National Energy Policy for Country Sint Maarten

Towards a sustainable development

MINISTRIES OF VROMI and TEZVT
GOVERNMENT OF SINT MAARTEN

There is no Planet B

Document **National Energy Policy of Sint Maarten**

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1 EXECUTIVE SUMMARY

1.1. Goals and Objectives

The energy policy is a document which contains a list of measures and procedures necessary to ***mitigate the impact of energy usage on our environment*** while offering consumers ***lower tariffs*** for energy use. The National Energy Policy contains a series of measures to ensure a secure supply of energy, at affordable prices, with efficient use in an environmentally sound manner.

The primary Goal of this policy is to contribute towards a sustainable development of the Country Sint Maarten, to reduce the country's dependency on imported fuels with the ever increasing fuel costs and also to reduce the high carbon footprint of Sint Maarten per capita. Unpredictable price volatility of petroleum fuels and burdensome Greenhouse Gases and other air pollutants are having a significant effect on Sint Maarten. Electricity tariffs are high compared with other islands in the regions, and it is recognized that high electricity tariffs are a heavy burden on the economy, the citizens and particularly for the tourism industry. For Sint Maarten it is of high importance to keep the tourism industry at a competitive level in the Caribbean region, since ± 80% of our labour force is engaged in tourism.
The minister of Public Housing, Spatial Planning, Environment and Infrastructure (VROMI) has initiated the preparation of a National Energy Policy and the actions needed to move from policy to implementation, in order to move away from the use of diesel #2 and heavy fuel oils for power production for reasons of security of supply, price volatility and the environmental impact of emissions. With the ultimate goal to ensure a sustainable, affordable and environmental-friendly energy situation for Sint Maarten.

On sustainable energy:

- promoting access to secure, affordable, clean and sustainable energy services as a key driver for poverty eradication and inclusive growth, with a special emphasis on the use of local energy sources;
- fostering greater use of renewable energy technologies, energy efficiency and promoting low emission development strategies;
- promoting energy security through diversification of sources and routes, considering price volatility issues, emission reduction potential, improving markets and fostering energy interconnections and trade.

1.2. Issues and Actions

In order to move to a sustainable, affordable and environmental friendly energy situation and to ensure an adequate and stable energy supply for an affordable price to all in society, and to ensure decent quality of life, the following critical issues and actions are addressed in this energy policy:

Issues and Actions:

1. Move away from the use of diesel # 2 and heavy fuel oil for power production.
2. Introduce a country-wide Energy Efficiency program.
3. Pursue improved efficiency at N.V. GEBE's power station.
4. Promote the use of Renewable Energy options.
5. Study the impact of introducing Smart Grid concepts for an improved electric supply chain from major power plants to customer premises.
6. Study the introduction of LNG/LPG as an alternative to diesel & heavy fuel oil.
7. Study the possibilities for inter-island cable connections for importing Renewable Energy.
8. Study the options & economics of supplying power from the Saba and St. Eustatius geothermal power plant projects.
9. Continue with the plans for the Waste to Energy plant.
10. Study possibilities of introducing a Regulatory Framework for the power sector.
11. Draft Terms and Conditions for potential power supply from independent producers, households and businesses.
12. Study the options for vehicle fleet operations on natural gas and all electric (powered by solar energy).
13. Decrease environmental impact and carbon foot print.
14. Find opportunities for diversification and growth in our domestic or external market in order to trigger a 'virtuous' spiral of development.

2 INTRODUCTION AND BACKGROUND

On a global scale the availability of fossil fuels are diminishing. There is a worldwide trend in slowly turning and looking into the opportunities of alternative and mostly renewable energy sources. Sint Maarten faces the challenge that it is totally dependent on fossil fuels. Due to this dependency, the increase in oil prices has proven to have a significant effect on the island's economy and the social lives of the people. The ongoing increase in fuel cost over the last years has proven to have a considerable effect on food products, energy bills and subsequently disposable income, causing an upward trend in inflation.

In order to mitigate these detrimental effects of the increasing oil prices, it is imperative for Sint Maarten to look into renewable energy sources and alternative energy sources like LNG (Liquid Natural Gas) and LPG. In addition, renewable sustainable energy sources also contribute to a healthier environment as it is less likely to cause pollution, thus improving the quality of life on Sint Maarten.

Therefore the Government of Sint Maarten, and in particular the Ministry of VROMI and the Ministry of Tourism, Economic Affairs, Transport & Telecommunication (TEZVT), has taken the initiative to develop a National Energy Policy Framework and Action Plan, in close cooperation with the Utilities company N.V. GEBE.

The primary goal of the National Energy Policy for Sint Maarten is ***to contribute towards a sustainable development for the Country of Sint Maarten.***
In order to reach this goal, the following main objectives are formulated:

Objectives for a sustainable development

1. Ensure provision of adequate and stable energy supply for an affordable price to all in society, in order to ensure decent quality of life.
2. Reduce dependence on fossil fuel and more emphasis on renewable energy.
3. Decrease environmental impact/ carbon foot print, increasing environmental resilience.
4. Promote energy efficiency.
5. Regulate Energy market e.g. regulatory body & legislation.
6. Ensure sustainability of N.V. GEBE.

In the following sections of the National Energy Policy, we will discuss these objectives.

2.1 Country Profile

The Country Sint Maarten, which is part of the Leeward Islands in the North-Eastern area of the Caribbean Sea, is with its 34 km² and its population of 37,329 (January 2010) a very densely populated island with 1100 persons per km². Looking at the gross GDP of NA*f* 1,466.5 million (2012) and the GDP per capita (PPP) of NA*f* 44,000.-, (2012) Sint Maarten can be ranked among the relatively well performing island nations in the Caribbean.
For Sint Maarten 80% of the total GDP comes from Tourism and Tourism related activities. Furthermore there are limited industrial activities and there is hardly any agricultural business. It is of great importance to keep the tourism industry at a competitive level in the Caribbean region and to look for further sustainable growth. Since the financial crisis occurred in the end of 2008, followed by a worldwide economic crisis, tourism in the Caribbean has suffered from a decreasing number of tourists and less spending per tourist per day.

Caribbean governments and utilities are seeking for ways to cut costs and to decrease tariffs by increasing the utilities' efficiencies and by looking at energy conservation and efficiency measures. They are also seeking more sustainable and cost-effective power generation options in order to reduce the dependency on fossil fuels and to reduce the utilities' cost of service and consumer tariffs.

2.2 Energy & Economy

As mentioned above, tourism is the main source of income with more than 2 million tourists (almost 1.8 million cruise and 467.000 stay over (2013)) visiting the shores of Sint Maarten per year. Hence, due to the ongoing growth in population size as well as annual increase in tourism arrivals, the demand of energy will only continue to increase in the nearby future.

On a macro-economic level, energy costs are of great concern for the Government of Sint Maarten. In 2012 Sint Maarten spent a total of NA*f* 264.8 million on importing of oil products, which comprises a remarkable 18% of the total GDP[1]. This shows the heavy dependency on imported oil for Sint Maarten, and its country's vulnerability as this causes an upward pressure on inflation (higher cost of living and doing business) and affects our competitive position as a country.

The relatively high level of welfare is also reflected in the energy consumption per customer.[2] The approximately 20,000 customers of N.V. GEBE are as an average consuming around 1,500 kWh monthly, which is one of the highest consumption figures in the region.

[1] *GDP of NAf 1,466.5 million in 2012*
[2] *The higher the welfare, the higher the energy consumption by purchase and use of AC's and other appliances.*

When looking at the average peak demand of around 50 MW during the weekdays the average peak is 3 kW per customer, the average load at the evening hours is 43 MW, which is 2.5 kW per customer (Curaçao: 1.82 kW per customer). Only a few Caribbean islands, like Grand Cayman, Bermuda and Grand Bahama have a higher electricity consumption level.

N.V. GEBE has 3 categories of customers: domestic, commercial and large consumers: the average electricity bill for domestic consumers is ± USD 200.- per month per household.

Category	Monthly Average kWh	Nr. of Clients
Domestic *Single Phase meters* *Two/Three Phase meters*	 **362** **587**	 **5,247** **11,744**
Commercial *Single Phase meters* *Two/Three Phase meters*	 **888** **5827**	 **147** **2884**
Large consumers/ Industrial	**422,631**	**12**

Source: N.V. GEBE

2.3 Energy & Environment

The 1992 United Nations Conference on Environment and Development (**UNCED**) in Rio de Janeiro was an unprecedented international event which changed the way we look at our environment. The Earth Summit's plan of action included major program areas, such as promoting transitions to different energy sources, increasing energy efficiency, promoting renewable energy sources and sustainable transport systems.

As Sint Maarten faces the challenges of the transition to a more sustainable society, we need innovation and resilience for a competitive economy and a sustainable future. Sint Maarten needs to consider the valuable, yet fragile nature of its resources (both natural and other), assume ecological responsibility through resource efficiency, renewable energy and green technologies, as well as achieving other equally important goals such as cultural preservation, and consumer education. Balancing out economic resilience with ecological responsibility is fundamental to achieving not only improved quality of life, but in addition, equality, social cohesion and social equity. And it will contribute in reducing the Carbon Footprint[3] of Sint Maarten, which is one of the highest in the region.

[3] *Carbon footprint: "the total sets of greenhouse gas emissions caused by an organization, event, product or person. Or more specific: "A measure of the total amount of carbon dioxide (CO_2) and methane (CH_4) emissions of a defined population, system or activity, considering all relevant sources within the system."*

2.4 Current energy market

Electrical energy is being produced and distributed by N.V. GEBE, which is a fully owned Governmental company. In December 2013 all the shares were transferred to the government of Sint Maarten as the only shareholder. N.V.GEBE is the sole supplier of electrical energy according to the energy concession d.d. July 16, 2010, nr. 644 and will expire after 25 years. The electricity tariffs consist of a base rate (set by Government in 2011 at NA*f* 0,25 – 0,29 per kWh) and an adjustable fuel surcharge which fluctuates every month in which the actual fuel costs are passed on to the consumers.

N.V. GEBE has one power station located in Cay Bay with a total installed Nameplate capacity of 97.3 MW of diesel generation. 86 MW (Nameplate capacity) of which is HFO (Heavy fuel oil) operated. Currently the peak load is around 50 MW and the annual consumption of electrical energy is 372,671,233 kWh (2013). Total fuel consumption in 2013 was 82,6 million litres, and the average fuel efficiency for N.V. GEBE 32,7%[4]. These figures do not include line losses in delivering power to the customers (estimated 9%).

Major issues that need to be addressed are:

- Improvement of fuel efficiency.
- Improvement of the Utility's efficiency.
- Reduction of the power system losses.
- Reduction of (air) pollution.
- Improvement of the power system's reliability.

Next to the imported fuel for N.V.GEBE, additional fuels are imported like aviation fuel (60 mln liters/year), bunker C, diesel and LPG (for cooking: 4 mln. lbs/year). Sol Antilles N.V. is N.V.GEBE's fuel supplier, SOL Antilles N.V. and Chevron/Texaco are the island's suppliers of gasoline and diesel, estimated at around 18 Million liters in total. Next to the fuel suppliers as mentioned there are some others supplying bunker services to cargo vessels, yachts and cruise ships, (e.g. NuStar's barges from Statia).

[4] *Sint Maarten Sustainable Energy Assessment, a study of Electric Supply options, DNV KEMA, April 2012*

2.5 Legislation & regulatory framework

The current Electricity concessions Ordinance (AB 2013, GT no. 147) and the Electricity Concession of N.V. GEBE reflect provisions and regulations already containing the option of granting concessions to corporations for producing power by waste incineration, gasification or with other renewable energy sources. Also small scale producers using renewable energy sources for own usage – but only up to a maximum of 500 kVA (~ 450 kW) - are allowed in the Electricity Concessions Ordinance. With regard to Green Energy the Electricity Concession requires of N.V. GEBE that by 2015 merely 2% of all energy produced has to come from renewable energy sources. In the appendices of the Electricity Concessions Ordinance clear targets have been set for power quality, reliability of supply and safety. Timelines have been set for reaching these targets while quarterly progress reporting by N.V. GEBE is required. The articles of incorporation of N.V. GEBE need to be adjusted to incorporate the vision and recommendations in the Energy Policy.

Electricity Tariffs are established by the Government. A Tariff Setting Methodology still has to be developed as well as targets on improvement of efficiency and productivity and the reflections of these targets in the tariff levels.

The implementation of the Energy Policy and its different related issues could bring the need for revising current legislation. However, according to the ordinance Individual Power Producers are allowed to produce electricity, but cannot sell that electricity to any other entity than N.V. GEBE. On the premise that produced electricity can be sold to N.V. GEBE based on a power purchase agreement at a reasonable price, changing of the ordinance is not immediately necessary, however it could become necessary in the future. A ministerial exemption is necessary for the event of generation of more than 500 kVA for own use by entities other than N.V. GEBE.

In addition a regulatory framework e.g. regulatory body needs to be established urgently to oversee the overall energy market, to ensure “just and reasonable” pricing, equitable access to infrastructure, good quality service and security of supply. The role of the regulatory body is threefold, namely to protect the consumers from abuse of market power, to support investment by protecting investors from arbitrary action by government, and to promote economic efficiency. The regulator’s main responsibilities are:

1. development and implementation of regulations for establishing and sustaining a fair investment environment (based on restructured legislation);
2. protection of consumers against abuses by market player(s).

The regulator’s function is broad ranged and includes issuance of licenses to market participants operating in the regulated marketplace, setting tariffs (e.g. feed-in tariffs, net metering agreements), developing performance standards for various segments and monitoring the overall energy market. This regulatory body will also monitor and ensure compliance to the Electricity Ordinance and Policy.

2.6 Regional and international energy issues

The cost of crude oil is volatile and is expected to rapidly increase in the years and decades to come due to the increasing world demand, depletion of fossil fuels, global speculations on oil prices and the limited production and refinery capacity. All these factors have an upward effect on fossil fuel prices.

The aforementioned issues have not only a direct impact locally. Throughout the Caribbean, the islands are experiencing similar challenges, and have similar reasons for high electricity prices:

- Small economies of scale.
- The islands' dependence on imported fuels.
- Each island has an isolated grid which leads to monopolies, with a single utility company on each island responsible for production, transmission, and distribution of electricity.
- Simple production technology and lack of competition means that utilities largely pass on their only variable cost—fuel—to their customers via a simple surcharge. As oil prices have increased in the last decade, however, this situation has led to dramatic rises in the price of electricity.
- No available funds to execute Renewable and Alternative Energy projects.
- Insufficient awareness of energy consumption and its' effects by the population.
- Challenge to detect the optimum mix between Fossil Fuel generation, Renewable Energy sources and Storage Capacity.

However, regionally there are multiple opportunities and initiatives in the field of alternative, green and renewable energy of which Sint Maarten can make use of:

- French side (St Martin) cooperation.
- Saba and St. Eustatius interconnection-Geothermal.
- LNG/LPG from regional suppliers.
- Experience of other islands with Renewable Energy (Aruba).

In conclusion, with the depletion-- on global scale-- of fossil fuels, which is having considerable effects on economies worldwide, it is important for Sint Maarten to explore and ascertain the options that exist for the utilization of alternative and renewable energy sources. In addition, by not looking into other sources of sustainable energy, on the long term the effect will ultimately be higher fuel prices and subsequently higher utility prices. Ultimately, investing in other sustainable energy sources will lessen the dependency of Sint Maarten on fossil fuels and subsequently decreases food and utility prices, thus positively affecting households disposable income.

3 APPROACH & METHODOLOGY

3.1 Approach

The Minister of VROMI established an Energy committee with the task to produce a National Energy Policy as soon as possible, to stress the importance for Sint Maarten to steer away from heavy fossil fuels towards a more sustainable island.

The Committee comprises of:

- Ministry of TEZVT
- Ministry of VROMI
- N.V. GEBE, Electric Utility company of Sint Maarten.

3.2 Research Methods

In order to develop this Policy as well as the Energy Action Plan, the Committee has conducted research, such as an extensive benchmark study on policies and regulations throughout the Caribbean.

Further research methods used were to gather and review existing information and market knowledge, benchmarking, study technical feasibility of Renewable Energy technology, identify critical trends, study the effect of Renewable energy on the power grid, and study Energy Efficiency. In addition, meetings were conducted with various stakeholders (on and off island).

3.3 Scope of research

The scope of research for the energy committee included:

- Attendance to conferences on Renewable Energy
  - CARILEC in Barbados, September 2013
  - CREF (Caribbean RE Forum) & Green Aruba in Aruba, October 2013.
- Benchmark research on Energy Policies & Visions of different countries.
- Meetings with several stakeholders, and government representatives of other islands.
- CARICOM and OCTA Energy Reports.
- SXM Sustainable Energy Assessment and SXM Energy Policy by DNV/KEMA.
- Waste to Energy study, DNV/KEMA, 2010.
- GEBE Power generation Growth Scenarios, DNV/KEMA 2008-2023.
- Study of literature and reports on the topics.

4 RESEARCH & FINDINGS

4.1 Goals and Objectives

It is very important for the country of Sint Maarten to change towards a sustainable future: we need to ascertain our competitive position and thus stay attractive for residents and tourists alike, and ascertain a certain quality of life. Tourists can find beautiful beaches everywhere, Sint Maarten has to do more to keep attracting tourists.

Primary Goal of this Energy Policy is

- **to contribute towards a sustainable development of Sint Maarten,**
- **to reduce the dependency on imported fuels with the ever increasing fuel costs,**
- **to stimulate Renewable Energy,**
- **to ensure a sustainable, affordable and environmental friendly energy situation.**

Issues and Actions

In order to move to a sustainable, affordable and environmental friendly energy situation and to ensure an adequate and stable energy supply for an affordable price to all in society, and to ensure decent quality of life, the following critical issues and actions are addressed in this energy policy:

Issues and actions:

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5. Study the impact of introducing Smart Grid concepts for an improved electric supply chain from power plant to customer premises.
6. Study the introduction of Liquid Natural Gas/ LPG as an alternative to diesel & heavy fuel oil.
7. Study the benefits from inter-island cable connections for Renewable Energy.
8. Study the options & economics of supplying power from the Saba and St. Eustatius geothermal power plant projects.
9. Continue with the plans for the Waste to Energy plant.
10. Introduce a Regulatory Framework for the power sector.
11. Draft terms and conditions for potential power supply from independent producers, households and businesses, and determine feed-in tariffs.
12. Study the options for vehicle fleet operations on natural gas and all electric.
13. Decrease environmental impact and carbon foot print.
14. Find opportunities for diversification and growth in our domestic or external market in order to trigger a 'virtuous' spiral of development.

These issues and actions are detailed for realization in a separate action and implementation plan.

4.2 Regional activities on renewable energy

With regard to energy resources and utilization, the region keeps facing high oil dependency. For the islands this means that the main energy source is costly, subject to price volatility, vulnerable to supply interruptions and not environmentally friendly. Regional governments are therefore considering energy supply alternatives, incentives for efficient use and increased reliance on market-based solutions to ensure a sustainable development, supporting economic growth and protecting the environment. With respect to electricity, the islands are looking for ways to lower energy costs while improving service performance and reliability.

Despite access to abundant oil and gas resources in countries like Venezuela, Mexico, and Trinidad & Tobago, the energy options for the islands are limited and there is increasing attention for possible fuel diversification options and for renewable energy sources, especially considering the associated environmental benefits.

Several islands in the Caribbean, such as Nevis, Jamaica, Barbados, Curaçao, Aruba, Bonaire and Saba, have already started with using alternative energy sources in order to generate energy. For instance, Bonaire is in the process of building a wind turbine park that will provide a 100% energy capacity for the island. Saba and St. Eustatius on the other hand are exploring the possibilities of geothermal energy. Drilling for geothermal energy is scheduled to start in Saba and it is estimated that the energy generated would be 250-300 Megawatts. Saba's current usage is approximately under two Megawatts, subsequently giving Saba the opportunity to export the geothermal power via submarine interconnection cables to other surrounding Caribbean islands.

Some islands in the Caribbean have already started with their own sustainable energy policy plans, but there are still quite a few without a policy and/or legislative framework in place. Islands with National Energy Policies are: Anguilla, Antigua & Barbuda, Barbados, Bermuda, Bonaire, Cayman Islands, Curaçao, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Martinique, Montserrat, Puerto Rico, St. Kitts & Nevis, St. Lucia, St. Vincent & The Grenadines, The Bahamas, Trinidad & Tobago, Turks & Caicos Islands.

When reviewing the Energy Policies as issued in the Caribbean Region the following major issues can be identified:

- Pursue **reduction of the dependency on fossil fuels** because of the high costs, volatility of supply, burden for the foreign currency reserves and cost of living, and greenhouse gas emissions;
- **Introduce renewable energy sources**. The Energy Policies show targets set for the percentage of renewable energy sources on short term and long term;
- Investigate **interconnection with other islands** for exporting or importing renewable energy in case of abundant availability such as geothermal energy on certain islands;

- Encourage **private investments** in renewable energy power generation;
- **Introduce power sector Regulation**, based on the principle that a concession for Power Generation is not exclusively for the local utility company but concessions for Power Generation can also be issued to Independent Power Producers. The local utility company remains the sole transmission and distribution company, operating according the Single Buyer Model, regulated on tariffs, reliability and quality;
- **Allow individual clients** (households, commercial clients) to install their **own renewable energy power generation** (such as small-scale photovoltaic applications, small wind turbines) and allow these small generators to deliver excess power to the grid, in most cases making use of **net metering** and compensation of kWh's delivered to the power grid (tariffs to be determined by the regulator: some islands have one-to-one, others have tariffs less than the utility sales tariff);
- Introduce a country wide **Energy Efficiency program**, stimulating the population and commercial enterprises to save on energy usage.

With the depletion of fossil fuels, which is having considerable effects on economies worldwide, it is also important for Sint Maarten to explore and ascertain the options that exist for the utilization of alternative forms of renewable energy sources and start to develop a comprehensive energy policy for Sint Maarten.

Regarding renewable energy sources, wind and solar power are the main targets, since all the Caribbean countries have solar energy and wind power resources. Among renewable energy sources, also Waste to Energy is considered to be an option in most of the Caribbean countries. Some of the countries have hydropower and biomass resources and some of the countries have geothermal energy sources. Possibilities on geothermal energy and on bio-fuels have also gained interest among the Caribbean islands. For areas where geothermal and hydropower can be developed at a large scale, plans are also being developed for supplying neighboring islands by submarine cable connections.
Solar water heaters are promoted and used in many islands, with Antigua and Barbados showing application of solar water heaters on a large scale.
Wind power initiatives can be identified in Aruba, Curacao, Bonaire, Puerto Rico, Bahamas, Bermuda, St. Lucia, St. Vincent, Barbados, St. Kitts, Nevis, Grenada and Guadeloupe and are being prepared on more islands.

An important issue that has come forward in the past few years, is the aspect of addressing technical issues when integrating large amounts of intermittent renewable energy sources, such as wind and solar power. Small island power systems will suffer from grid instability if no measures are taken in

case energy supply with intermittent sources exceed some 25 - 30 % of the total energy supply. Measures may include energy storage, increased spinning reserves, demand response measures making use of a more advanced communications infrastructure with (large) energy users, in the end resulting in an overall Smart Grid concept for the Energy Infrastructure.

In recent Energy Policies of Smaller Island States the application of Liquid Natural Gas (LNG) instead of heavy fuel oils is also considered, like for example Aruba and St. Lucia, but also on Sint Maarten.

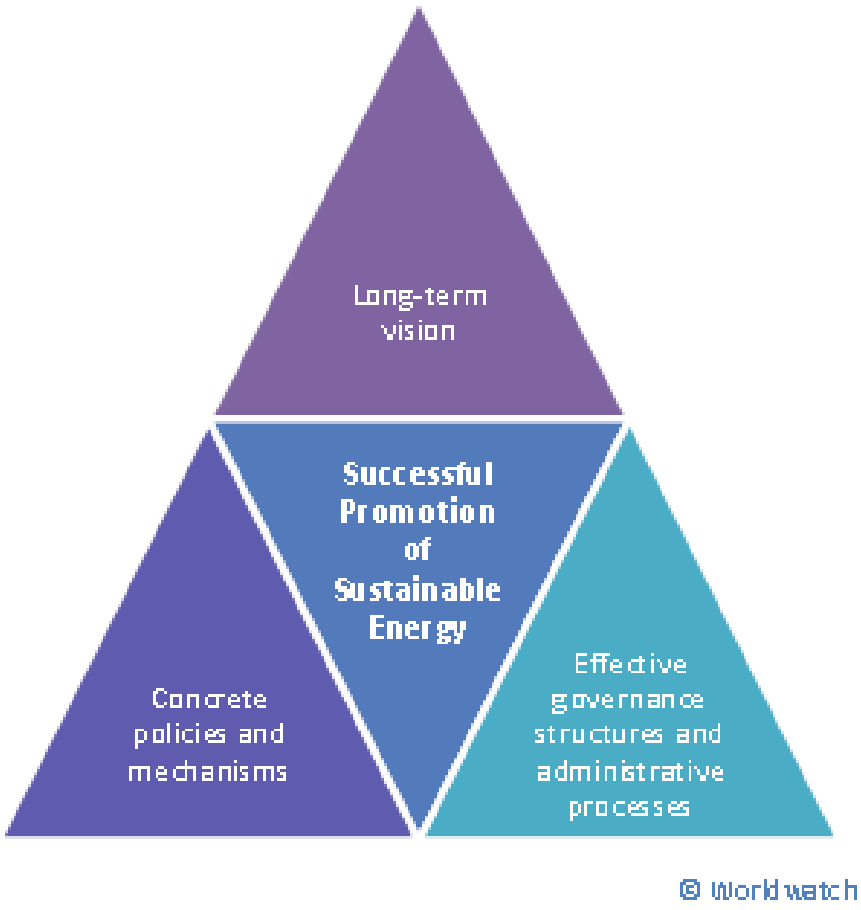

Figure 1: Components of successful sustainable energy promotion

4.3 Regional Prices of Electricity for Consumers

Country	USD / kWh
Surinam (hydro – energy)	0.05 – 0.11
Orlando, FL (coal and nuclear)	0.11
Nevis	0.21
Haiti[5]	0.28
Aruba	0.28 - 0.32
BVI	0.34
St Lucia	0.35
Sint Maarten	**0.35 - 0.36**
St Vincent	0.36
Barbados	0.38
Belize	0.39
USVI	0.40
Jamaica	0.40 - 0.42
Curacao	0.42
Bahamas	0.42

Average prices for 2013

The list above shows that energy prices on Sint Maarten are high, but not the highest of the Caribbean islands. Prices on the Caribbean islands however are very high compared with for example the U.S.

Some islands already have high Renewable Energy penetration (Aruba, Curacao, Bonaire) but electricity tariffs are relatively still very high. Rates were supposed to go down, but that has not happened yet, except for Aruba, where costs of utilities have been reduced by 30% for water, and 15% for electricity. Montserrat also will reduce cost of electricity thanks to a 2 MW geothermal energy plant. Conclusion: the energy market is changing but the benefits for the customers on most islands are still yet to come.

[5] *In Haiti only 25% of the population is paying for electricity, 75% of the population doesn't have electricity.*

4.4 Overview of Energy supply options

4.4.1 Traditional Non-Renewable Energy Sources

Fossil Fuel oils: are fuels formed by natural processes such as anaerobic decomposition of buried dead organisms, a process which takes millions of years. Fossil fuels contain high percentages of carbon and include coal, petroleum, and natural gas. The use of fossil fuels raises serious environmental concerns. Carbon dioxide is one of the greenhouse gases that enhances radiative forcing and contributes to global warming, causing the average surface temperature of the earth to rise in response, which the vast majority of climate scientists agree will cause major adverse effects.

Natural gas/ LNG/ LPG: is a hydrocarbon gas mixture consisting primarily of methane, but commonly includes varying amounts of other higher alkanes and even a lesser percentage of carbon dioxide, nitrogen, and hydrogen sulfide. Natural gas is often described as the cleanest fossil fuel. It produces less carbon dioxide than oil and coal, and potentially fewer pollutants than other hydrocarbon fuels. However, in absolute terms, it comprises a substantial percentage of human carbon emissions, and this contribution is projected to grow.

Coal/pet coke: Petroleum coke is a carbonaceous solid derived from oil refinery coker units. It is far more polluting than Fossil fuel oils.

There will be a world-wide scarcity for the above mentioned energy sources with great consequences for pricing and availability.

Nuclear energy: nuclear power is a low carbon power generation method of producing electricity, with emissions similar to some other renewable sources in a comparison of greenhouse gas emissions. There is an ongoing debate about nuclear power. Proponents contend that nuclear power is a safe, sustainable energy source that reduces carbon emissions. Opponents contend that nuclear power poses many threats to people and the environment.

4.4.2 Renewable Energy: technically & commercially proven

Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electrical power. Onshore wind is an inexpensive source of electricity, competitive with or in many places cheaper than fossil fuel plants. Utility companies increasingly buy surplus electricity produced by small domestic wind turbines.[2] Offshore wind is steadier and stronger than on land, and offshore farms have less visual impact, but construction and maintenance costs are higher. Wind power is plentiful, renewable, widely distributed, clean, produces no greenhouse gas emissions during operation and uses little land. Wind power is very consistent from year to year but has significant variation over shorter time periods. As the proportion of wind power increases, a need to upgrade the grid, and a lowered ability to supplant conventional production can occur. Power management techniques such as having excess capacity storage, dispatchable backing sources, storage such as pumped-storage hydroelectricity, exporting and importing power to neighboring areas or reducing demand when wind production is low, can greatly mitigate these problems. In addition, weather forecasting permits the electricity network to be readied for the predictable variations in production that occur.

Solar energy: radiant light and heat from the sun, is harnessed using a range of ever-evolving technologies such as solar heating, solar photovoltaic and solar thermal electricity. Active solar techniques include the use of photovoltaic panels and solar thermal collectors to harness the energy. The development of affordable, inexhaustible and clean solar energy technologies will have huge longer-term benefits. It will increase countries' energy security through reliance on an indigenous, inexhaustible and mostly import-independent resource, enhance sustainability, reduce pollution, lower the costs of mitigating climate change, and keep fossil fuel prices lower than otherwise.

Biomass: most often refers to plants or plant-derived materials. As an energy source, biomass can either be used directly via combustion to produce heat, or indirectly after converting it to various forms of biofuel. Conversion of biomass to biofuel can be achieved by different methods which are broadly classified into: *thermal*, *chemical*, and *biochemical* methods. Wood remains the largest biomass energy source today; examples include dead trees, yard clippings, wood chips and even municipal solid waste.

Geothermal energy is thermal energy generated and stored in the earth. The geothermal gradient, which is the difference in temperature between the core of the planet and its surface, drives a

continuous conduction of thermal energy in the form of heat from the core to the surface. Geothermal power is cost effective, reliable, sustainable, and environmentally friendly, but has historically been limited to areas near tectonic plate boundaries. The earth's geothermal resources are theoretically more than adequate to supply humanity's energy needs, but only a very small fraction may be profitably exploited. Drilling and exploration for deep resources is very expensive. Forecasts for the future of geothermal power depend on assumptions about technology, energy prices, subsidies, and interest rates. The cost of generating geothermal power has decreased by 25% over the past two decades.

Hydroelectricity: is the term referring to electricity generated by hydropower; the production of electrical power through the use of the gravitational force of falling or flowing water. It is the most widely used form of renewable energy, accounting for 16 percent of global electricity generation. The cost of hydroelectricity is relatively low, making it a competitive source of renewable electricity. The average cost of electricity from a hydro plant larger than 10 megawatts is USD 0.03 to 0.05 per kWh. Hydro is also a flexible source of electricity since plants can be ramped up and down very quickly to adapt to changing energy demands. However, damming interrupts the flow of rivers and can harm local ecosystems, and building large dams and reservoirs often involves displacing people and wildlife. Once a hydroelectric complex is constructed, the project produces no direct waste, and has a considerably lower output level of the greenhouse gas carbon dioxide (CO_2) than fossil fuel powered energy plants.

Waste-to-energy (WtE) or **energy-from-waste** is the process of generating energy in the form of electricity and/or heat from the incineration of waste. Most Waste to Energy processes produce electricity and/or heat directly through combustion, or produce a combustible fuel commodity, such as methane, methanol, ethanol or synthetic fuels. Incineration, the combustion of organic material such as waste with energy recovery, is the most common Waste to Energy implementation. Modern incinerators reduce the volume of the original waste by 95-96 percent, depending upon composition and degree of recovery of materials such as metals from the ash for recycling. Incinerators may emit fine particulate, heavy metals, trace dioxin and acid gas, even though these emissions are relatively low from modern incinerators. Other concerns include proper management of residues: toxic fly ash, which must be handled in hazardous waste disposal installation as well as incinerator bottom ash, which must be reused properly. Critics argue that incinerators destroy valuable resources and they may reduce incentives for recycling.

4.4.3 Renewable Energy Sources: under development

Ocean Energy: covers all technologies to harvest the renewable energy of our seas and oceans other than offshore wind. It can be harvested in many forms, for example through wave energy and tidal stream energy. Moreover, ocean energy can help to balance out the output of other renewable energy sources such as wind energy and solar energy to ensure a steady aggregate supply of renewable energy to the grid. Examples of ocean energy are:

- Ocean thermal energy conversion (OTEC): uses the temperature difference between cooler deep and warmer shallow or surface ocean waters to run a heat engine usually in the form of electricity. OTEC is a base load electricity generation system, i.e. 24hrs/day all year long. However, the temperature differential is small and this impacts the economic feasibility of ocean thermal energy for electricity generation. OTEC can also supply quantities of cold water as a by-product. This can be used for air conditioning and refrigeration.
- Wave energy: is the transport of energy by ocean surface waves, and the capture of that energy for electricity generation, water desalination, or the pumping of water (into reservoirs).
- Tidal stream energy: Tidal stream generators make use of the kinetic energy of moving water to power turbines, in a similar way to wind turbines that use wind to power turbines. Some tidal generators can be built into the structures of existing bridges or piers, involving virtually no aesthetic problems.

Ice storage air conditioning is the process of using ice for thermal energy storage. A small storage facility can hold enough ice to cool a large building from one day to one week. Replacing existing air conditioning systems of large buildings with ice storage offers a cost-effective energy storage method, enabling surplus wind energy and other such Intermittent energy sources to be stored for use in chilling at a later time. In this application, a relatively standard chiller runs at night to produce an ice pile. Water then circulates through the pile during the day to produce chilled water that would normally be the chiller's daytime output.

4.5 Optimum Energy Mix for Sint Maarten

The types of renewable energy options available for Sint Maarten are dependent on social, economic and environmental issues, electric infrastructure, energy supply systems and regulation factors that exist on the island. These issues will affect the costs, economics and viability of renewable energy options. Significant reductions in use of fossil fuels for electric generation can be obtained with the installation of a variety of renewable energy options.

The results of the research done for this report presents the following renewable options that can potentially be used and practically implemented in Sint Maarten.

Solar Energy

Most commonly used solar technologies are solar thermal (hot water heating) and solar photovoltaic (PV electricity). Solar energy varies based on sunrise, sunset and cloud conditions. But solar systems output can be modeled very accurately based on the timing of sunrise and sunset and on predicted weather conditions.

Solar hot water heaters: There is a large potential for fossil fuel savings by replacing existing hot water systems with solar hot water heaters. Efficiency of the systems can run as high as 80%, with a payback time of less than 5 years. It is estimated that about 14 % of the average home's electric consumption is for hot water use, resulting in an average fuel saving of 300 liters per household[1]. Commercial solar hot water systems in for the average 100-room hotel can save over USD 166.000 annually.

Photovoltaic (PV). Advances in solar photovoltaic (energy generated by solar panels) has reduced the cost of systems significantly over the last few years, and cheaper technologies are coming out almost every day. The solar energy generations works by converting sunlight directly into electricity. Due to land shortage, it is strongly advised that the focus for Sint Maarten is on rooftop solar panels for households and commercial buildings, small scale energy production, on schools, government buildings, hospital and other larger commercial buildings. Also solar covered parking areas are very feasible for Sint Maarten, especially if combined with charging systems for electric cars and buses. Annual electric savings for an average 20 solar panel system per household for a total output of 4 kW would amount to USD 3,600.- savings per year with a payback time with current energy prices of 4 to 5 years. Annual fuel savings for N.V.GEBE would amount to roughly 3,000 liters per household.[6] Coupling rooftop solar panels with large scale generation options can result in all of Sint Maarten's electric supply being provided by renewable energy.

PV also allows new forms of revenue by feeding back into the grid: Prosumer, consumers who also generate energy.

[6] *Sint Maarten Sustainable Energy Assessment, a study of Electric Supply options, DNV KEMA, April 2012*

Wind Energy from wind turbines

Wind power is a very well developed technology with worldwide experience. The most likely location for wind development on Sint Maarten is offshore because of limited space onshore, however possible locations must be further explored, including an Environmental Impact Assessment for every potential location. New turbines using direct drive technology and better foundations promise reduced cost of offshore wind. The gravity based and compact foundations will minimize disturbance of the seabed and marine life and can reduce overall installation costs. Sea conditions and shallow waters make the installation of offshore wind a good candidate for reducing the dependency on fossil fuels. The key issue is the ability of the units to withstand hurricanes. There are specifically developed models for hurricane-prone areas.

The wind resources of Sint Maarten (wind speed and profiles) hold the promise of wind power production with better capacity factors than almost anywhere else in the world. But wind energy varies significantly due to cyclic nature of wind conditions. The production from wind power requires the use of actual measured wind data, and requires two years of wind measurement, so electric output of the wind units can be projected based upon configuration, height and size of the turbines. The new generation of wind turbines generate 5 to 8 MW per turbine, and produce during 63% of the time at least 80% of its capacity. A larger project would likely require some method of storage to be compatible with the load profile of the electric grid.

A way to introduce wind energy is to issue a Request for Proposals to find a suitable project developer for installing (off shore) wind turbines.

A two blade turbine specifically developed for hurricane-prone areas.

Waste to Energy

The planned Waste to Energy Plant (8 – 9.3 MW) will be in operation by 2016. The plant will be built, owned and operated by an Individual Power Producer (IPP). It has shown that tariffs to be paid to the IPP are not as favorable as tariffs for wind and solar power. The leveled costs of Energy for the Waste to Energy project are very high compared to the average cost of energy. But, in addition to reduction in consumption of fossil fuels, the Waste to Energy project resolves the critical problem of lack of landfill space and limitations of the existing landfill on Sint Maarten.

Geothermal

Geothermal energy technologies utilize natural heat produced from the earth and convert steam and hot water to electricity as the geothermal source rotates a turbine connected to a generator. Although Sint Maarten does not have the potential for geothermal energy for electric production, the islands of Saba and St. Eustatius have a high potential for geothermal energy. Sint Maarten, St. Eustatius and Saba have recently taken the initiative to research and develop the use of geothermal energy. Because of the small scale of Saba and St. Eustatius, it is interesting for them to have Sint Maarten participate in this initiative. Sint Maarten, in turn, would benefit from the lower energy prices. It is estimated that Saba can support a 100 MW or larger geothermal project based upon preliminary investigations and issues of land mass utilization. The plant has to be interconnected via a 60 km submarine cable capable of moving 100 MVA of power. Estimated cost for a submarine cable would be USD 25 mln[7]. Advantage of geothermal energy is that it can be delivered under base load conditions, at reasonable tariffs, and it is available 24/7.

Liquid Natural Gas / Liquid Petroleum Gas

Conversion of the Heavy Fuel Oils generators to Liquid Natural Gas (LNG) or Liquid Petroleum Gas (LPG) will reduce the carbon footprint drastically as well as a reduction of emissions. However, LNG/LPG is an intermediate solution: it is still a non-renewable, finite energy source, even though studies show that the world's supply is enough for the coming 60 years. The expectation is that price for LNG will be favorable for the next 10-15 years, especially because of the controversial winning of Shale gas in the USA. But in the long term availability and pricing are still an issue.

The conversion of the engines to LNG needs a considerable investment[8] with a proportional payback period. Converting an engine to operate on gaseous fuel improves fuel efficiency in three ways:

- **Natural gas burns efficiently** – highest energy content fossil fuel.
- **Natural gas burns cleanly** – lower maintenance costs and emissions, cleanest fossil fuel.
- **Natural gas is attractively priced** – more power for less money: only ± 20% of the HFO price[9].

[7] *Sint Maarten Sustainable Energy Assessment, a study of Electric Supply options, DNV KEMA, April 2012*
[8] *Investment ± USD 900.000,- /MW, source N.V. GEBE.*
[9] *62 MW Power plant Gas consumption: USD 47,353.- per day, HFO consumption: USD 225,198.- per day. Source N.V.GEBE.*

Other options

In the near future there might be other Renewable Energy options for Sint Maarten than wind, solar, WTE and Geothermal, which are commercially and technically proven as of today. However, rapid improvements in the development of Renewable Energy sources imply that other renewable sources will probably be economically favorable in the medium to longer term, the payback time is getting shorter and shorter, and the technologies more affordable.

Examples of other options for renewable electricity generation may be the very promising Ocean Energies like Tidal and Wave energy, Deep See Water Cooling, Ocean Thermal Energy Conversion, where the difference in temperature between deep sea water and the surface water is transformed into electricity.

4.5.1 Estimated costs for Renewable Energy

Energy source	Generation cost of Energy USD / kWh
Solar Hot Water	0.10 – 0.13
PV residential	0.24
PV commercial	0.48
Off shore wind	0.17
WTE	0.08 – 0.12 (Average in the US)
Geothermal Project Saba	0.12 (0,02 – 0,10 average in the US)
N.V.GEBE	0.22

Source: DNV KEMA

Considering the high cost of electricity and the high amount of sun hours per day in the Caribbean it is estimated that an investment in solar panels can pay itself back within 4 to 5 years[10], without incentives.

[10] *Source: KEMA presentation at the Caribbean Renewable Energy Forum, 2013*

4.6 Impact of RE on the Utilities Business and energy management

4.6.1 Intermittency of Renewable Energy technologies

Renewable energy systems can be one of two types:

- "Firm" sources of generation, such as geothermal, biomass, hydro-electric or waste-to-energy, which are generally available 24/7 and can be dispatched to meet variations in demand.
- "Intermittent' sources such as wind and solar, that depend on how strongly the wind is blowing and the sun is shining, and which require storage or other sources of energy to be available on a standby basis to make up for fluctuations in there intermittent sources.

In order to maintain a consistent power supply in an energy system based on solar and wind energy, power grid operators have to precisely balance the amount of power being generated against the amount being used, and some form of standby supply must be built into the system.

The power grid system faces three different types of challenges:

- Very short term changes in supply or demand (seconds- minutes):
  Sudden fluctuations in wind speed or overcast for solar. This can be solved by running generators at low loads (e.g. maintaining spinning reserves) or by using short term storage technologies (e.g. batteries or flywheels).
- Medium-term changes in supply or demand (hours):
  At night when there is no solar generated energy, the fluctuation can be met by firing up peaking generators, or addressed with storage technologies that hold larger amounts of energy (e.g. flow batteries, deep sea storage, ice storage, charging electric buses at night: batteries can act as storage).
- Longer term variations in supply or demand (days to weeks):
  Solar energy and wind speeds also vary across different seasons, and substantial back-up capacity in the form of a dispatchable[11] power source is required. Fossil-fuel based peaking plants typically provide this. Currently, the only renewable option for longer-term storage is large hydro-electric reservoirs.

These types of challenges will require investments in increasingly large amounts of storage capacity, sophisticated control systems, and back-up sources of energy generation.

Increasing the amount of renewable energy sources in the system will reduce the level of fuel and overall system costs. On the other hand, the level and amount of issues related to operations of the power system increase with an increasing amount of intermittent renewable energy sources in the system, resulting from increasing system balancing efforts to maintain security of supply. These

[11] *Dispatchable power is generating capacity that can be turned on and off on relatively short notice.*

efforts are likely to involve increasing spinning reserve requirements from dispatchable units and/or significant investments in storage capacity. The technical integration of the renewable technologies and capacities need thus to be assessed in terms of how to maintain security of supply and to determine related spinning reserve requirements, as well as the economic implications of the according system configuration.

4.6.2 Grid Stability

The addition of significant amounts of renewable energy will require upgrades to the electric grid, and a reliable electricity network with adequate distribution capacity is vital, with an adequate network infrastructure and grid stability. If intermittent (solar and wind) renewable energy levels rise above 25 – 30 % of total load, it can cause problems with maintaining voltage on distribution circuits within acceptable voltage limits. Energy storage and buffering allows for better management of produced energy. As a result, the time shift between the actual energy production and energy consumption is manageable. The most common energy storage approach is the use of batteries available in many different forms.

Other power grid stability issues which may need to be addressed by applying more spinning reserves, introducing storage, smart controls, smart grid, demand response, and curtailment. Advice is that N.V. GEBE conducts a renewable energy integration study to assess the potential impact of renewables on electric grid operations, and research at feeder level with growing integration of small scale renewables:

- Load flow and short circuit studies at feeder level
- Smart grids
- Energy storage
- Protection scheme and protection controls review
- Voltage regulator review
- Capacitor banks review
- Safety issues.

4.6.3 Smart Grid

A Smart grid is a network of integrated micro grids (see figure below) that will provide more electricity to meet rising demand, increase reliability and quality of power supplies, increase energy efficiency, and ability to integrate renewable energy sources into the power network. A smart grid possesses demand response capacity to help balance electrical consumption with supply, as well as the potential to integrate new technologies to enable energy storage devices and the large-scale use of electric vehicles. Another benefit is that reliability is greatly improved, electrical losses are reduced as are capital expenditures and maintenance costs. A smart grid will provide greater control over energy costs and a more reliable energy supply for consumers. Environmental benefits include reduced peak demand, integration of more renewable power sources, and reduced CO_2 emissions and other pollutants (sulfur dioxide).

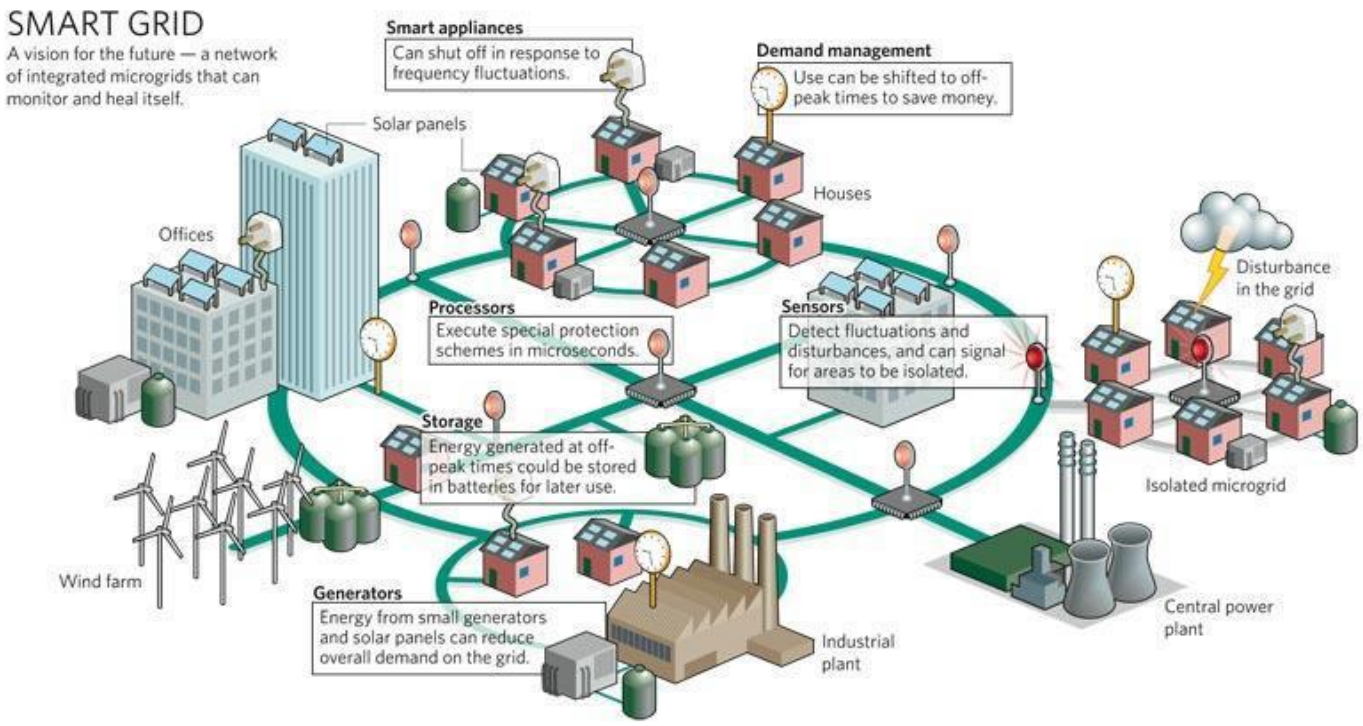

Figure 2: vision for the future: example of a smart grid

4.6.4 Net metering and feed-in tariffs

Small scale power generation with e.g. solar panels has a big potential for households and small businesses. When these energy sources produce more energy than a household consumes, the excess in energy will be delivered back into the grid. The tariff received for this excess energy is called feed-in tariffs. With the regular (analog) meters the meter will run backwards when (renewable) energy produced by the consumer is fed into the grid, so energy used is compensated by feeding-in of the renewable energy, which is called net metering. In such case, the feed-in tariff is equal to the unit-price of energy the consumer pays to the electric utility. This can lower the electricity bill substantially, depending on the amount of renewable energy produced. N.V. GEBE is gradually replacing the analog meters to digital ones, so the amount of generated energy fed into the grid can be closely monitored and measured.

There are a few additional advantages. It is a very sustainable way of making the power production more sustainable, it is very beneficial for the environment, and it promotes the awareness of the usage of energy and it helps Sint Maarten to become more sustainable. Technically it is positive that the peak demand during the day is leveled by the generation of solar energy. Financially it is interesting for N.V.GEBE and government that consumers invest in their own power production and as such pay for improving the generation of electricity on Sint Maarten.

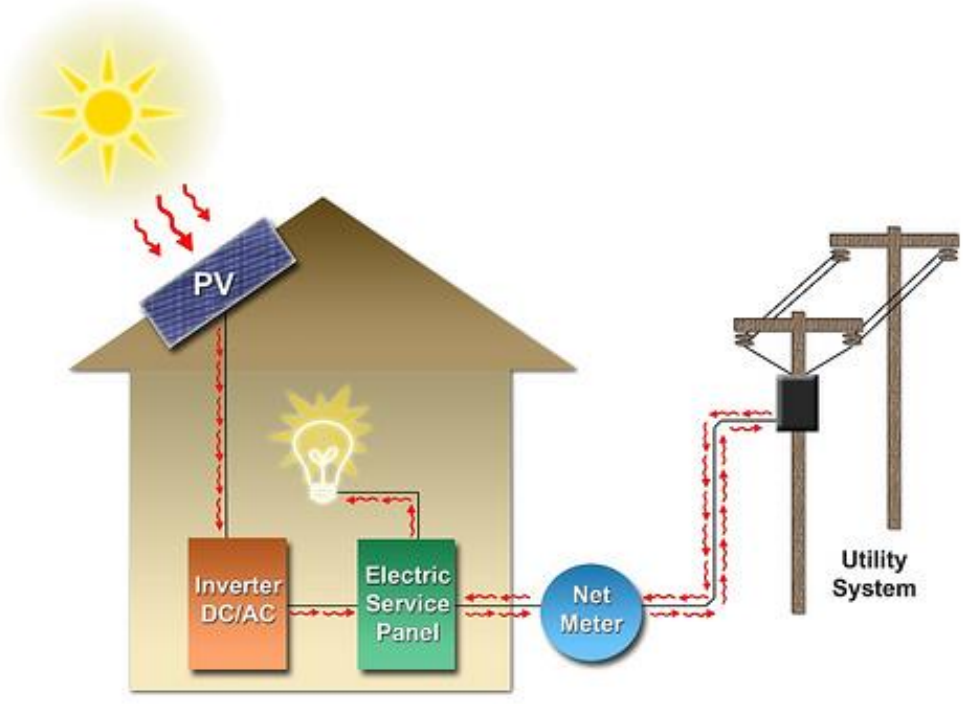

Figure 3: energy generation through PhotoVoltaics (PV: solar energy generated by solar panels)

Adjustment of legislation can regulate that households and small companies can feed back into the grid, and the discussion will have to be if they are allowed to feed back more or less than the same amount of energy they have used on average over the previous year. This stimulates sustainable energy generation by households without the necessity to upgrade the power generation by N.V. GEBE. The small scale renewable energy generation has a stabilizing effect on the net and of the system. This is different for large scale renewable energy producers, a feed-in tariff has to be determined between these larger power producers and N.V.GEBE.

4.6.5 Financial implications

In connection with costs for measures to maintain grid stability, N.V.GEBE has its tariffs based on a base rate (for operational and capital expenditures and a reasonable rate of return) and a fuel surcharge, adjusted monthly for the actual fuel cost per kWh. It is suggested to incorporate the prices paid for renewable sources into an 'Energy Charge' which replaces the 'Fuel surcharge'. This means that next to fuel costs per kWh also costs per kWh for the renewable energy as purchased from Individual Power Producers are incorporated into an Energy Charge. If the Renewable energy prices per kWh are lower than the fuel costs per kWh, the Energy Charge will be lower than what the Fuel Surcharge will be without the Renewable Energy sources. This way the benefit of lower costs per kWh for renewables is directly passed on to the customers. However, this has to be researched further.

5 FOCUS ON ENERGY EFFICIENCY

Every dollar spent on energy efficiency can return 3 dollars in energy savings!

Energy is one of the most important commodities of modern society. It must be used in the most economical way, being as sustainable as possible and causing minimal harm to society and the environment.

The Trias Energetica is a model developed by the Delft University of Technology, and acts as a guide for energy sustainability. It makes clear that energy savings have to come first on the path to environmental protection. It is our guide line for being as sustainable as possible: first reducing the need for energy, second fulfill the need for energy by means of renewable energy and finally to make use of fossil fuels in an optimal way, thus helping to cut energy costs, to be less vulnerable to the volatile energy market and to be prepared for the future.

In the next chapter there will be an elucidation on energy efficiency in different sectors.

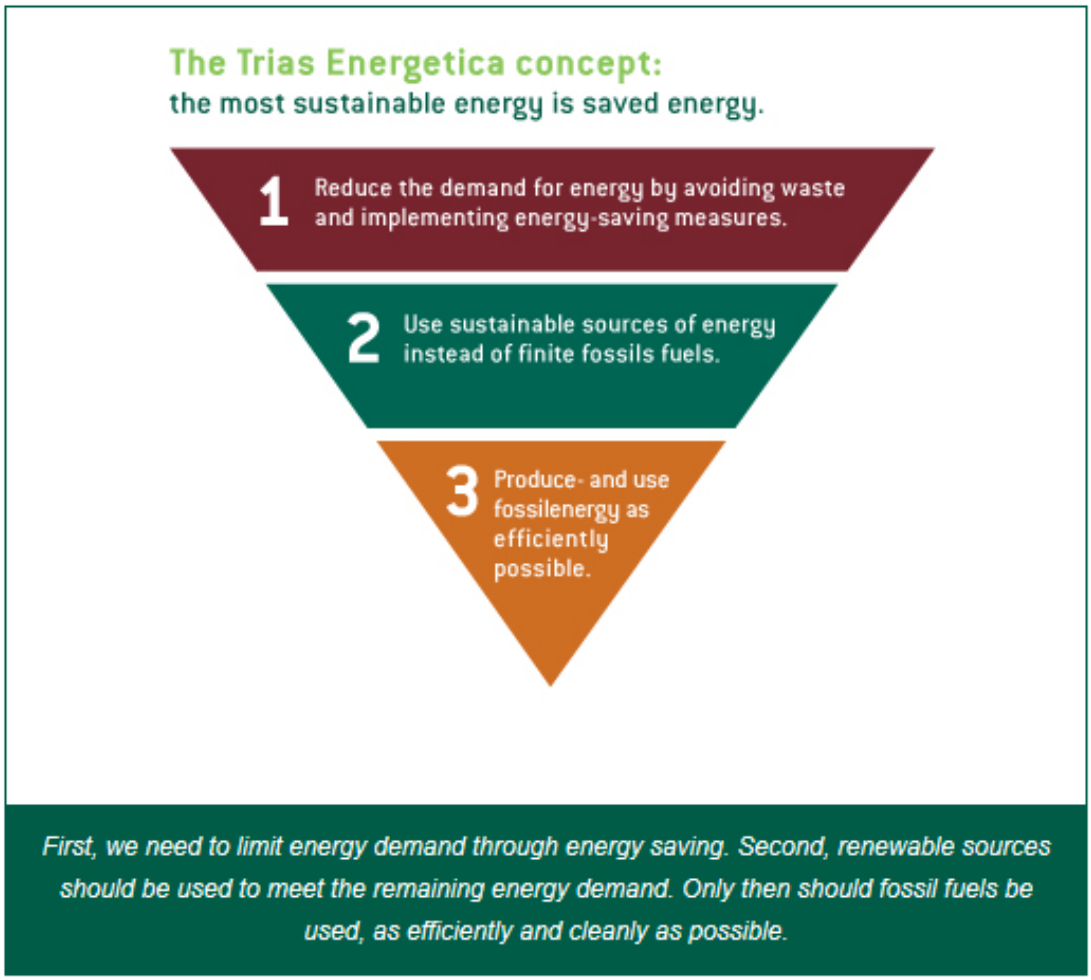

Figure 4: Trias Energetica Concept

5.1 Energy efficiency in the different sectors

As oil price trends indicate, the era of an unbridled supply of cheap energy is over. Fossil fuels are becoming scarce and clean energy has yet to become fully scalable. Saving energy provides the most immediate and effective way to become a more sustainable island and slow global warming. Energy efficiency and reducing energy consumption can be attained via the following measures.

Built environment

- Energy audits (gov. buildings, schools, install energy manager).
- Energy efficient technologies in the design of new buildings.
- Retrofitting of existing buildings.
- Introducing a Green building code.

Households, businesses & tourism

- Solar panels on roofs, solar hot water.
- Efficient AC units & appliances, water saving measures.
- Replace most used lights into LED, install room occupancy sensors, motion sensors, dusk-to dawn lights, and electric timers on pool pumps, LED street lights.
- For hotels: ICE based cooling systems, deep seawater cooling systems.
- Awareness campaigns: small affordable adjustments & behavior change can reduce energy bills by 15 – 25 %.

Transportation and mobility

- Promote electric transportation: Electric taxis, (school) busses, electric cars, charged with energy from solar panels.
- Replace Government L-vehicles by electric cars when new vehicles are needed.
- Opportunity charging: charge taxis during every break: they can get 400 miles/day.
- Buses take 2-3 hr. to charge, rest of the night they can act as a grid stabilizer and load stabilizer.
- Electric transportation Cover parking areas with PV, with charging stations for electric cars.
- Electric bus or electric train in Philipsburg.



5.2 Opportunities with Renewable energy: Diversification of Economy

One of Government's goals is to diversify the economy by developing industries additional to our main pillar, being the tourism industry. The Renewable Energy industry has a lot of potential with regards to creating significant amount of jobs and promote a knowledge based pillar to the economy:

Direct Employment can be stimulated in the field of:

- Small and Medium Entrepreneurship in the field of production of (renewable) energy.
- Retrofitting of existing buildings.
- Installation of energy efficient and conservation measures and systems, for example certified electricians for installation of rooftop Solar PV panels.

Indirectly, the Renewable Energy industry can create employment by:

- Promoting Sint Maarten as Export knowledge hub – specialized in Renewable Energy - to other surrounding islands.
- Stimulate MICE tourism by holding Renewable Energy conferences.
- Spin-off effect to already existing Financial industry.

Aruba Airport: impression of the USD 11 mln. solar covered parking project, with charging stations for electric cars. It will generate 3 MW, equivalent to the power the airport uses during its peak hours, to be completed by the end of 2014.

6 ROLES AND RESPONSIBILITIES FOR A SUCCESSFUL IMPLEMENTATION

A successful transition to a greener and sustainable island depends on the input and efforts from each stakeholder to reach the goals mentioned in this policy:

6.1 Roles and responsibilities of Government

Government's targets will be to reduce dependence on oil by fuel diversification and with special emphasis on renewable energy sources that can contribute to a lower environmental burden in an economically feasible manner; and assuring access to affordable energy by the poor and vulnerable customers in line with government policy, accompanied by corresponding direct or indirect subsidies in order to maintain financial health of the utility.

Government's role is to facilitate an enabling environment for introduction of Renewable Energy by:

- Executing the Implementation Plan to the National Energy Policy (in coop. with N.V.GEBE);
- Developing or updating legislation;
- Preparing a template for a ministerial exemption to enable larger consumers (> 500 kVA, which is ± 450 kW) to feed Renewable Energy back into the grid;
- Allow IPP's and consumers to sell electricity from renewable sources to the grid, based on a power purchase agreement, purchased and distributed by N.V.GEBE, at competitive prices.
- Adjust articles of Corporation of N.V. GEBE to incorporate the vision on renewable energy;
- Establish a regulatory body and an independent energy regulator;
- Create (fiscal) incentives for Renewable Energy for consumers:
- Create incentives for Electric transportation, charged by solar energy;
- Develop a program for introducing attractive incentives for solar water heating;
- Develop a program for low income consumers for solar energy (social housing projects)
- Study interconnecting with the Saba and St. Eustatius Geothermal projects;
- Request for Proposals for Individual Power Producers (IPP's) for solar covered parking, with charging stations for electric vehicles, and for rooftop solar on government buildings;
- 'Lead by example': focus on energy efficiency:
  - Energy audits of government buildings.
  - LED lighting and other energy efficiency and water saving measures in government buildings and schools.
  - Promote e-transportation and gradually replace L-cars by e-cars, powered by PV.
  - Start awareness campaign.
- An energy efficiency program for stimulating the consumers to reduce their energy consumption, and a 'Green' campaign and public awareness.

6.2 Roles and responsibilities of N.V. GEBE

N.V. GEBE is a fully owned Governmental company and the sole supplier of electrical energy according to the Energy Concession d.d. July 16, 2010, which will expire after 25 years. However, the issues Sint Maarten is facing regarding sustainability (see chapter 4) are forcing Government and N.V. GEBE to revise the agreements in the concession, and rethink N.V. GEBE's role:

- Transform from an electricity producer to an electricity and power grid manager;
- Ensuring a reliable power supply at highest quality to all sectors of the society against lowest costs as possible and at the lowest burden as possible for the environment;
- Maximizing the efficiency of energy use in production, distribution and end-use;
- Increase in efficiency→ needs to be reflected in fuel clause;
- Develop an 'Interconnection Policy' including technical and commercial requirements for connecting the distributed renewable energy sources to the grid;
- Upgrade and adjust grid for integrating Renewable Energy and possible net-metering;
- Install Smart Grid;
- Enter reverse metering agreements for households. For big users: set up feedback agreement; feed-in tariffs, possible pre-paid metering.
- Study the possibilities of the conversion of engines to Liquid Natural Gas or LPG: significant lower fuel costs, and it substantially reduces Greenhouse Gases and other pollutants;
- Replace Heavy Fuel Oil engines by Dual Fuel engines or Spark Gas Engines;
- Effort to decrease dependency on fossil fuels by going into Renewable Energy Technologies via potential Individual Power Producers (IPP);
- Request for Proposals for (off shore) wind and Photovoltaic/Solar Energy projects;
- Study possibilities of pre financing PV and Solar Water heaters, so average households can afford Renewable Energy;
- Study interconnecting with the Saba and St. Eustatius Geothermal projects;
- Cooperation with French side: shared use of electricity, adapt grid for connection with French side and possibly with Anguilla
- Review legal obligations of Concession with SOL to be able to use other suppliers;
- Create Public awareness and promote Energy efficiency and savings;
- Open information center for renewable energy and energy efficiency at N.V. GEBE.

6.3 Society's Role

Public needs to be aware of their social and corporate responsibility in energy saving, energy efficiency and become environmentally aware. For example:

- Install roof top solar panels and solar water heaters.
- Change to LED lighting for most used lights, use motion detection and dusk to dawn lights.
- Energy efficient Air Conditioning and appliances, and efficient use of AC.
- Be energy efficient and environmentally aware.
- Install water saving measures.
- Use environmental friendly products.

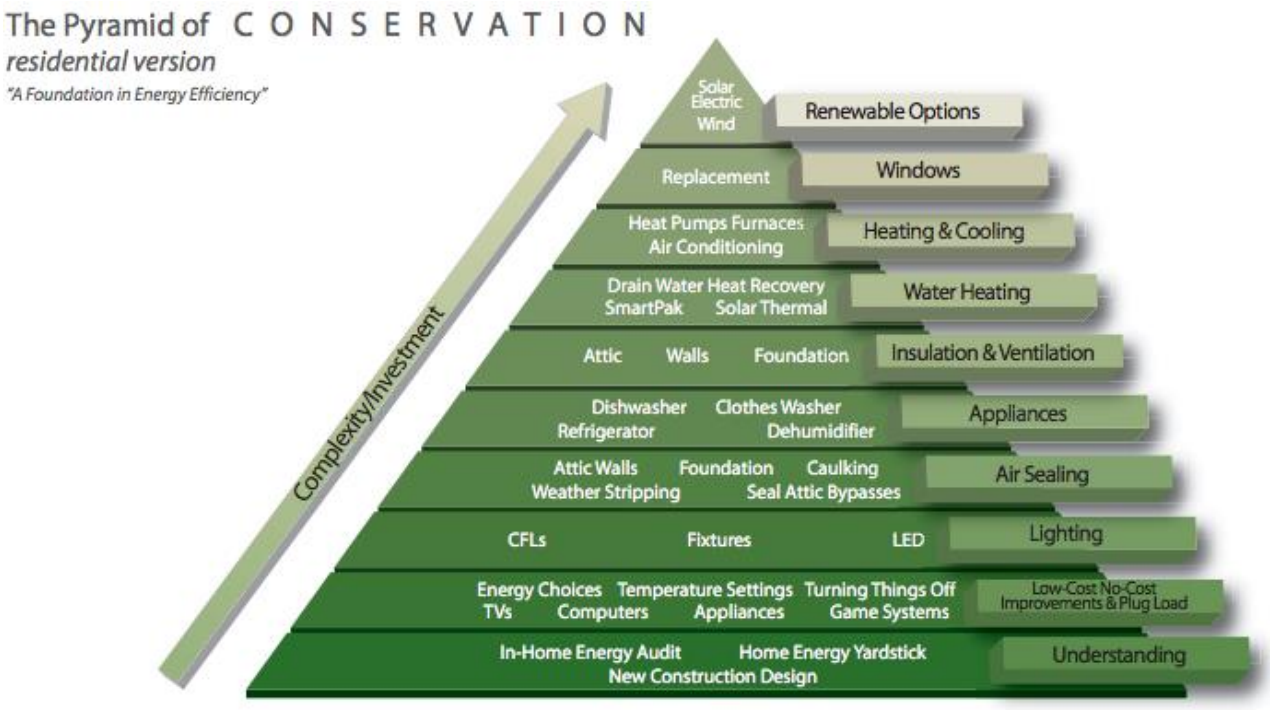

Figure 5: The pyramid of conservation for residences

7 VISION FOR SINT MAARTEN

7.1 Vision: 80% Renewable by 2020, 100% HFO free by 2025

The objective is to provide Sint Maarten an assessment of renewable energy options and recommendations for renewable options that will result in 35% Renewable Energy by 2016 (18% due to the planned Waste to Energy plant).

By 2020 Sint Maarten's goal is to have 80% of the electricity produced with Renewable Energy and alternative fuels. Several potential options are listed in the table below in order to achieve 80% of Renewable Energy by 2020, on the basis of an average production of 50 MW produced by N.V. GEBE.
By 2025 Sint Maarten's vision is to have achieved 100% Heavy Fossil fuel Oils free.

2014 – 2016: 35% Renewable Energy by 2016

Result of actions to be taken in period 2014 – 2016:

2014 - 2016 actions	MW	% RE	
Waste to Energy Plant	8 - 9,3	16 - 18 %	in operation 2016[12]
Solar energy (PV) residential and solar hot water (focus on rooftop)	1 - 3	2 - 6 % [13]	
Solar energy (PV) commercial (incl. 2 & 5 MW projects, and 755 kW Westin project)	8	16 %	Tenders for IPP's
Issue Request for Proposals for Wind 3-5 MW	-	-	IPP, in operation in period 2017-2020
Total Renewable Energy	**20 MW**	**35 %**	
Purchase of new Dual fuel engines or Spark Gas engines	to be determined	to be determined	GEBE

Other actions to be taken in period 2014 – 2016:

- 5% Savings thru Energy Efficiency and Awareness.
- LED streetlights: Replacement of all streetlight fixtures to LED fixtures within a period of 4 years (50% energy savings).
- Fiscal incentives and awareness campaign.
- Regulatory body and Legislation.

[12] *Depending on negotiations in contract phase and permit process*
[13] *Depending on initiatives by households*

- Renewable Energy and Energy Efficiency center at N.V.GEBE.
- Initiate meetings with LNG/LPG suppliers about availability for Sint Maarten.
- Research connection with Saba and St. Eustatius Geothermal projects.

2017 – 2020: total 80% Renewable Energy and 30 – 40% alternative fuels by 2020

Result of actions to be taken in period 2017 - 2020:

Actions in period 2017 - 2020	MW	% RE	
More Solar PV residential and solar hot water	1	2 %	
More Solar PV commercial (focus on rooftop solar) + 4 MW PV at Waste to Energy plant	7	14 %	IPP
(Off shore) Wind energy	15	30 %	IPP
Total Renewable Energy added in 2017- 2020	**23 MW**	**46 %**	
Total Renewable Energy by 2020	**40 MW**	**80 %**	
LNG/ LPG conversion or Dual fuel/Gas spark engine	16 - 22	30 - 40 %	2-3 new engines[14]

Other actions to be taken in period 2017 – 2020:

- 5% more Savings thru Energy Efficiency and Awareness.
- LED streetlights: continue to replace all 3200 - 3500 streetlights before 2018.
- Extend smart grid by N.V.GEBE.
- Fiscal incentives and ongoing awareness campaign.
- New Regulatory body and Legislation.
- Change Fuel clause to Base rate (Dutch: vast recht), prepaid meters

2020 – 2025: Heavy Fuel Oils free! 85% Renewable Energy and HFO free engines at N.V. GEBE

- Further reduction of dependency on heavy fossil fuel oils through awareness campaigns on energy efficiency, energy savings, installing more solar PV and solar water heaters, wind turbines and electric transportation.
- LNG/ LPG conversion/ Dual Fuel or Spark Gas engines of all 'peak' engines 50 MW.
- Extend Smart Grid.

[14] *Information received from seminars held by the end of 2013, states that LNG will most likely be available within the next 3 to 5 years in our region. Therefore, this is still a topic of discussion.*

7.2 Summary of goals for a Sustainable and Heavy Fuel Oils Free Future

Summary of **all actions** in the period 2014 till 2025:

% Renewable	% by 2016	ttl % by 2020	ttl % by 2025
Waste to Energy Plant	18 %	18 %	18 %
Solar PV residential (focus on rooftop)	2 %	4 %	5 %
Solar PV commercial (focus on rooftop)	16 %	30 %	32 %
(Off shore) Wind Energy	-	30 %	30 %
Total Renewable Energy	**35 %**	**80 %**	**85 %**
LNG conversion/dual fuel/spark gas 2 x 11 MW, 4 x 8 MW	to be determined	30 %	all peak engines

To reach these goals it requires commitment from all stakeholders:

- Government.
- N.V. GEBE.
- Public (households & businesses).

7.3 Immediate actions for promoting Renewables to reach 35% Renewable Energy by 2016

Sint Maarten has to immediately initiate steps to promote Renewable Energy:

- Government has to facilitate with incentives and legislation to make renewable energy interesting for the public
- Promote solar hot water heating
- Promote residential solar energy (focus on rooftop PV!)
- Promote commercial solar energy (focus on rooftop PV!)
- Request for proposals for commercial solar projects and wind energy
- Promote and purchase electric cars, charged by solar energy
- Start awareness campaign on Energy Efficiency and Renewable Energy
- Determine buy back rate/ feed in tariff for residential and commercial consumers
- Power Grid analysis and adjustments to be able to facilitate renewable energy
- Draft technical requirements, terms and conditions for solar energy (electricians).

8 ACTIONS & CONCLUSIONS

Solar (preferably rooftop installations), Wind, Waste to Energy and Geothermal sources of renewable energy are the most promising for Sint Maarten. These renewable energy sources are commercially and technically proven as of today. However, rapid improvements in the development of renewable energy sources imply that other renewable sources will probably also be economically favorable in the medium to longer term, the payback time of all renewable energy sources is getting shorter and shorter, and the technologies more affordable.

Examples of other options for renewable electricity generation may be the very promising Ocean Energies like Wave energy, Deep See Water Cooling, Ocean Thermal Energy Conversion, where the difference in temperature between deep sea water and the surface water is transformed into electricity.

8.1 Targets for Action

The support of every citizen and stakeholder must help to achieve the Renewable Energy and Sustainability vision for Sint Maarten. The following actions will contribute towards a sustainable development of Sint Maarten, will reduce the country's dependency on imported fuels with the ever increasing fuel costs, will help to lower electricity prices for consumers and also will reduce the high carbon footprint per capita of Sint Maarten.

A separate implementation and action plan is drafted; the summarized targets are defined as follows:

CHANGE AS QUICKLY AS POSSIBLE TO RENEWABLE ENERGY SOURCES

Target: 35% of Sint Maarten's electricity demand will be produced with Renewable Energy sources by the end of 2016. 80% of the electricity demand in the year 2020.

- Promote **rooftop** Solar panels for households and commercial buildings.
- Install **rooftop** Solar panels on schools and government buildings.
- Promote solar water heaters.
- Request for proposals for wind turbines and for solar car parking and rooftop solar projects.
- Conversion of N.V. GEBE's heavy fuel oils engines to alternative fuels like LNG/ LPG. Target is to produce at least 30% of N.V. GEBE's produced electricity with natural gas as of 2020. (LNG will most likely not be available within the next 3 to 5 years in our region. Therefore, this is still a topic of discussion.)
- Allow individual power producers to sell electricity to N.V. GEBE based on a power purchase agreement.
- Determine feed-in tariff and allow consumers to sell their excess renewable electricity to N.V. GEBE at a reasonable rate.
- Introduce a regulatory body and a regulatory framework for regulating the power sector.
- Establish requirements for Solar Energy installations and train and certify electricians to install solar panels safely.
- Power Grid analysis to facilitate renewable energy and roll out 'smart grid'.

- Study transformation of N.V. GEBE into 'net manager'.
- Stimulate electric transportation and electric cars charged by solar energy.
- Draft a sustainable mobility plan (electric cars, electric scooters, electric bikes, free 'hop on-hop off' electric buses in Philipsburg, adequate sidewalks and bicycle lanes).
- Build Waste to Energy plant.
- Study the possibilities to connect with geothermal projects on Saba and St. Eustatius, and options of interconnection with other islands for importing "green" electricity.
- Introduce an Energy Efficiency program, aiming at a reduction of power usage of at least 10%.
- Start awareness campaign.
- Train energy managers for government buildings, and perform energy audits.
- Open information center for Energy efficiency and Renewable energy at N.V. GEBE.
- Set up Tax incentives for Renewable Energy and Energy Efficiency
- Further studies will be performed towards identification of the achievable total percentage of renewable energy, including considerations of introducing storage, demand response and the smart grid concept.

8.2 Implementation and timeline

The activities of the Energy Implementation Committee who will be in charge of preparing the implementation of Energy Policy Issues resulted in a separate list of actions. Targets for completion of these actions are added in a table of activities in a separate report. The Energy Implementation Committee will report quarterly to the Minister of VROMI on progress of the implementation activities.

The renewable energy market is a fast changing market, newer and cheaper technologies are coming out every day and Renewable energy is getting more affordable for every one every day. In 80 countries around the world solar energy is already the cheapest energy source.[15]

[15] *Al Gore, The turning point, new hope for the climate, article in Rolling Stone Magazine, June 2014*

ADDENDUM

1. ACKNOWLEDGEMENTS

This policy is made possible because of the initiative of the Minister of VROMI, Hon. Maurice Lake and his cabinet, and the effort of the **Energy Committee**:

N.V. GEBE : R. Maduro, L. Benschop, R. Carty, A. Hodge
Cabinet of the minister : Mrs. V. Jansen – Webster, J. Richardson
Ministry of TEZVT : M. de Weever, Mrs. E. Radjouki
Ministry of VROMI : L. Brown, Mrs. C. Hooft Graafland

LDD, DSC Delft, Netherlands

2. ABBREVIATIONS

EE	Energy Efficiency
GEBE	N.V. GEBE: Electric Utility of Sint Maarten
HFO	Heavy Fuel Oils
IPP	Independent Power Producer
kVA	kilo Volt ampere
kWh	kilo Watt hour
LNG	Liquid Natural Gas, a less polluting and more cost efficient alternative to HFO's
MW	Mega Watt = 1000 kW
PPA	Power Purchase Agreement
PV	Photovoltaic cell: solar panel for generating electricity
RE	Renewable Energy
RES	Renewable Energy Sources
RET	Renewable Energy Technologies
RFP	Request for proposals
UNDP	United Nations Development Program
W2E	Waste to Energy

3. SOURCES

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4. FURTHER INFORMATION and WEBSITES

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