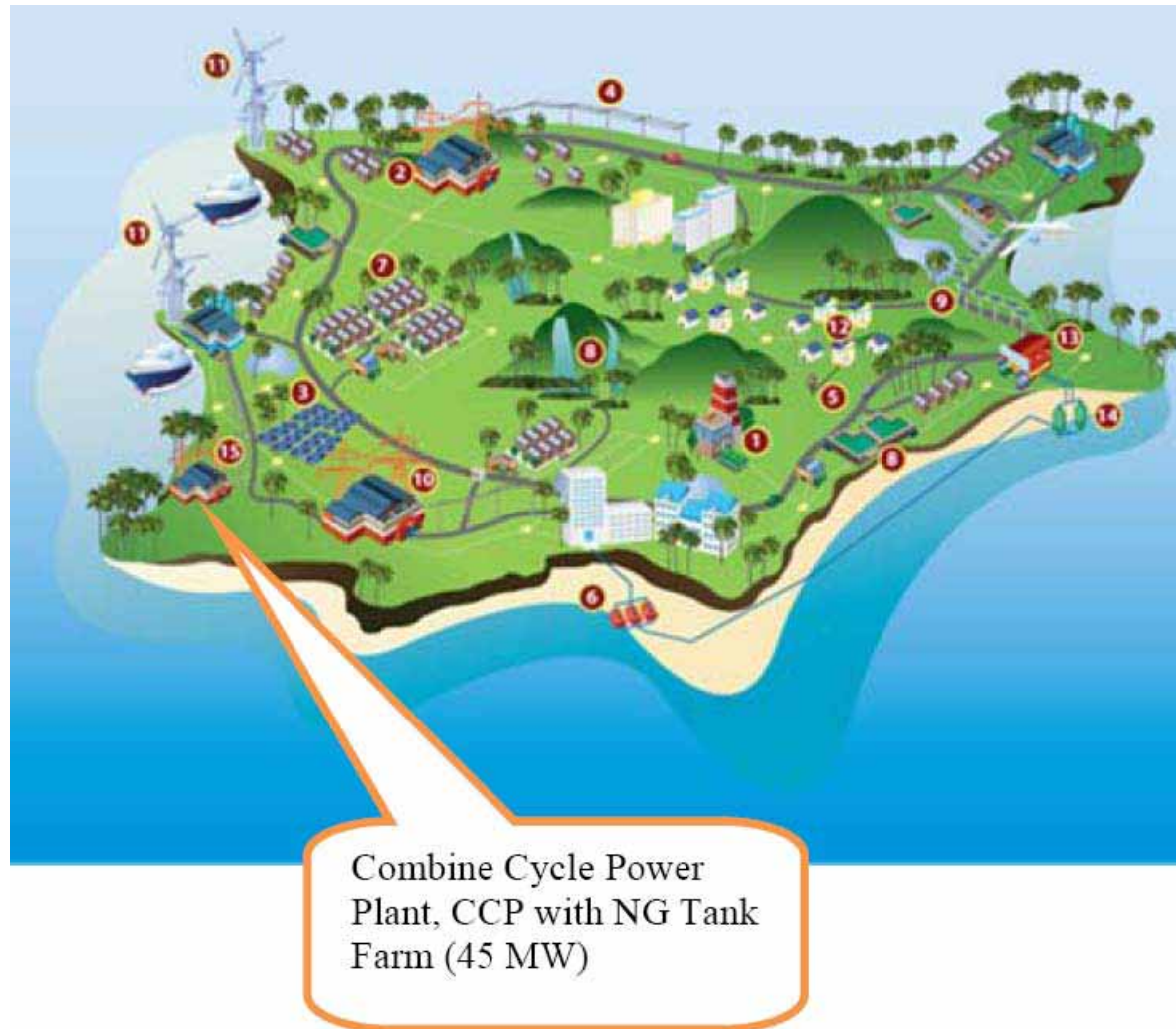


FIGURE 7-4 Combine Cycle Plant (CCP) for SAMUI Island

3.Area Energy Planning



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4.Area Energy Management

- SMART Grid
- MICRO Grid

Initial analysis results

Amount of CO₂ Reduction = n.a tCO₂/y

Estimated Investment budget ~ 5,000,000 USD (35 M.Baht)



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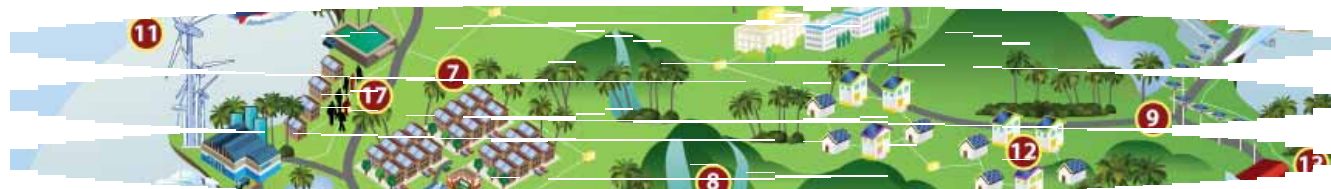
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SAMUI'S S

GRID M

Define Number

1. Micro...
2. Electrical Grid...



5. Energy Storage for Micro...
6. Fuel cells
7. Solar Rooftop
8. Small hydro power
9. Solar Street Light
10. Solar Water Pump



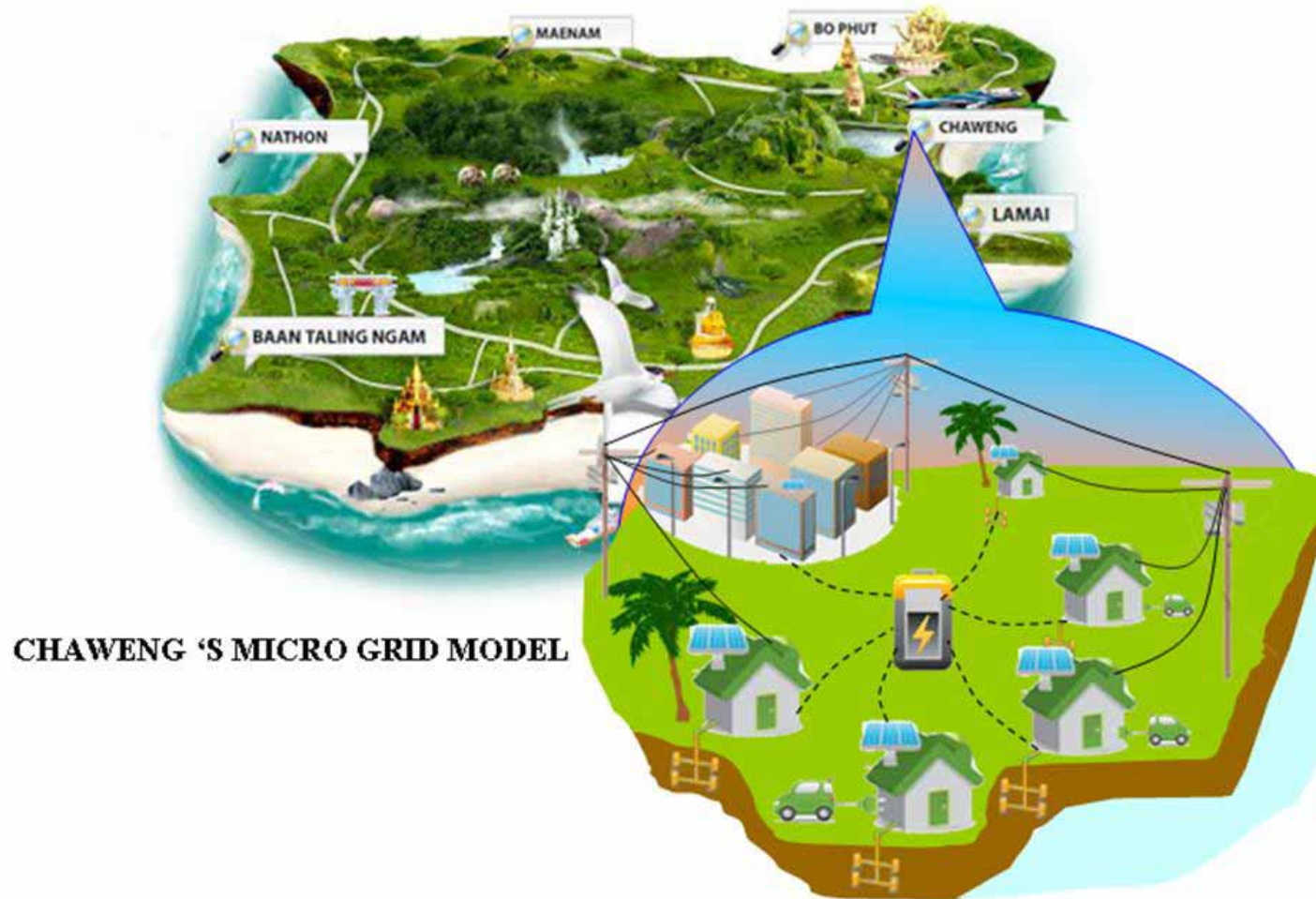
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Area Energy Management



Micro Grid



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5. Renewable Energy

- Solar, Wind, Small Hydro

Initial analysis results

Amount of CO₂ Reduction = 8,684.36 tCO₂/y

Estimated Investment budget = 37,000,000 USD (1,110 M.Baht)



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5. Renewable Energy



2 MW Solar Farm



7 MW (Total) Solar Rooftop



250 kW (Total) Solar Street Lighting (LED)



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For Samui Island, Thailand.

Renewable Energy



Wind Energy (Symbolic Measure)



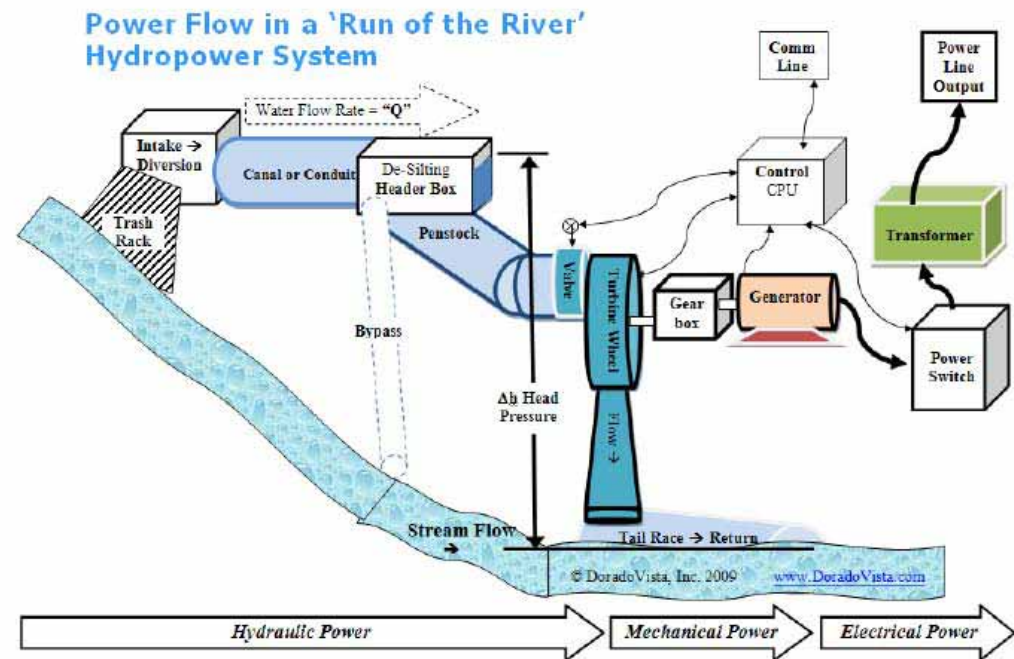
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Renewable Energy



Small Hydroelectric Power



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6. Untapped Energy Use Planning

- Waste heat from incinerator (3.28 MW)
- Biogas from kitchen waste (642.35 kW)

Initial analysis results

Amount of CO₂ Reduction = 17,389.06 tCO₂/y

Estimated Investment budget = 33,380,000 USD (1,000 M.Baht)



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Untapped Energy Use Planning



The existing incinerator plant



The New incinerator power plant

**2 x 200 ton/d
New Incinerator
Plant
with 3.28 MW
Electricity
Generation**



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7. Low Carbon Building

Initial analysis results

Amount of CO₂ Reduction = xxxxxx tCO₂/y

Estimated Investment budget = xxxxx USD (xxx M.Baht)



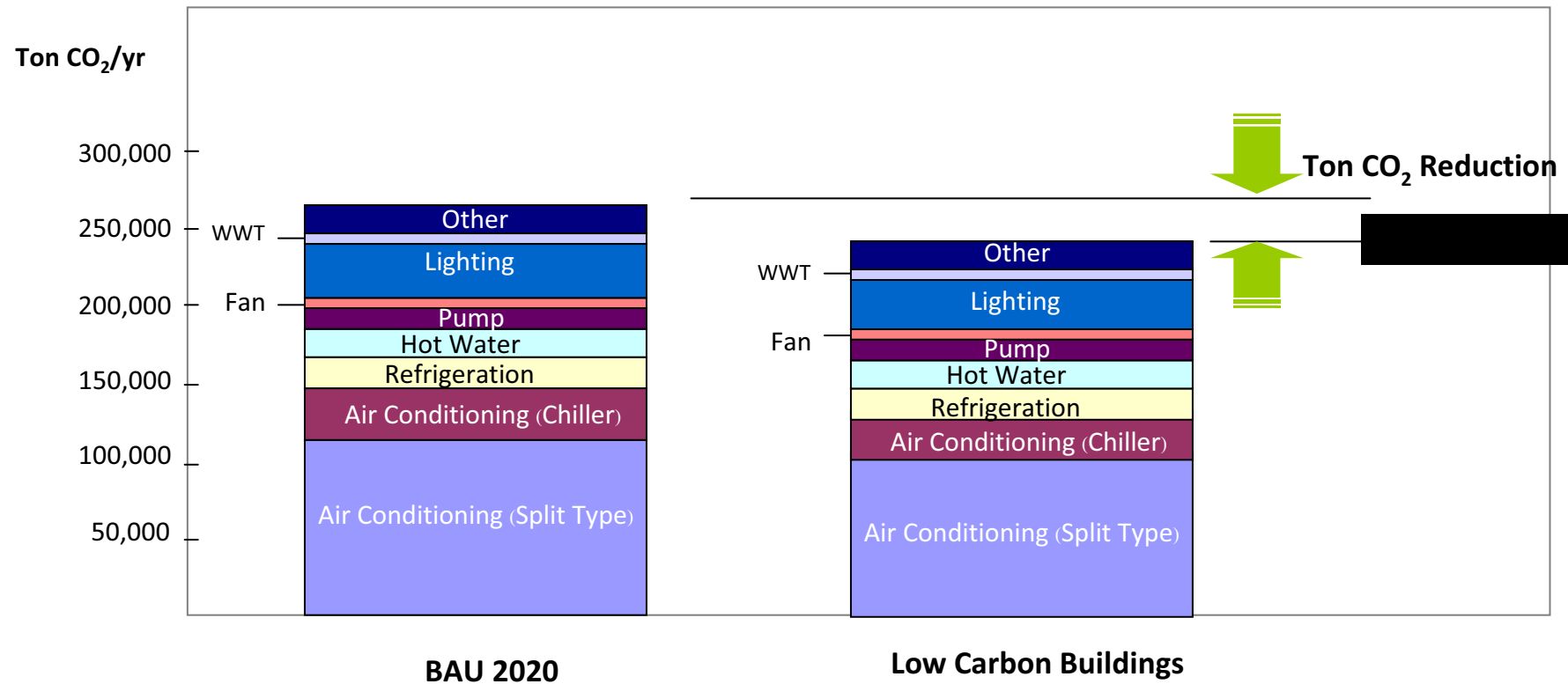
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Carbon Emission Reduction on Samui Island (Low Carbon Buildings)



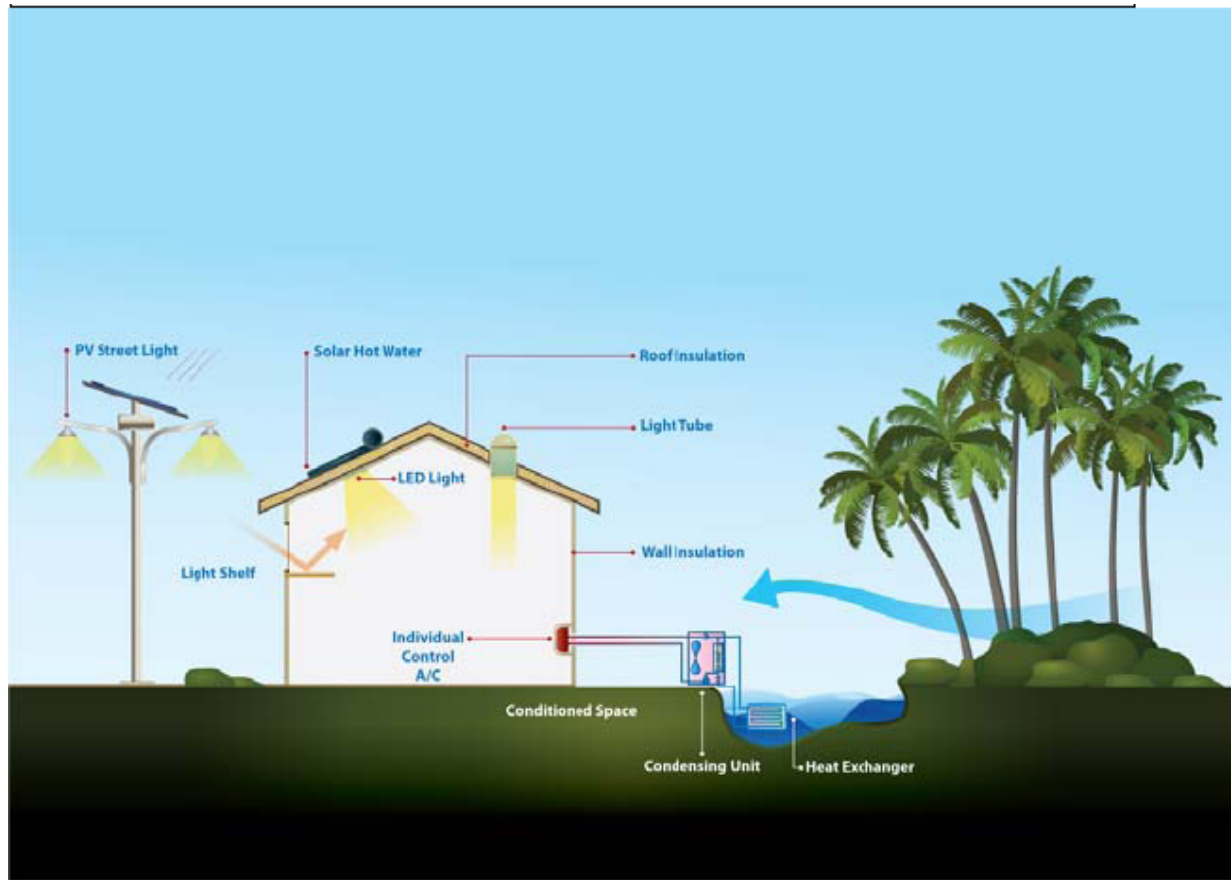
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7. Low Carbon Building



Low Carbon Resort Model



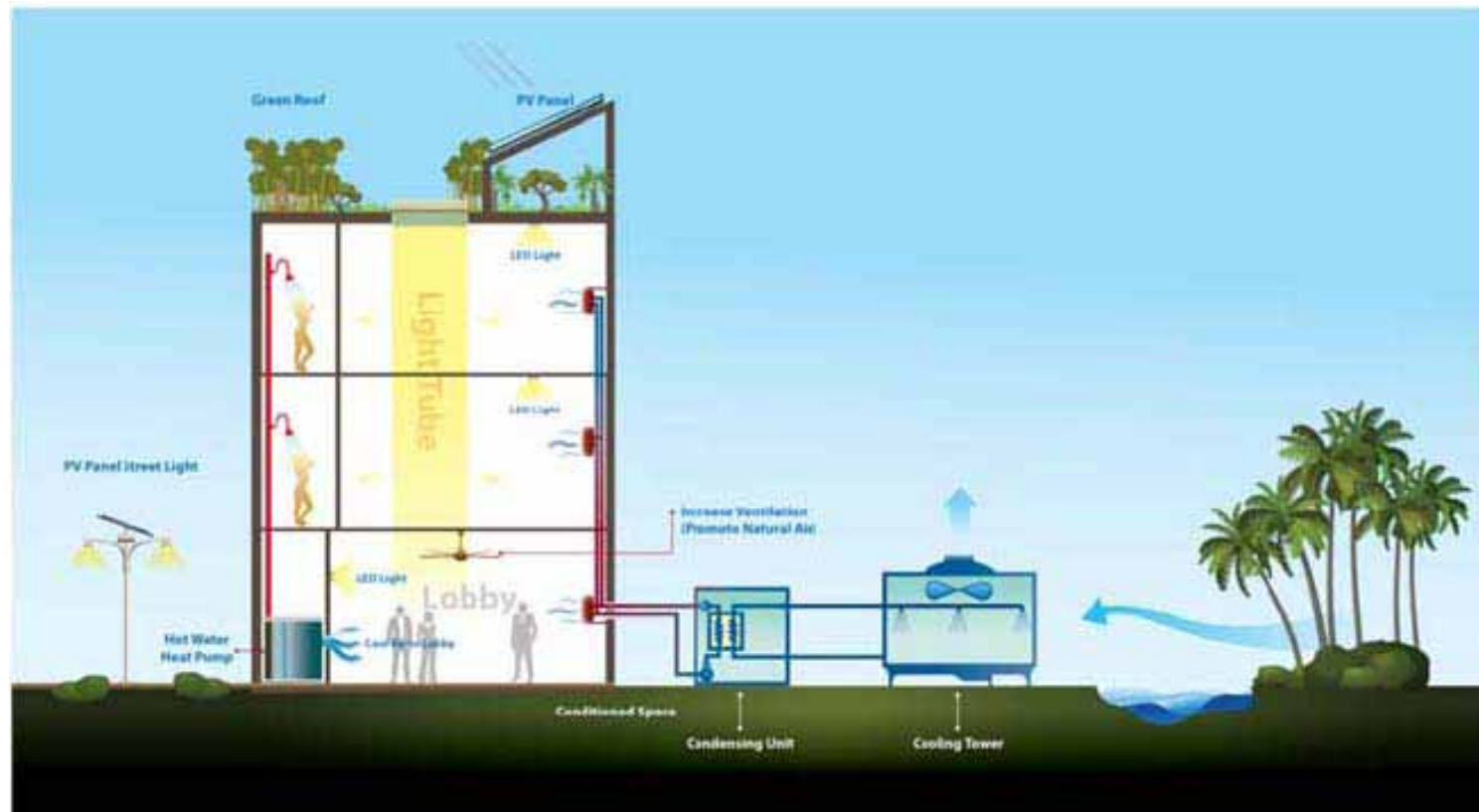
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7. Low Carbon Building



Low Carbon Hotel Model



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8. Eco-life style

- Low Carbon Center
- Eco-point Programme

Initial analysis results

Amount of CO₂ Reduction = 40,309.64 tCO₂/y

Estimated Investment budget = xxxxxxxx USD (xxx M.Baht)



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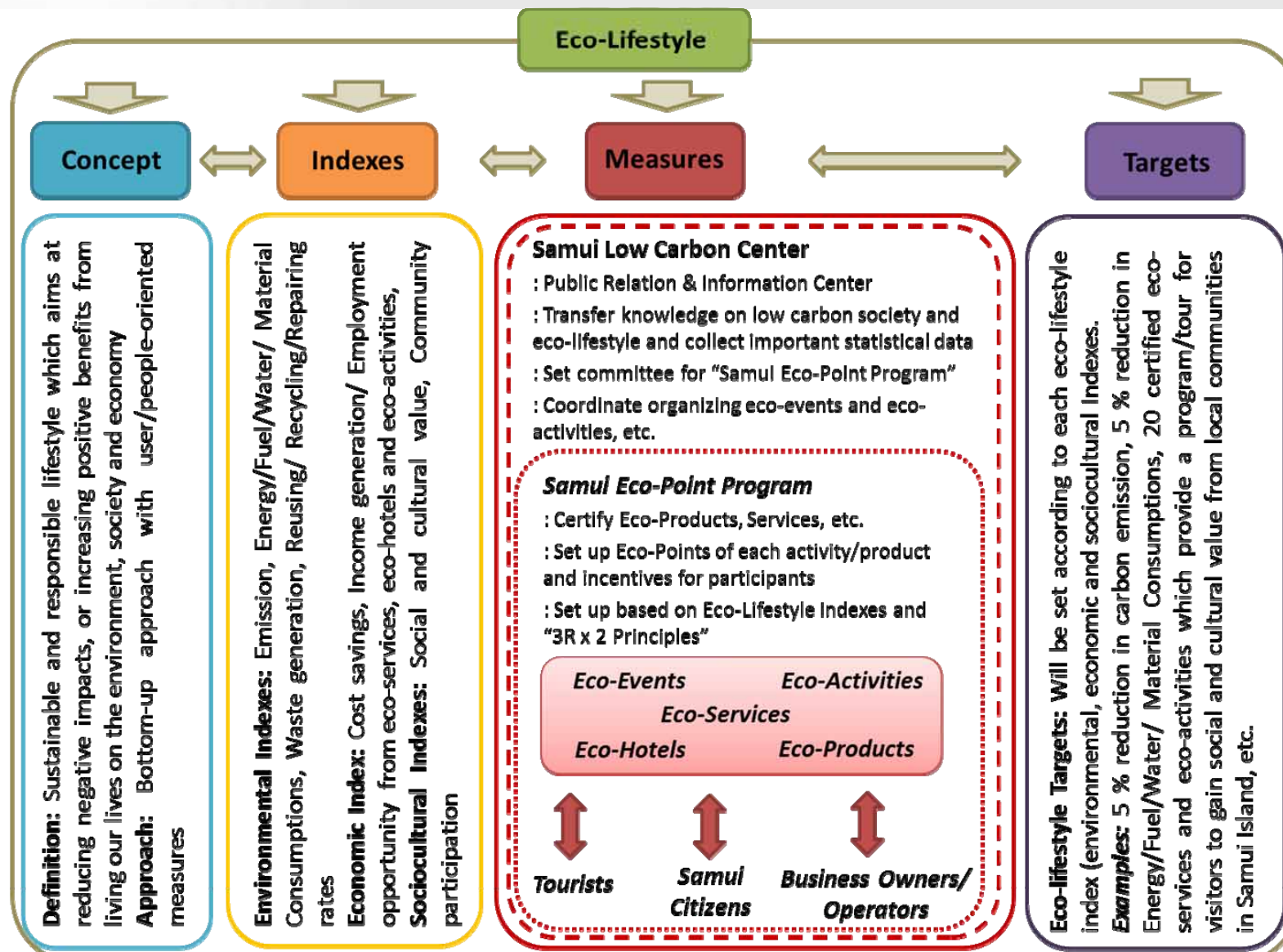
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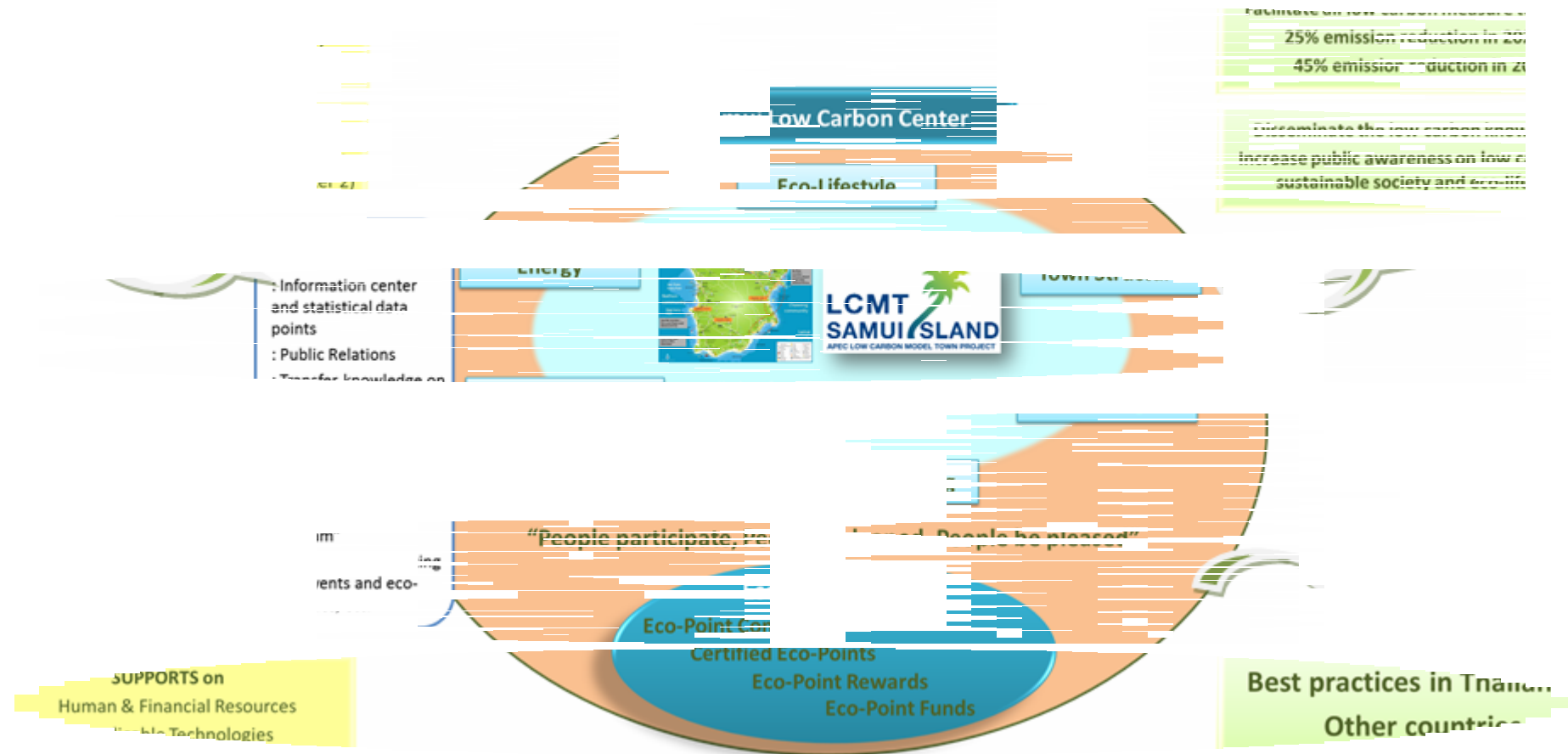
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Eco-lifestyle: Interconnection of eco-lifestyle concept, indexes, measures & targets



Eco-lifestyle: Visualization of SAMUI Low Carbon Center



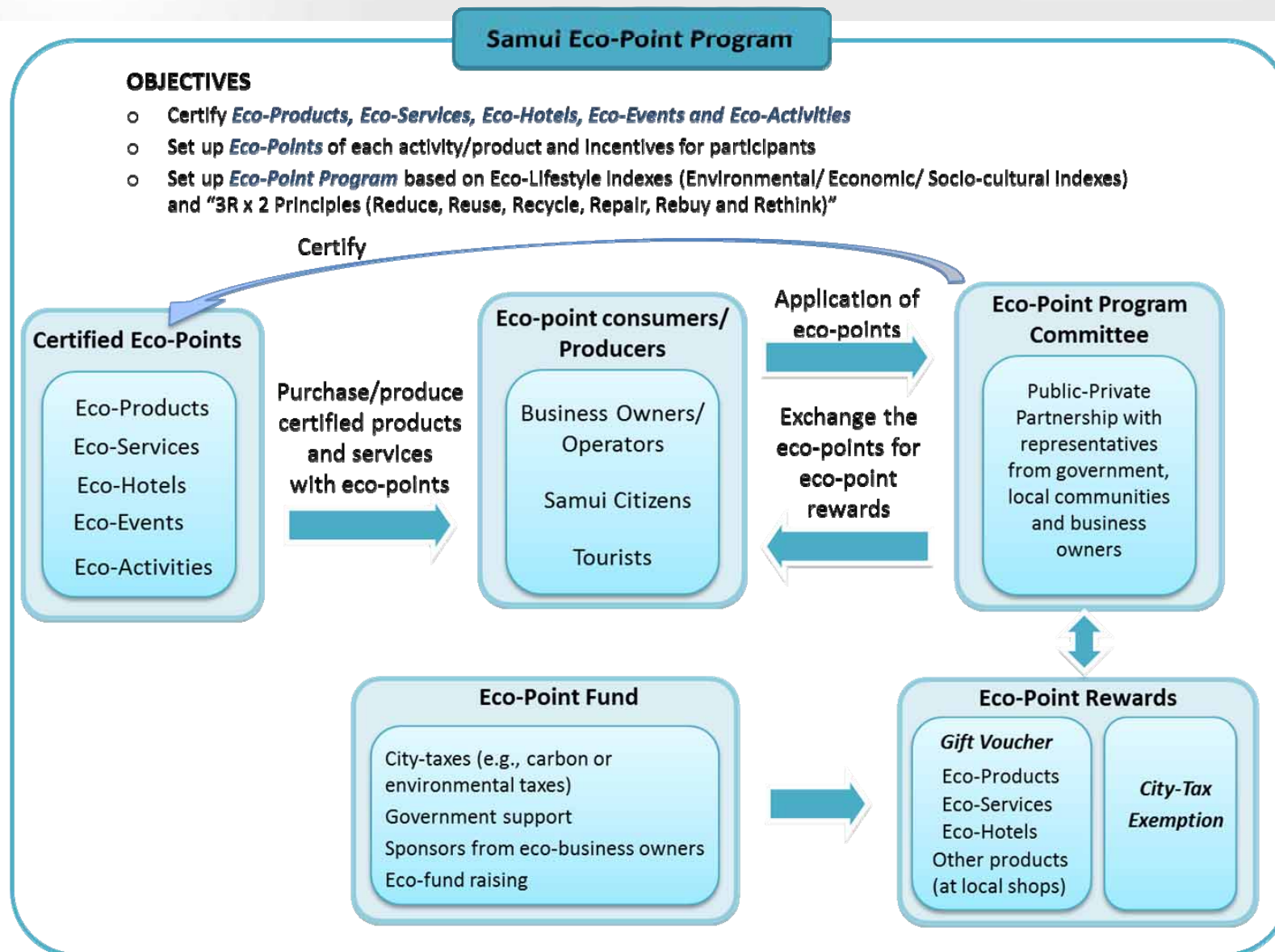
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Eco-lifestyle: Overall framework for eco-point program



Index and Targets

Eco-Lifestyle Index	Targets for eco-lifestyle measures
Main Target	
Carbon Emission (% Reduction)	5% Reduction from BAU in 2020 and 2030
Sub-Targets	
1. Energy Consumption (<i>Electricity and heat; % Reduction</i>)	10% from BAU in 2020 and 2030
2. Fuel consumption (% Reduction)	10% from BAU in 2020 and 2030
3. Water consumption (% Reduction)	10% from BAU in 2020 and 2030
4. Material consumption (<i>Other materials excl. fuels and water; % Reduction</i>)	15% from BAU in 2020 and 2030
5. Waste generation (% Reduction)	15% from BAU in 2020 and 2030
6. Reusing rate (% of Total waste generation)	15% from BAU in 2020 and 2030
7. Recycling rate (% of Total waste generation)	15% from BAU in 2020 and 2030
8. Repairing rate (% of Total waste generation)	15% from BAU in 2020 and 2030
9. Cost savings (<i>Only from selected measures e.g., energy-fuel-material consumption reduction; %</i>)	10% from BAU in 2020 and 2030
10. Income generation from eco-services, eco-hotels and eco-products (<i>Bath/Year</i>)	4,600,000,000 THB
11. Employment opportunity from eco-lifestyle measures (Number of workers)	3,000 Workers in 2020 and 5,000 Workers in 2050
12. Social and cultural value (<i>Number of eco-services and eco-activities which provide a program/tour for visitors to gain social and cultural value from local communities in SAMUI Island</i>)	50 Eco-services & 50 Eco-activities in 2020 and 100 Eco-services & 100 Eco-activities in 2050 Note: Only eco-services & eco-activities to increase social and cultural value & awareness of local communities in SAMUI Island
13. Community participation (<i>Number of SAMUI Citizens involving in eco-services, eco-hotels and eco-activities</i>)	20,000 SAMUI Citizen in 2020 and 40,000 SAMUI Citizen in 2050



Example of the Best Practice as a benchmark : Japanese Team minus 6%

Climate Change

... to the global ...
... a project aimed ...
... civil groups, NP ...

minus 6%
... against ...
... CO2 emissions ...
... government ...
... and policy, which ...
... conditioning set at 28 degrees centigrade in summer

Climate Change
... GHGs by 6% ...
... collaboration among ...

Team minus 6%
... CO2 reduction called for by the team minus 6%

Set air conditioners to 28°C in summer and to 20°C in ...
Turn off a faucet every time you use it ...
Unplug electric appliances when not using ...

みんなで止めよう温暖
チーム・マイナス6%

energy saving

Cool Asia

(2007)

Know 96%	Know 4%
Manufacturers set to higher temperature than previous year	48.1%
Estimated amount of CO2 reduction	1,400,000 tons

"Cool Asia 2006" on May 31 2006 in Tokyo. Many ambassadors of Asian countries and Cabinet members of Japanese government attended the eminent fashion-show



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Carbon Reduction Impact and Low Carbon Costs of Measures

Carbon emission target is set up for implementation of all eco-lifestyle measures as 5% in 2020 and 2030 (~400,000 tons CO₂ in 2020)

No.	Eco-Lifestyle Measure	Cost Estimation
1	Eco-Logo	100,000 THB
2	Low Carbon Center*	900,000 THB (excl. infrastructure**)
3	Eco-Point Program -Eco-point funds - Infrastructure and Operating costs*** - Organizing eco-activities/eco-events and certifying eco-products/eco-hotels***	110,000,000 THB/year (from 2013 to 2020), 125,000,000 THB/year (from 2013 to 2030) 0 THB 0 THB

* Infrastructure establishment (building construction) and operating costs

** Costs for Infrastructure establishment will be added by another team

*** No cost (Use the same facilities and human resources in SAMUI Low Carbon Center and the existing certification systems in Thailand: Green label, Green leaf, etc.)



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Examples of Eco-Products and Eco-Hotels

Green Label



Total certified products for Green Label (Updated in 31 July 2011) are 507 Models 25 Products Category and 75 Companies. The full list of all certified products is published and publicly available in:

Office of Green Label Secretariat, TEI (2011), List of Thai Green Label Products. Update 31 July 2011. [online] Also available at:

<http://www.tei.or.th/greenlabel/eng%20pdf/2011-07-Name-GL-eng.pdf>



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Examples of Eco-Products and Eco-Hotels

Green Leaf



There are 669 Green Hotels that certified by Green Leaf, the information provide at http://www.greenleafthai.org/th/green_hotel/

Examples of Hotels with Green Leaf in Samui are

=> AMARI PALM REEF KOH SAMUI

=> BAN SABAI SUNSET BEACH RESORT & SPA

=> BANANA FAN SEA RESORT

=> BHUNDHARI SPA RESORT & VILLAS SAMUI | A CENTARA RESORT

=> CENTARA GRAND BEACH RESORT SAMUI



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9. Environmental Planning

- Water supply
- Waste water treatment
- Solid waste

Initial analysis results

Amount of CO₂ Reduction = n.a tCO₂/y

Estimated Investment budget = 21,000,000 USD (630 M.Baht)



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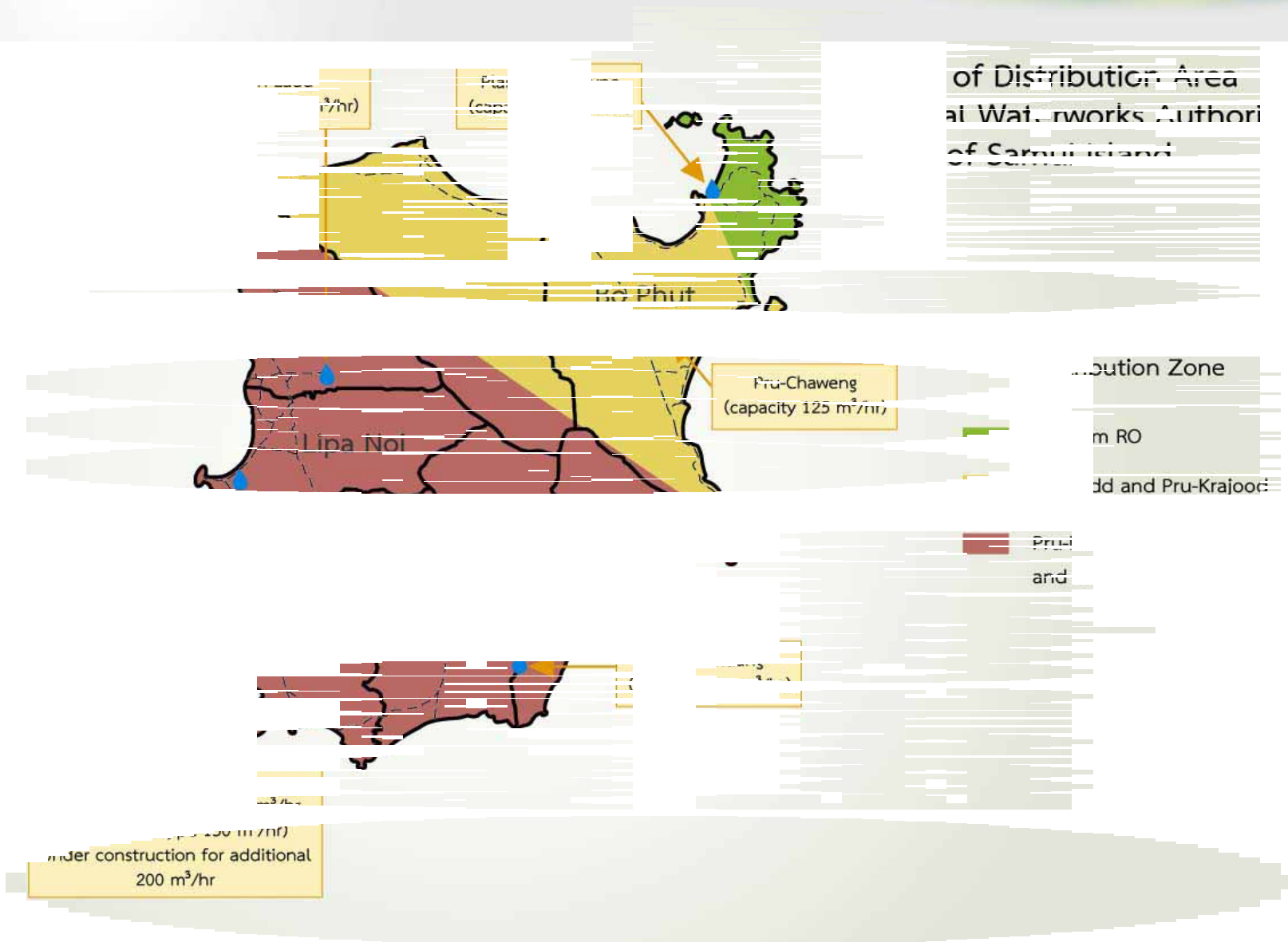
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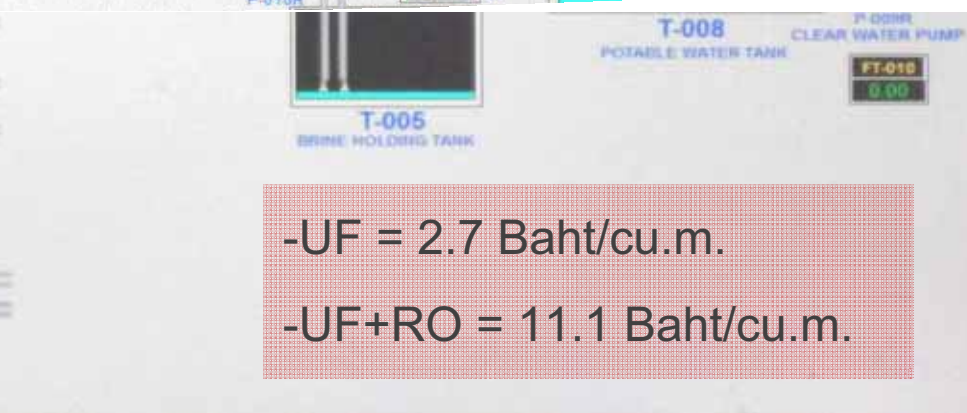
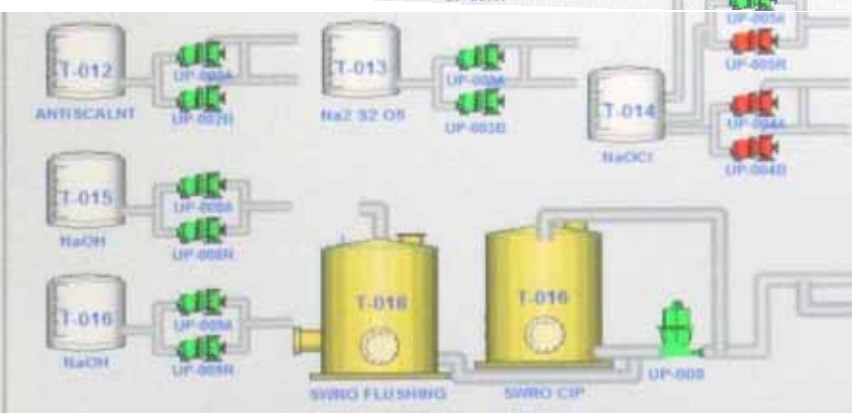
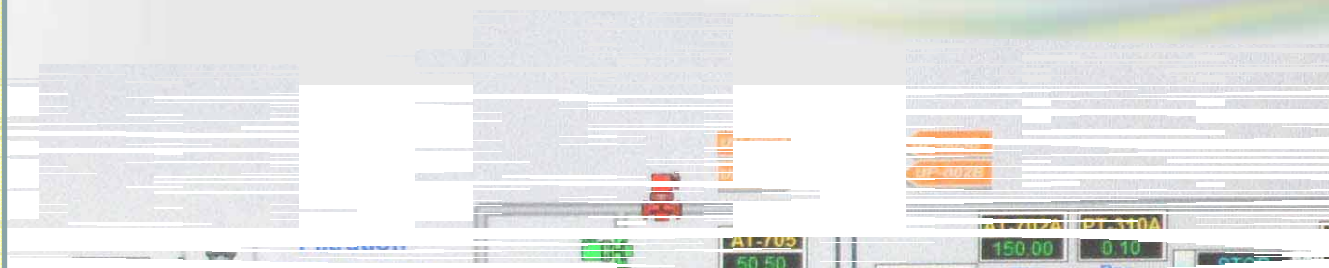
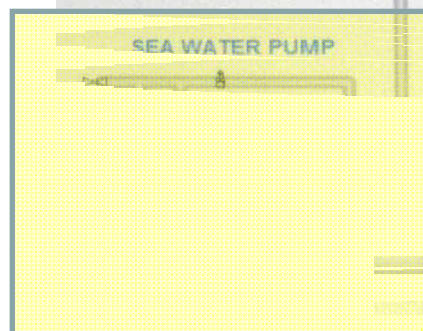
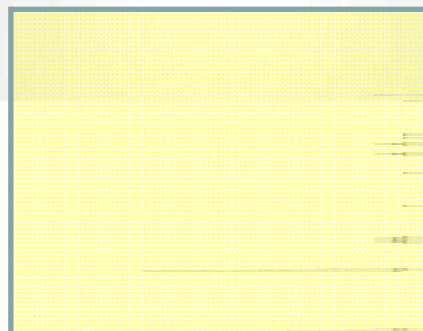


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Water Supply System





-UF = 2.7 Baht/cu.m.
-UF+RO = 11.1 Baht/cu.m.



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Water Supply System

Recommendation

- ✓ Use recycling water for irrigation.
- ✓ Recommendations for the Development of Various Reservoirs on Samui Island.
- ✓ Recommendation for Water Supply System Development



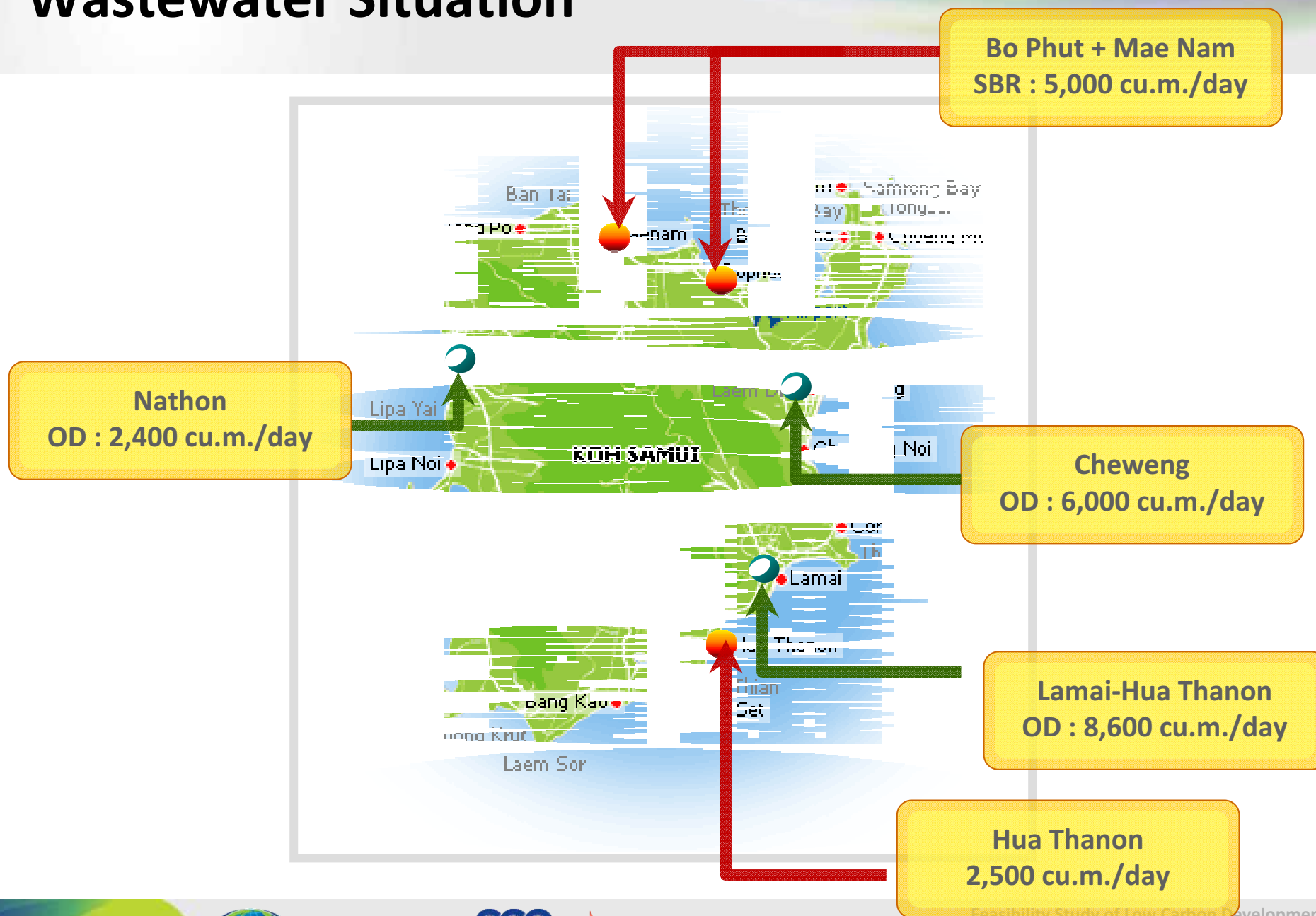
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Wastewater Situation



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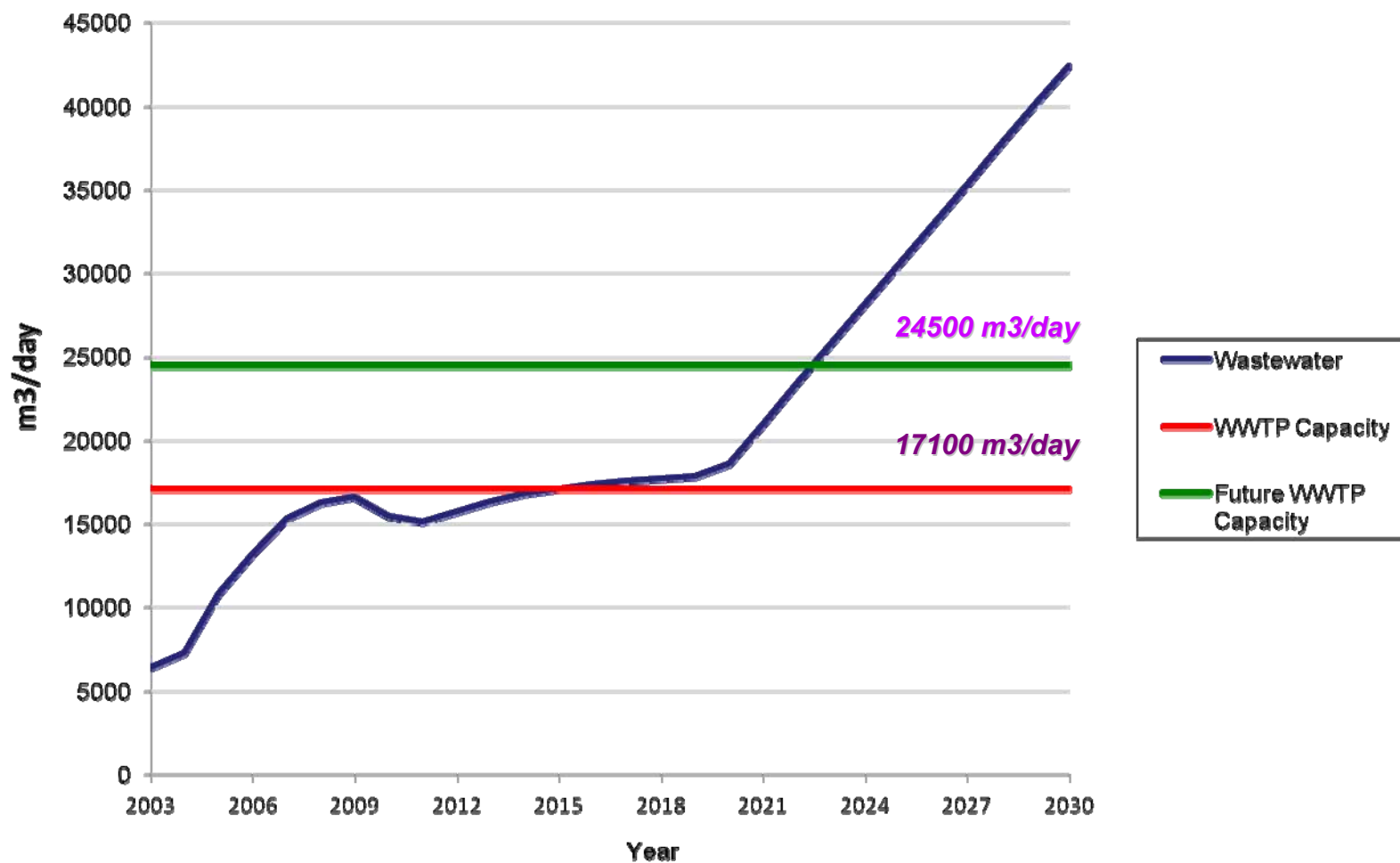


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Wastewater Situation

WWTP



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Wastewater Planning : Recommendation

Short-term Plan

- ✓ The system should be **repaired**.
- ✓ **Encourage Mangrove wetlands** as WWTP.
- ✓ Apply **advanced service charges** for wastewater.
- ✓ Offer **incentives to the public** in order to reduce the level of wastewater produced.
- ✓ Apply **strict control** over the amount of wastewater released from each households and commercial buildings.



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Long-term Plan

- ✓ Encourage **sewage collection pipeline** for all area to connect the central wastewater.
- ✓ Encourage **the recycling water** as irrigation, flushing toilet for new hotel, cooling tower etc. The recycling pipeline will be serviced in agricultural area in phase I in 10 year's time.
- ✓ The Municipality Authority has a plan to construct Wastewater Treatment Plant.



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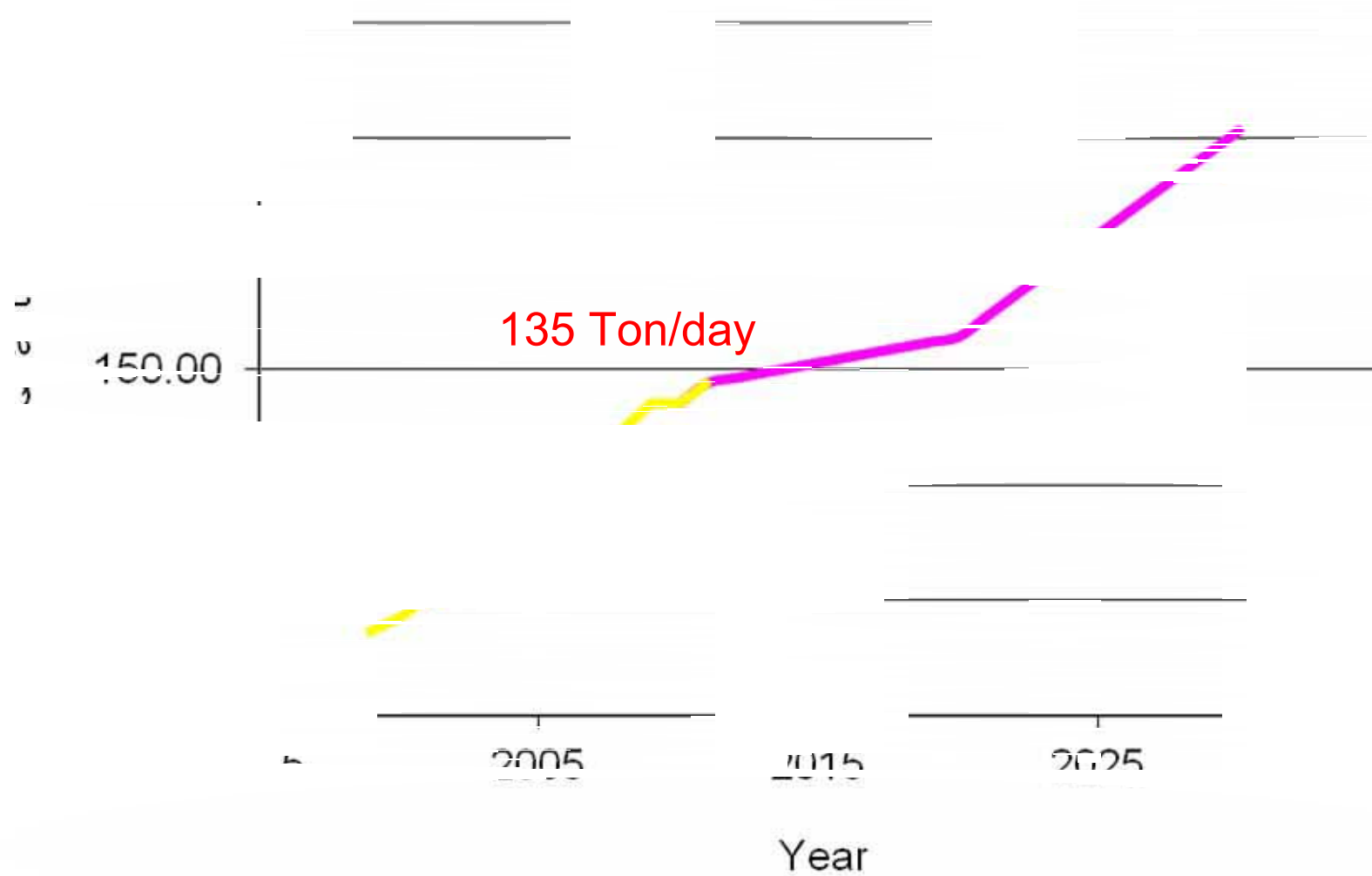
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Forecast For Samui Island (1988-2030)



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Solid Waste Management

- ✓ **Purchased New Incinerator : Capacity 2 x 200 ton/day.**
- ✓ **Sorting**
- ✓ **Encourage Combined Heat and Power Generation from Municipal Solid Waste. (Produce energy 3-5 MW)**



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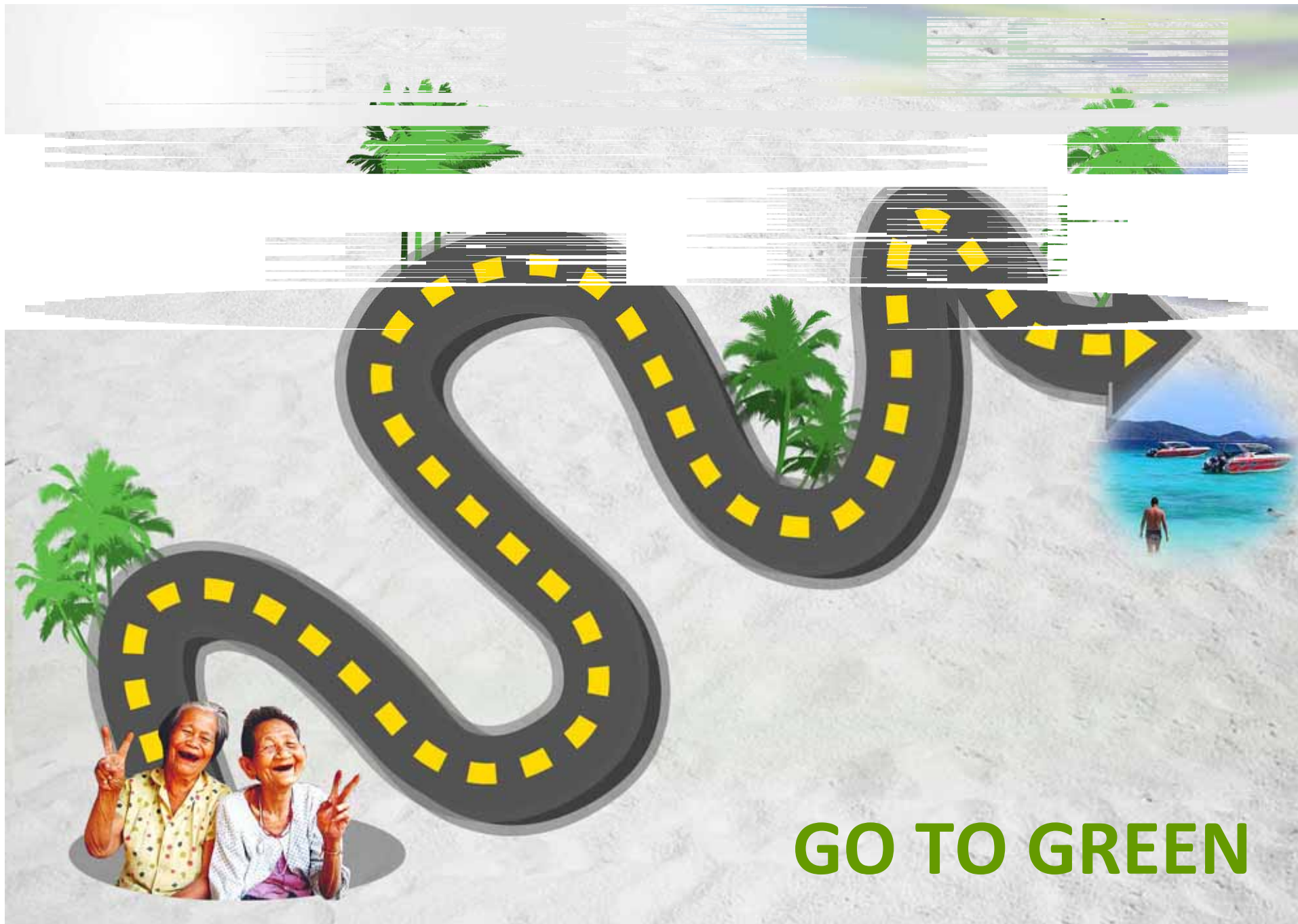


G20 KNOWLEDGE NETWORK



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GO TO GREEN



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**Thank You
For
Attention**

