

NATIONAL ENERGY POLICY for Curaçao

Building a Sustainable Future



Ministry of
**Economic
Development**

For more information, please contact:

The Ministry of Economic Development, Policy Department

ADDRESS: Pletterijweg 43
Amidos Gebouw, 4de verdieping
Curaçao

PHONE: +5999 4621444
FAX: +5999 4626569

WEBSITE: www.gobiernu.cw.

DATE: February 9, 2018

PREPARED BY: The Government of Curaçao in
collaboration with D-Cision B.V.

This project is co-funded by the European Union, through the provision of technical assistance to the Government of Curaçao for the programming of the 11th European Development Fund (EDF).

Overview

Preface	6
PART 1. THE ENERGY POLICY	7
1. Quote	9
2. An energy policy, why?	9
3. What entails an energy policy	10
4. Components of the National Energy Policy	10
5. Our vision	11
6. Our mission	11
7. The Energy Policy Cube	12
8. Our six policy objectives	13
9. Our nine strategies	14
Strategy I: Solar panel electricity production	15
Strategy II: Wind energy	16
Strategy III: Natural gas	17
Strategy IV: Construction of a waste-to-energy facility	18
Strategy V: Energy efficient transport	19
Strategy VI: Energy efficient buildings	20
Strategy VII: Demand-side energy efficiency	21
Strategy VIII: Efficient system operation	22
Strategy IX: Efficient system planning	23
10 Policy on new energy technologies	24
11. Pilot projects	25
12. Institutions and instruments	26
13. Development of an Energy Act	26
14. Responsibilities for the energy policy	27
15. Secondary regulation	28
16. The role of the utility companies	28
17. Carrying out the energy policy	29
18. Monitoring and periodic review	29
19. Time path	30
PART 2. ELABORATION OF THE MISSION	31
1. Core principles of the energy policy	33
2. Enhancing energy security	34
3. Reducing the national energy consumption	37
4. Transparent and effective institutions and regulations	38
PART 3. STRATEGIC WORK PLAN 2018–2022	39
1. Introduction	41
2. Strengthening the institutions	42
2.1. Institutions	42
<i>The Energy Office</i>	42
<i>The regulator (BT&P)</i>	43
<i>Government departments</i>	44
2.2. Legislation	44

2.3. Instruments	45
2.4. Monitoring and evaluation	45
2.5. Actions to be taken	46
2.6. Project realization	47
3. Measures to enhance security of supply in the energy sector	48
3.1. Technologies	48
<i>Conventional energy technologies</i>	<i>48</i>
<i>Renewable energy technologies</i>	<i>48</i>
<i>Other technologies</i>	<i>50</i>
3.2. Regulatory measures	51
3.3. Financial and fiscal measures	51
3.4. Actions to be taken	51
3.5. Project realization	53
4. Measures to enhance efficiency and sustainability in the transport sector	53
4.1. Technologies	53
<i>Conventional energy measures for the transport sector</i>	<i>53</i>
<i>Renewable energy measures for the transport sector</i>	<i>55</i>
4.2. Actions to be taken	56
4.3. Project realization	56
5. Measures with respect to energy efficiency and energy conservation	57
5.1. Proposed measures	57
5.2. Actions to be taken	58
5.3. Project realization	60
6. Budget and financing	60
7. Monitoring and evaluation	61
APPENDIX: THE CURAÇAO ENERGY SECTOR	63
1. General	65
2. The Renewable Energy Policy of 2011-2015	66
3. Structure of the energy sector	68
4. Regulatory framework of the energy sector	71
5. Overview of the energy market	72
6. Electricity sector	76
6.1. Generation	76
6.2. Renewable energy	77
6.3. Production mix projections and expansion plans	78
6.4. Distribution	79
6.5. Electricity rates	81
6.6. Barriers for renewable electricity generation	83
7. The transport sector	84
7.1. General	84
7.2. Barriers for optimizing the transport sector	85
8. Energy efficiency	87
9. The N.V. Buskabaai and the Asphalt Lake	89
10. Conclusions	90

Preface

This document presents the National Energy Policy for Curaçao. It is a comprehensive document that contains an overview of the energy vision of the Government of Curaçao. This vision is elaborated in a mission which includes the objectives, measures and procedures necessary to reduce the negative impact of energy consumption on the economy and environment and promote a sustainable energy system. Through efficiency gains, efficient use of resources and a reduced dependence on petroleum fuel imports the competitive position of Curaçao will be strengthened.

This policy document consists of three parts. Part 1 provides the focus and main themes of the National Energy Policy. It also defines the targets to be realized. Part 2 gives a more in-depth elaboration of our mission. It focuses on the underlying core principles and objectives of the National Energy Policy. Finally, in Part 3, the policy objectives are further detailed by measurable actions in a strategic work plan for the coming five years 2018 thru 2022. Also, the associated budget is presented. Some background information to support the National Energy Policy has been included in the appendix.

It is with great pleasure and pride that the Government of Curaçao presents this National Energy Policy. It will need our joint efforts to implement the actions which have been defined in order to realize our objectives. We are confident that the people of Curaçao will harvest the benefits of increased energy efficiency and a reduced dependence on imported fuels. And that the future generations will be able to benefit from the sustainable energy system we are about to implement.

Part 1

THE ENERGY POLICY



1

“Our resources are finite. One day our present energy system will come to an end. Therefore, we need to change the way we use energy. As a landmark for change, we need a smart energy policy which provides in our energy needs in a sustainable way, which brings new jobs, triggers continuous innovation, and boosts economic development. With the combined objective to create a better environment for ourselves and a better world for our children.”



Dr. I.S. (Steven) Martina
Minister of Economic
Development

2 An energy policy, why?

This National Energy Policy for Curaçao sets the objectives and priorities for developing Curaçao's energy sector into a **sustainable energy system**. This policy aims at making Curaçao's energy sector more efficient, more transparent for stakeholders and less dependent on petroleum fuel imports.

Presently, Curaçao is heavily dependent on imported petroleum, although the first steps have been taken with respect to the use of more renewable resources. Energy conservation and improved energy efficiency will lower the energy footprint, and thereby the environmental burden from combustion of petroleum fuels. An increased share of renewable energy resources for power production will, if introduced correctly, reduce the production costs of electricity and reduce the dependence on international fuel oil prices. Indirectly, this will improve the affordability of electricity and enhance Curaçao's international competitiveness.



3 What entails an energy policy

The National Energy Policy details the manner in which the Government of Curaçao aims to address important issues related to energy production, distribution and consumption. The National Energy Policy consists of a long-term vision and a strategic work plan to realize this vision.

The following questions are answered in the National Energy Policy:

The National Energy Policy contains an institutional design as well as a timetable for taking all necessary steps.

- ① What is the vision on energy self-sufficiency and **energy dependence** for Curaçao?
- ② Which **energy resources** will be used in the future?
- ③ How will energy consumption on Curaçao change in the future, and what will be the contribution of **energy conservation and energy efficiency**?
- ④ What types of energy resources will become available for different sectors, among others the **refinery** and the **transport sector**?
- ⑤ What will be the **reliability and quality** standard for the energy supply?
- ⑥ How will the energy system develop itself and what **energy efficient appliances** will be encouraged?
- ⑦ What specific mechanisms (e.g. **taxes, incentives, manufacturing standards**) will be in place to implement the energy policy?

4 Three components of the National Energy Policy

The first part contains the **high-level ambition and approach**. This is the heart of the National Energy Policy.

The second part provides an **elaboration of the mission**. This part further describes the core principles of the National Energy Policy.

The third offers a detailed **Strategic Work Plan** for the period 2018-2022. This section describes the actions to be taken and the budget involved.



The National Energy Policy starts with a **vision and mission**. These provide our long-term goals with respect to energy, water and mobility. The mission is subsequently expressed in the form of **six objectives**. These objectives provide specific indicators, allowing objective measurement of the progress achieved. Then, **nine strategies** are identified. These strategies provide the route we take for realizing our vision and mission. The last section deals with the necessary **institutions and arrangements necessary to support the policy**.

5 Our vision

The Government of Curaçao strives for a reliable, affordable, secure and sustainable energy system which supports the welfare and well-being of Curaçao's residents and contributes to make Curaçao the preferred country in the region for industry, trade and tourism. To this end, the energy, water and mobility infrastructure are among the best in the Caribbean.

In order to outperform other countries in economic attractiveness, the energy, water and mobility infrastructures need to be among the best in the Caribbean. At the same time, consumers in Curaçao are aware of the environmental impact of mobility and energy use and are therefore committed to use energy and potable water efficiently.

6 Our mission

The Government of Curaçao supports economic development and welfare increase by ensuring access to clean, affordable and reliable energy supplies to all citizens, companies and other energy end users. The Government aims to realize the following mission to ensure sustainable and economic development of Curaçao and increase its competitiveness in the region:



ENHANCE

energy security through an energy supply that makes optimal use of locally available renewable resources. The objective is to cover at least 50 % of national energy needs from locally available renewable energy resources by 2035.



REDUCE

the national energy consumption per capita with at least 25 % before 2040 (compared with 2016), via energy conservation, increased energy efficiency and demand side management.

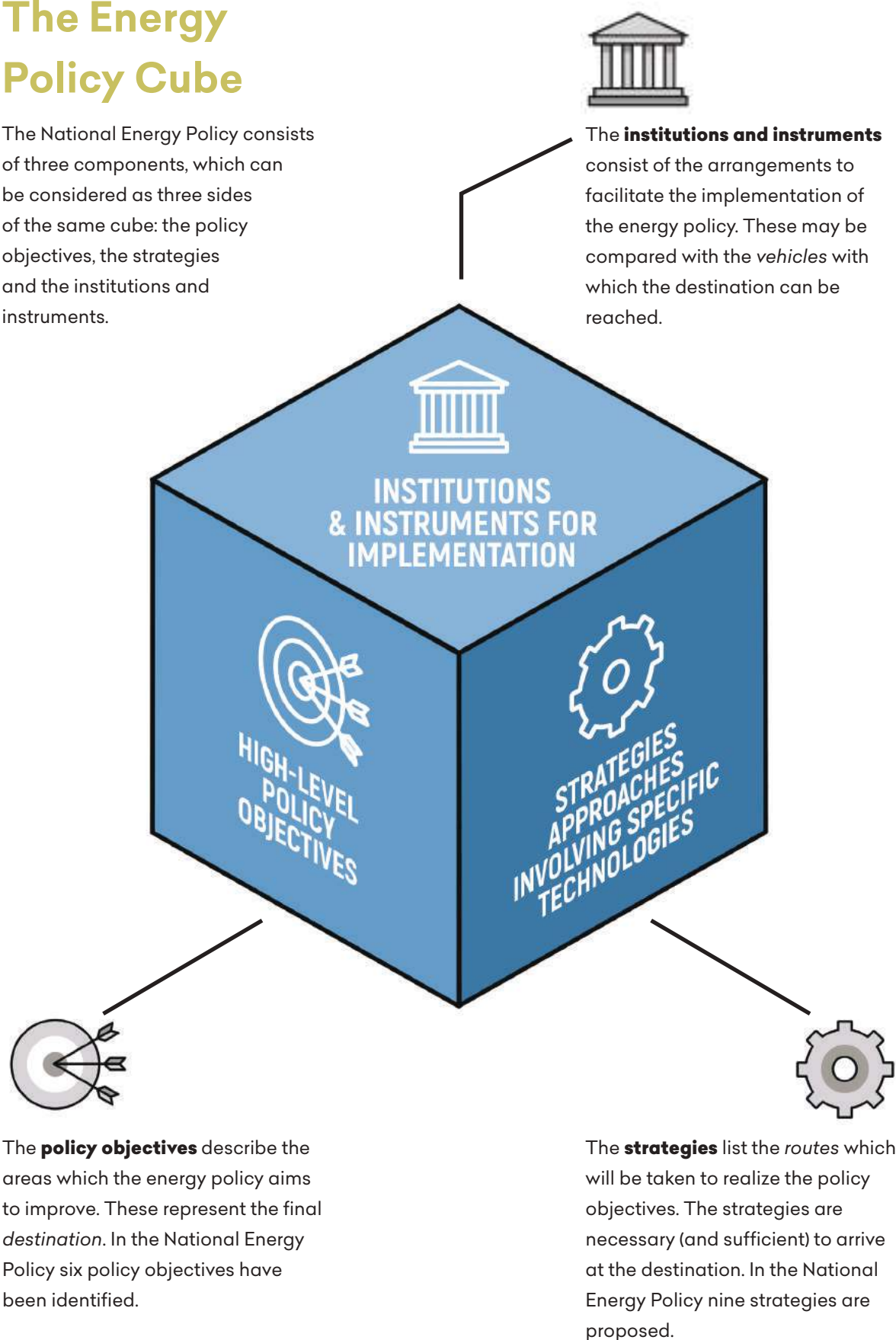


REALIZE

before 2023 transparent and effective institutions and regulations for the energy sector.

7 The Energy Policy Cube

The National Energy Policy consists of three components, which can be considered as three sides of the same cube: the policy objectives, the strategies and the institutions and instruments.



8 Our six policy objectives

The policy objectives describe the areas affected by the energy policy. Each objective contains a clear target to be achieved:



RELIABILITY.

The reliability implies that the transport sector and the electricity and water infrastructures will be available and well-functioning. The policy target is that Curaçao ranks among the top-5 countries with respect to reliability by 2023 when compared to other countries in the Caribbean region.



SECURITY.

The security (and adequacy) of supply refers to the continuous availability of sufficient fuels, electricity and water at all times. The policy focuses on enhancing energy security significantly by making more use of indigenous resources. The target is to use at least 50 % locally available renewable resources by 2035 (incl. waste) and maintain adequate fuel reserves for fossil fuels.



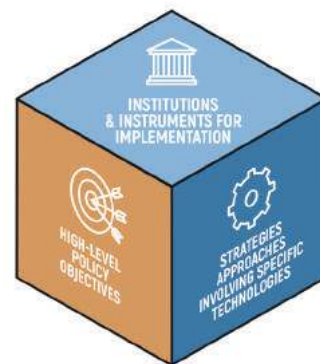
QUALITY.

Quality (of supply) means that the electricity provided by the energy system (what comes out of an electric outlet or tap) is compatible with the load that is plugged into it. Small disturbances may have negative consequences for appliances or generation. The policy target is that Curaçao ranks among the top-5 countries with respect to quality of the electricity and potable water infrastructures by 2023 in the Caribbean region.



CONSERVATION.

Conservation of energy and water will contribute to a decrease of the costs of the energy supply and to lower emissions. The policy target is to reduce the national energy (end user) consumption per capita with at least 25 % before 2040 (compared with 2016).



SUSTAINABILITY.

Sustainability refers to (economic and social) development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. The policy targets of the National Energy Policy are to comply with the Sustainable Development Goals for sustainable cities and communities (11), responsible consumption and production (12) and climate actions (13) as well as comply with local and international emissions standards for industry and mobility.



AFFORDABILITY.

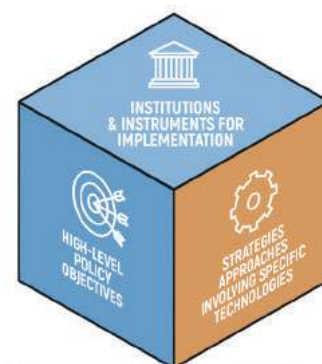
Affordability represents the extent to which energy is affordable for citizens and companies on Curaçao, measured by its cost relative to the amount that the purchaser is able to pay. The policy target is that Curaçao ranks among the top-5 countries with respect to affordability (of energy, water and mobility) by 2023 when compared to other countries in the Caribbean region.

When the National Energy Policy is fully implemented, these objectives will be achieved. Then, our mission will be accomplished as well.

1 See <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>.

9 Our nine strategies

In order to realize the policy objectives, nine strategies have been identified. Together these strategies span many areas in electricity and potable water use and energy efficiency in mobility. Each strategy contributes to the realization of multiple policy objectives.



	I SOLAR ELECTRICITY PRODUCTION	II WIND ENERGY	III NATURAL GAS	IV INVEST IN WASTE-TO- ENERGY	V ENERGY EFFICIENT TRANSPORT	VI ENERGY EFFICIENT BUILDINGS	VII DEMAND- SIDE ENERGY EFFICIENCY	VIII EFFICIENT SYSTEM OPERATION	IX EFFICIENT SYSTEM PLANNING
RELIABILITY	✓	✓						✓	✓
SECURITY	✓	✓	✓	✓	✓				✓
QUALITY							✓	✓	✓
CONSERVATION					✓	✓	✓	✓	
SUSTAINABILITY	✓	✓	✓	✓	✓	✓	✓		✓
AFFORDABILITY	✓	✓	✓		✓	✓	✓	✓	✓

	HOUSEHOLDS	COMPANIES	INDUSTRY	UTILITIES
INCREASE OF SOLAR ELECTRICITY PRODUCTION TO 55 MW IN 2028 I	SOLAR ENERGY			SOLAR ENERGY
INCREASE WIND ENERGY TO 65 MW IN 2028, IF POSSIBLE II				WIND ENERGY
INTRODUCTION OF NATURAL GAS FOR ENERGY PURPOSES III				LNG FOR POWER GENERATION
INVEST IN WASTE-TO-ENERGY IV			WASTE-TO-ENERGY FACILITY	
ENERGY EFFICIENT TRANSPORT V	ENERGY EFFICIENT MOBILITY (CNG, EV)			
ENERGY EFFICIENT BUILDINGS VI	ISOLATION	ENERGY EFFICIENT CONSTRUCTION		
DEMAND-SIDE ENERGY EFFICIENCY VII	ENERGY EFFICIENCY STANDARDS, DEMAND, RESPONSE		SWAC, OWAC	
EFFICIENT SYSTEM OPERATION VIII				NETWORK LOSS REDUCTION
EFFICIENT SYSTEM PLANNING IX				INTEGRATED RESOURCE PLAN

Some of the strategies focus on households and smaller companies, others on the industry or the utility companies (see Table).

Target groups for the nine strategies of the National Energy Policy.



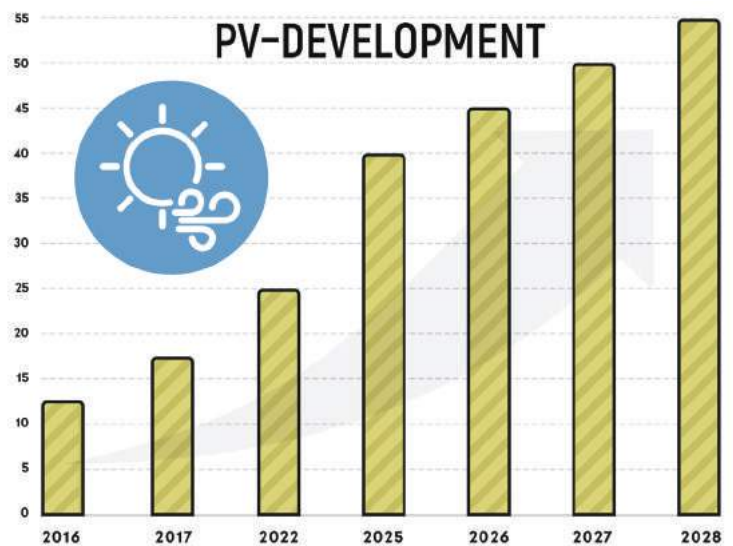


STRATEGY I

Solar panels

By producing electricity from solar energy, Curaçao's dependence on imported fossil fuels will diminish. Furthermore, once installed, electricity is produced at negligible costs during sunny hours.

The National Energy Policy sets as objective achieving **55 MW of electricity production with solar panels** on Curaçao by households and businesses by 2028.



Presently (2017), Curaçao has roughly 10.5 MW of solar panels installed, primarily in the form of small scale, individual installations. Aqualectra is developing large scale solar parks for up to an additional 12 to 15 MW of solar power.

The National Energy Policy aims to promote private and commercial investments in solar panel electricity production by adopting where necessary favorable fiscal conditions for solar generated electricity for households and commercial locations.





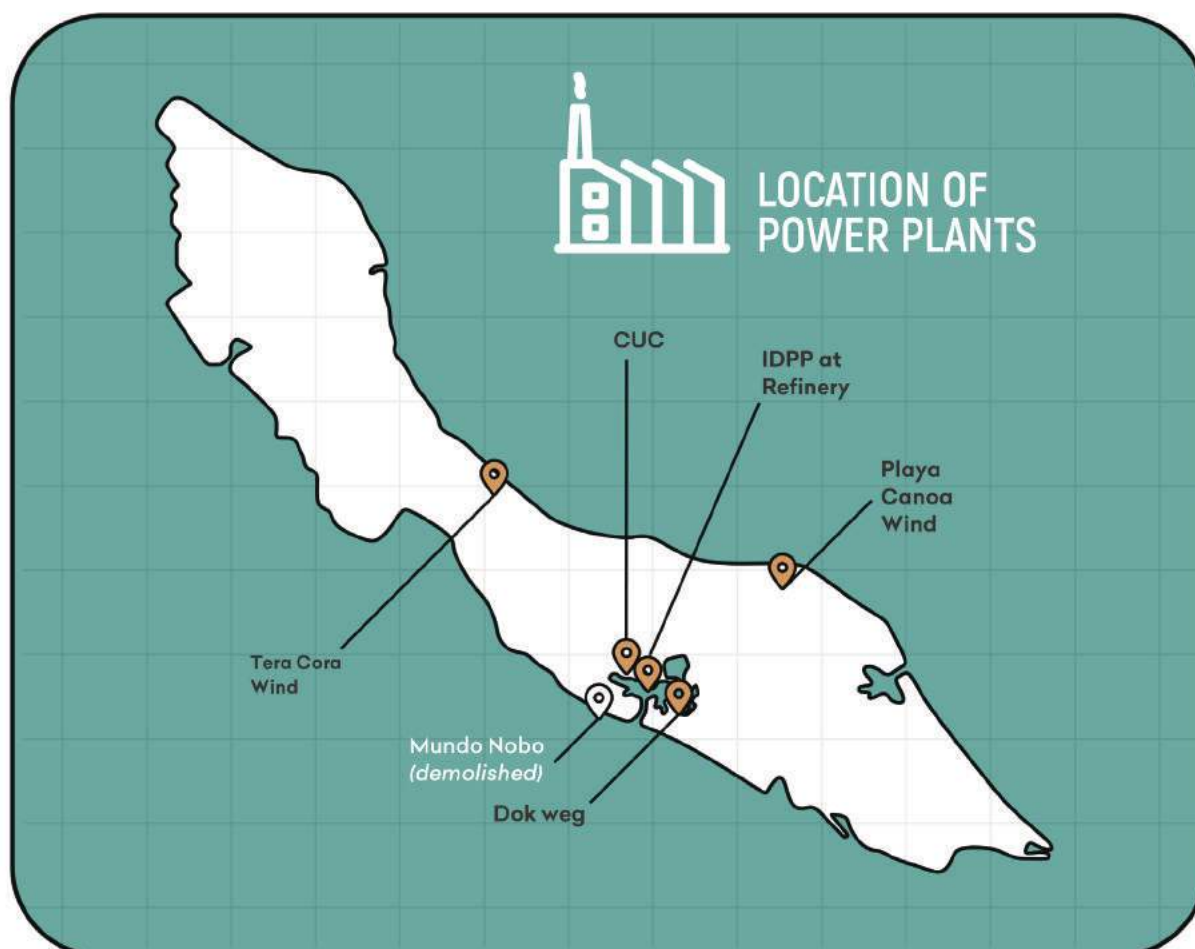
STRATEGY II

Wind energy

By producing electricity from wind energy, Curaçao's dependence on imported fossil fuels will diminish. Furthermore, once installed, electricity is produced at negligible costs.

The National Energy Policy sets as objective achieving **65 MW of electricity production with wind turbines** on Curaçao by 2025.

Presently (2017), Curaçao has 46.5 MW of installed wind capacity. The wind capacity has recently been increased and a grid impact study will be done to determine how to proceed. This study will determine how much additional wind capacity can be accommodated by the electricity system. If possible, the share of wind capacity shall be increased to 65 MW in 2025. To this end, a study needs to be performed which investments are needed for accommodating additional wind capacity.





STRATEGY III

Natural gas

Apart from electricity produced by solar energy and wind energy, all other energy on Curaçao originates from fossil fuels. These are imported in the form of crude (oil), which makes the island vulnerable for price fluctuations on the world oil market. Furthermore, in case of supply disruptions an energy crisis cannot be averted.

Presently, natural gas is not available on Curaçao. All conventional electricity production is done by petroleum based fuels. The emissions contribute to a high environmental burden in the form of air pollution. Natural gas is a cleaner energy source.

The National Energy Policy aims to diversify our fuel resources. By 2030 half of the energy consumed should be based on renewables, the remaining half on a mix of conventional fuels. It is envisaged that **natural gas** will be imported. For allowing imports of natural gas in a liquid form (LNG), a gas distribution infrastructure needs to be completed by 2024. Introduction of natural gas will benefit many energy consumers: power production, the refinery, industry, and possibly transports and households as well. It is further envisaged that the availability of a large LNG plant will allow Curaçao to develop into an international gas hub in the Caribbean region.





STRATEGY IV

Waste-to-energy

Waste has an energetic value. Therefore, electricity can be produced by waste combustion. Apart from reducing the need for space for landfills, it helps to become less dependent on imported fuels. The National Energy Policy aims to resolve (solid) waste problem by **installing a 7-15 MW waste-to-energy facility** by 2021 taking into account environmental concerns.

Presently, there is no waste-to-energy facility on Curaçao. The landfill will be full in 10 to 15 years and other solutions are needed for waste disposal. Waste-to-energy conversion provides a solution for the waste management problems. It will also contribute to a more sustainable electricity supply.

When investing in a waste-to-energy facility, solely proven technology will be considered. The investment, construction and operation of the facility will be done by an independent party, buying waste from waste management company Selikor and selling electricity (and possible water) to the utility Aquallectra. The optimal size of the facility will be established after an assessment of all recycling options.

VOLUME

32%
Plastics

25%
Clean paper
and cardboard

17%
Organic
wastes

Other
paper and
cardboard **10%**

Metals **7%**

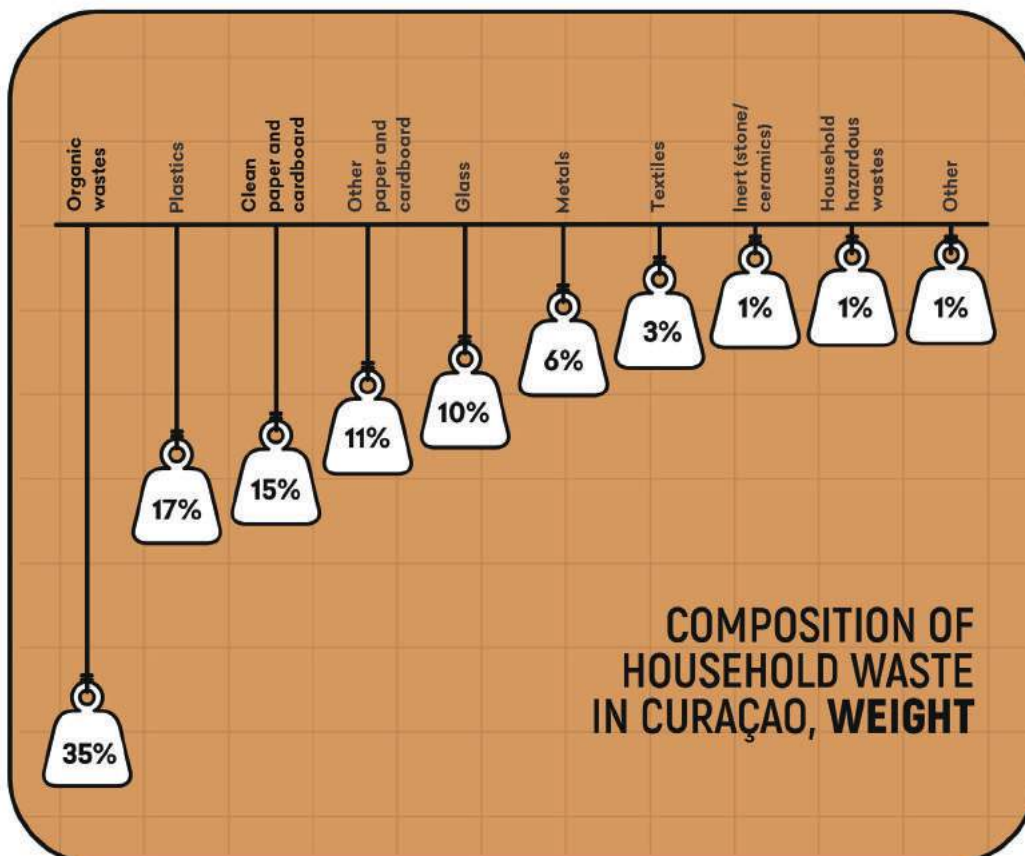
Glass **4%**

Textiles, 2% **0**

Household hazardous
wastes, 1% **•**

Inert (stone/
ceramics), 1% **•**

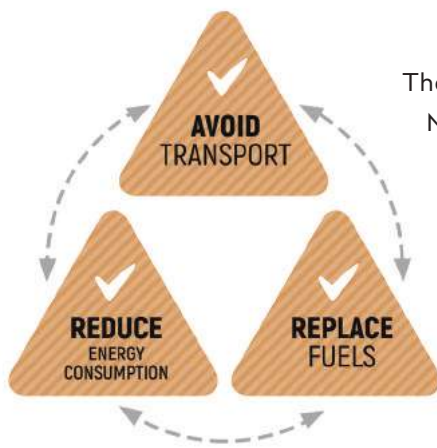
Other, 1% **•**





STRATEGY V

Energy efficient transport



The third area for energy conservation is the transport sector. The National Energy Policy envisages a reduction of the national energy consumption per capita with at least 25 % before 2040.

The transport sector offers significant opportunities for achieving reductions in petroleum fuel imports in Curaçao.

This reduction may be achieved by the **triple strategy**
Avoid-Reduce-Replace:

AVOID TRANSPORT

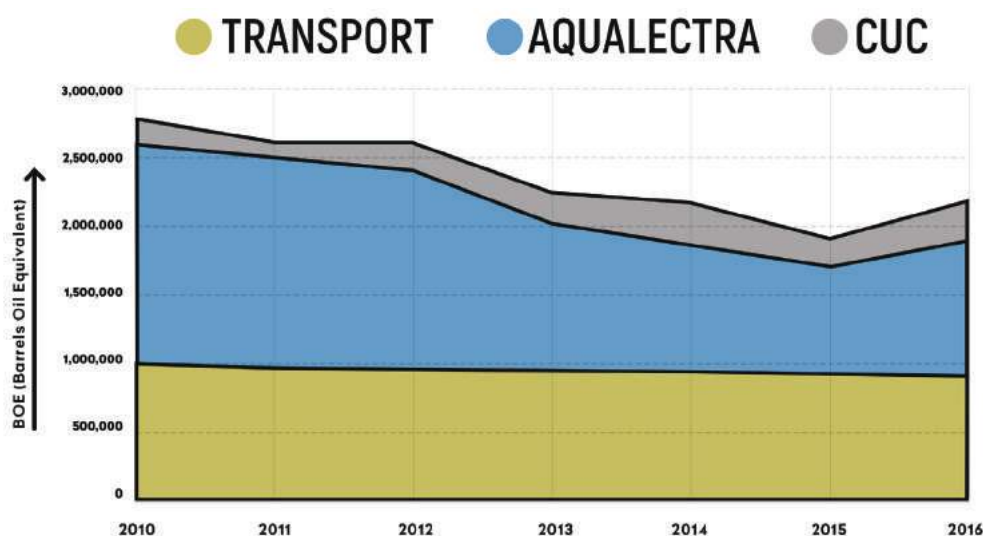
if possible, e.g. by promoting alternatives like using tele-communication facilities for meetings.

REDUCE ENERGY CONSUMPTION

of transport by utilizing more energy efficient transport modes (e.g. more public transport instead of private cars).

REPLACE CONVENTIONAL TRANSPORT FUELS

(diesel and petrol) by economically available cleaner and renewable fuels.



In the future, a switch to hybrid (conventional/ electric) vehicles, full electric vehicles, or hydrogen or natural gas operated vehicles is foreseen.

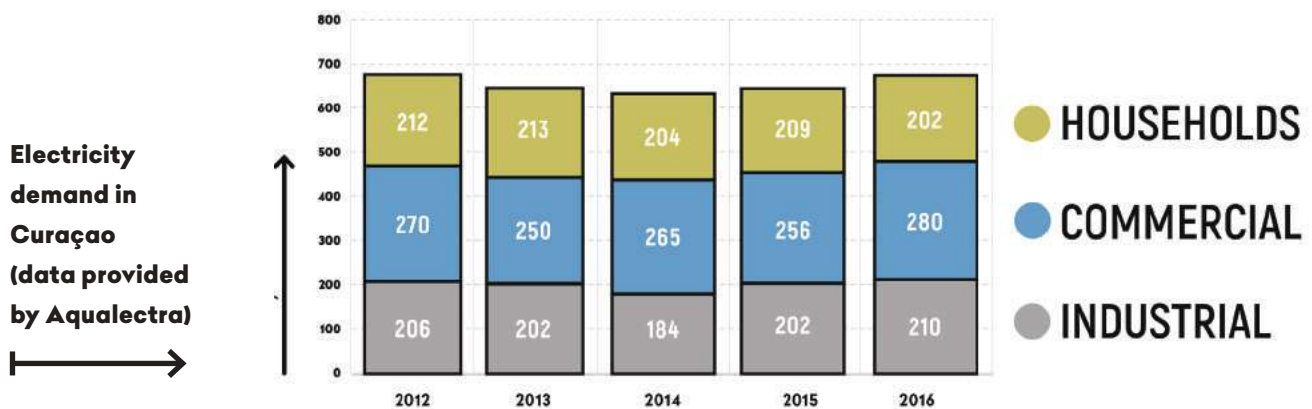
↑ Curacao fuel consumption for transport and electricity production, 2010-2016



STRATEGY VI

Energy efficient buildings

There is no need to produce energy that is not used. Energy conservation therefore contributes to lower costs and a lower environmental burden. The National Energy Policy envisages a **reduction of the national energy consumption per capita with at least 25 % before 2040**. This should, among others, be achieved by increased energy efficiency for buildings.



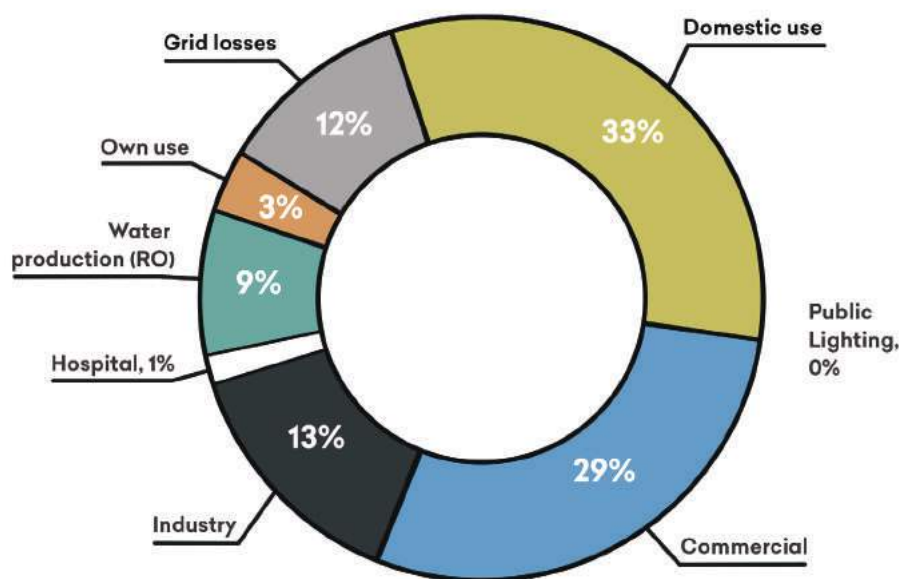
In 2016 the national energy consumption amounted to 13.3 ('barrels of oil equivalent') per capita. 54 % of this is needed for electricity production. A large share of the electricity is used for cooling and lighting. Energy conservation may be achieved through more efficient design that would allow cool air and light to penetrate more easily. To this end, the Government of Curaçao plans to investigate the possibilities for measures that discourage inefficient energy use and introduce minimum energy performance standards for buildings. Furthermore, energy efficiency will be encouraged by raising awareness among users and fiscal incentives will be developed to promote energy efficiency measures in buildings.

The energy efficiency standards will be included in the building code. It will start with an initial scheme that involves the issuance of certificates for buildings and building technologies that meet the energy performance requirements. Additional levels of certification will be issued for buildings with superior performances. In the end, a lower energy demand will lead to lower energy-related costs for the users of these buildings. Existing buildings will also gradually comply with these energy efficiency targets.



STRATEGY VII

Demand-side energy efficiency



Another area for energy conservation is demand-side energy efficiency. Overall, the National Energy Policy envisages a reduction of the national energy consumption per capita with at least 25 % before 2040 (compared to 2016).

Distribution of electricity consumption (2015)

To this end the Government of Curaçao will introduce **minimum energy performance standards for appliances** and implement a strategy to discourage the use (or import) of inefficient appliances. The use of efficient appliances will be promoted by raising awareness and fiscal measures.

Furthermore, the benefits of demand-side response will be studied. This means that consumers will actively reduce their consumption at hours of high electricity prices or insufficient generation and receive compensation in return. By this flexibility, the total costs of electricity production may go down.

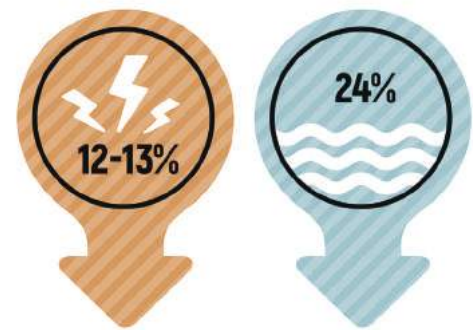




STRATEGY VIII

Efficient system operation

Generated electricity and produced water need to be transported to the end consumers. For this, an electricity and water infrastructure is in place. It will benefit Curaçao to have an efficient infrastructure, which means high quality for acceptable costs. These costs need to be paid by those who incur these costs. The efficiency can be improved by reducing system losses. The National Energy Policy aspires the operation of efficient energy and water infrastructure with **low losses and transparent and cost-reflective tariffs for system users.**



Presently, the electricity losses in distribution amount to 12 to 13% (2016) and the water losses amount to 24 % (2016). There are two types of losses:

TECHNICAL LOSSES

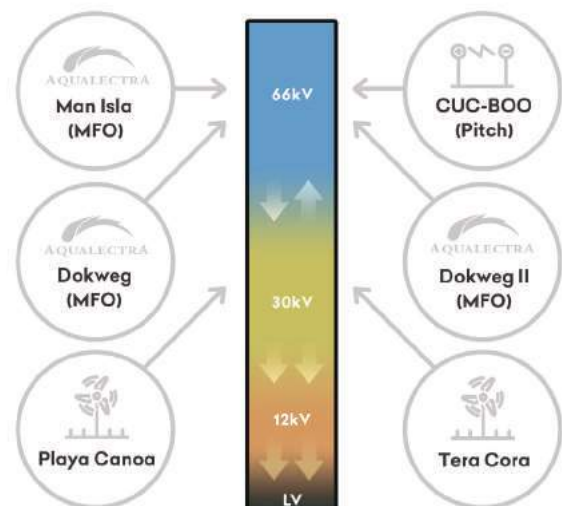
result from thermal dissipation (heat losses) of electricity and leakage of water in the transport and distribution grids.

ADMINISTRATIVE LOSSES

result from unpaid bills and theft of electricity and water, without the consent of the utility.

The energy policy aims to reduce both types of losses. A cost-reflective tariff structure for electricity and potable water consumption will be developed, which gives appropriate signals to consumers about the costs involved of electricity generation and water production. Furthermore, awareness of end users for their energy and water consumption will be promoted by implementation of smart meters. These meters will provide real-time information on electricity and water usage.

Main electricity production plants and the electricity grid





STRATEGY IX

Efficient system planning

It is important that sufficient investments are made in the energy and water infrastructures to safeguard future supply. The system should also be able to embrace new technologies, e.g. for renewable energy production. The National Energy Policy therefore aims to develop resilient energy and water infrastructures, capable of absorbing the optimal quantity of renewable energy.

Presently, most power production is based on oil-based generation. Water production is entirely done by an electricity-intensive production processes. It is our ambition to design strategies for all new electricity generation and water production units to adhere to the **highest possible standards with respect to sustainability, efficiency, quality and least cost of supply.**

The instrument for achieving this is to periodically perform a study to find out which technologies are optimal and which investments should be made. Such *Integrated Resource Plans* will be made each third year for all infrastructures (electricity, water, fuels and later also for gas) and will encompass all proven technologies. The plans will be published and thus provide insight in the resilience, reliability and security of the future energy and water system and infrastructure.



10 Policy on new energy technologies

Innovation continues and many innovative technologies are being developed. We **recognize the potential benefits of other renewable energy technologies** which may contribute to decrease the dependence on fossil fuels. Many of these technologies are not yet actively pursued in the National Energy Policy given that these are not yet mature.

Innovative technologies may be included in future updates of the National Energy Policy when the following conditions are met:

- The technological concept has been tested both in several large-scale settings and locally on Curaçao (as pilot project) and has proven itself as reliable and commercially viable.
- System and network integration is deemed possible by the utility companies and transport authority involved. This means that the technology should have been identified in the *Integrated Resource Plans*.
- The average cost of the energy or water and transport provided by the technologies, including the costs of system integration and user adaptations, is at a competitive level with respect to the technologies presently applied in the energy system.
- Implementation of the new technologies does not entail additional costs for the energy and water users and the transport sector. Or, in case they do, these costs can be fully recovered by surcharges to users directly advocating the new technologies.

Presently, progress is made in promising technologies like *Ocean Thermal Energy Conversion (OTEC)* and electricity storage in batteries. When the conditions above are met, large-scale implementation on Curaçao will be welcomed.



11 Pilot projects

The Government of Curaçao is willing to endorse small-scale pilots on Curaçao for **testing innovative renewable energy technologies**. Pilot projects need to meet the following conditions:

- A project is small scale, which means that a limited amount of energy consumers is involved and it contributes to the energy supply in a limited geographical area.
- The initiative is managed by private parties, who will also cover all costs.
- At least one knowledge center (a university or research institute) is involved as project partner.
- Any energy or water consumers who are supplied by the pilot need to give prior consent to their participation in the pilot. During the course of the pilot, all customers remain free to revert to the public energy and water supply if the end consumer costs of the pilot exceed the costs of the public energy and water supply.

If necessary, the Government of Curaçao is willing to facilitate small-scale pilots by:



Allowing temporary deviations from regulations:

The Government may give an exemption to a pilot for a limited duration and a limited geographical region from certain regulations. An exemption will only be given if it is necessary for the success of the project and if the effects are proportional to the importance of the project for Curaçao.

Exemptions should have no net financial impact for the Government budget, which means that it will not entail fiscal support or subsidization. After a predefined period, the exemptions will expire. From this point forward, the utility or the transport authority will determine the conditions for continuation of the pilot (or decide to discontinue it).

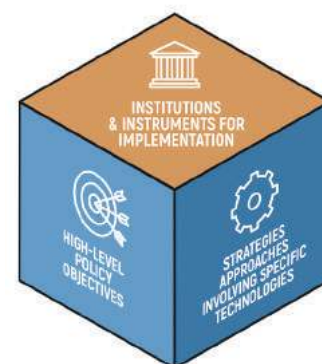
Facilitating the institutional implementation:

When necessary the Government of Curaçao is willing to assist the contract partners to reach an agreement for setting up the pilot.

12 Institutions and instruments

The six policy objectives describe our ambition. The nine strategies list the routes which will be taken to realize the objectives. To support these we will need the institutions and instruments. These arrangements are needed to allow and facilitate the implementation of the strategies identified in the National Energy Policy.

The institutions and instruments will provide sufficient arrangements to realize transparent and effective implementation of the National Energy Policy, legislation and regulations. The Government of Curaçao will endeavor to have **all arrangements in place before 2020**.



	POLICY	REGULATION	IMPLEMENTATION
INSTITUTIONS	Energy Office	BT&P	Ministries, Tiger Teams & Consultative groups
LEGISLATION	ENERGY ACT		
INSTRUMENTS	Policy documents, regulation, ministerial decrees	Quality & Price control	Implementation decrees, public-private partnerships
MONITORING	Every 3rd year policy evaluation and update	Annual monitoring report	Biannual report

**Table3,
Institutions and
instruments
matrix.**



13 Development of an Energy Act

For the implementation of the National Energy Policy new legislation and regulation will be issued. The encompassing legal framework will be contained in an **Energy Act**. A draft Energy Act will be sent to parliament in the second half of 2018.

The Energy Act will offer an integrated codification of the energy, potable water and fuel policy. It will include the defined policy targets and detail the legal framework and applicable procedures. It will also provide a clear attribution of responsibilities to the utility companies for the respective infrastructures and for the appropriate Government institutions.

The Energy Act will furthermore provide a framework for the development of secondary regulation. This may comprise of ministerial decrees, a grid code and other decisions. All in all, the Energy Act will offer a clear framework for all relevant aspects of the energy and water supply on Curaçao, including tariff regulation, the applicability of subsidies and social policies and support-mechanisms.



14 Responsibilities for the energy policy

The **Government of Curaçao** will be responsible for implementing the National Energy Policy by adopting the Energy Act and developing the necessary regulations. The **Energy Office**, a department within the Ministry of Economic Development, will be the prime responsible for developing, implementing and monitoring the National Energy Policy from the side of the Government.

The Energy Office will prepare most of the necessary legislation and regulations which will be submitted for adoption to the Government and Parliament of Curaçao. The Energy Office will also maintain relations with the utility companies and the major stakeholders and arrange for consultations, where necessary. The Energy Office will periodically perform an evaluation of the policy objectives and measures contained in the Energy policy. In due time and if necessary, it will provide an update of the National Energy Policy.

A consequence of the National Energy Policy is that the roles and responsibilities of **Bureau Telecom and Post (BT&P)** will be reinforced. BT&P will be transformed into an independent utility regulator with an autonomous mandate and budget, clearly defined in the Energy Act. BT&P will be responsible for tariff setting, economic and technical regulation of the utility companies, quality regulation of the supply and dispute settlement. Moreover, BT&P will become responsible for developing a data base with energy related data to support the Government in implementing the National Energy Policy.

Several future roles and responsibilities are not yet clear. In the course of 2018 and in the context of the development of the Energy Act these questions need to be answered:

- ① Who will be responsible for monitoring compliance of the utility companies with the Energy Act and the regulations?
- ② Who will be responsible for the (development and operation of) gas distribution infrastructure?
- ③ Who will be responsible for defining the policy on energy efficient buildings? Who will execute these functions?
- ④ Who will be responsible for defining the policy on energy efficient appliances? Who will execute these functions?
- ⑤ Who will be responsible for defining the policy on energy efficient vehicles? Who will execute these functions?



15 Secondary regulation

The Energy Act will offer the general framework for the roles and responsibilities of utility companies and energy users in Curaçao and the instruments available to the Government. Specific regulations will provide further details.

Secondary regulation will be developed for application of **regulatory and financial instruments** to foster developments towards energy efficiency and promote renewable energy investments. Furthermore, a **grid code** will be developed which will provide clear rules for all parties involved in the energy supply. Finally, regulations need to be developed for the **energy performance standards** for buildings, appliances and vehicles, energy efficiency labels and standards.

Bureau Telecom en Post will be responsible for the development of a **stable regulatory approach** for the determination of domestic energy and water prices, based on cost of service analysis and with cost-reflective tariffs.

Finally, **fiscal mechanisms** need to be developed to motivate stakeholders and consumers to adopt energy conservation and efficiency. (Non-financial) **support mechanisms** must be developed for the implementation of private small scale renewable energy systems, e.g. in the form of exemptions. Support mechanisms may also be desirable to promote energy reduction in the transport sector.

16 The role of the utility companies

The National Energy Policy will allocate the functions of production and distribution of electricity, gas, fuels and water to the utility companies. The utility companies will have a monopoly in all these areas. Exemptions may however be given to private small-scale renewable energy projects, subject to network and system constraints and the impact on the energy system and when approved by the Government.

Presently, the utility companies have a concession from the Government of Curaçao. These concessions will be transformed into a legal status for the utility companies, with the attribution of **clear responsibilities and appropriate remuneration**, to be supervised and monitored by the regulator. The Energy Act will define these obligations, roles and responsibilities of the utility companies with respect to the execution of the energy policy.

The Energy Act will impose constraints on the utility companies with respect to their corporate governance. This may include requirements with respect to the composition and independence of the supervisory board. Furthermore, the Energy Act will prescribe the regulatory governance of the utility companies. It will include performance (quality and revenue) regulation and tariff setting, to be carried out by the regulator.

It still has to be decided what procedure will apply for approving the investment plans (and the *Integrated Resource Plans*) of the utility companies. It is expected that both the Energy Office and BT&P (apart from the supervisory board) will play a role.



17 Carrying out the energy policy

The National Energy Policy requires many parties to co-operate. First of all, this will be essential for the development of appropriate legislation and regulation. The Government of Curaçao envisages to install **Tiger Teams** to assist and advise the Energy Office.

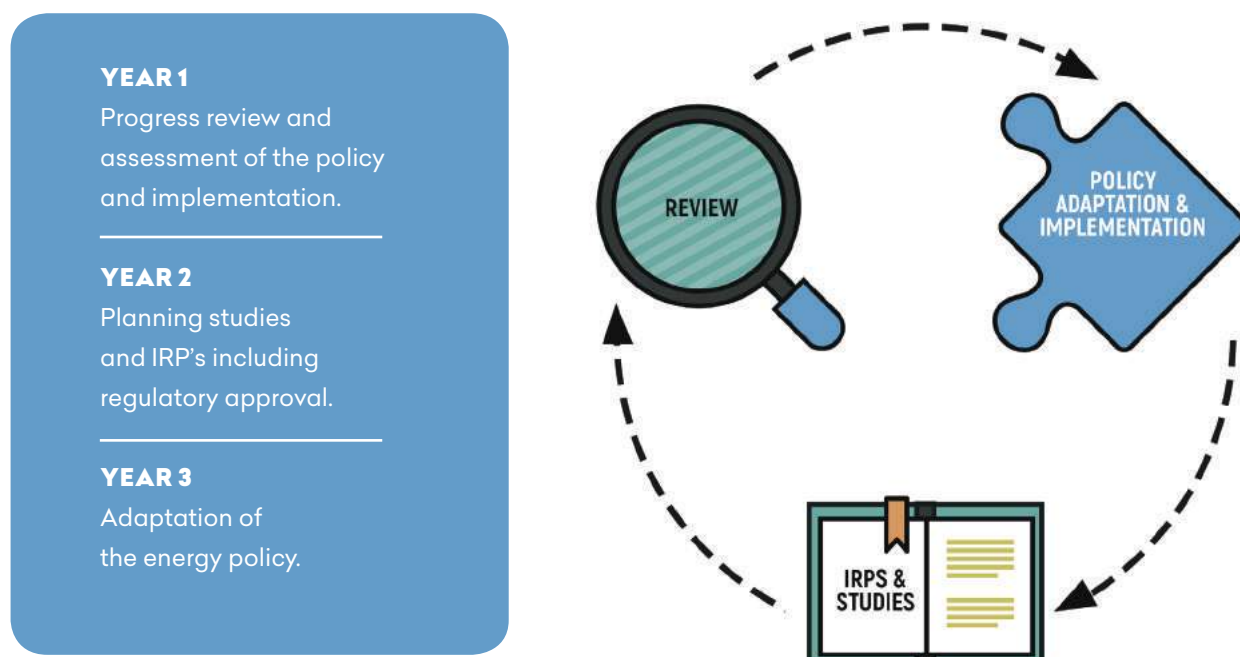
Tiger Teams will contribute to the development and implementation of specific policies. They will consist of one or more representatives from the stakeholders, one or more experts and are presided by a member from the Energy Office. It is expected that the small teams will be able to give a boost to the development of appropriate regulation.

When needed, the Government of Curaçao will invite stakeholders and representatives of consumers' organizations to establish **consultative groups**. These groups will be invited to review proposals for legislation or regulations. It is foreseen that such consultative groups will also play a role in the context of the periodic update of the Energy Policy.

18 Monitoring and periodic review

The effects of the National Energy Policy will be closely monitored. The Energy Office will publish an **annual monitoring report** with actual data on energy supply and demand in order to monitor the achievement of the policy objectives. To this end, Bureau Telecom and Post will collect data on the energy and potable water consumption.

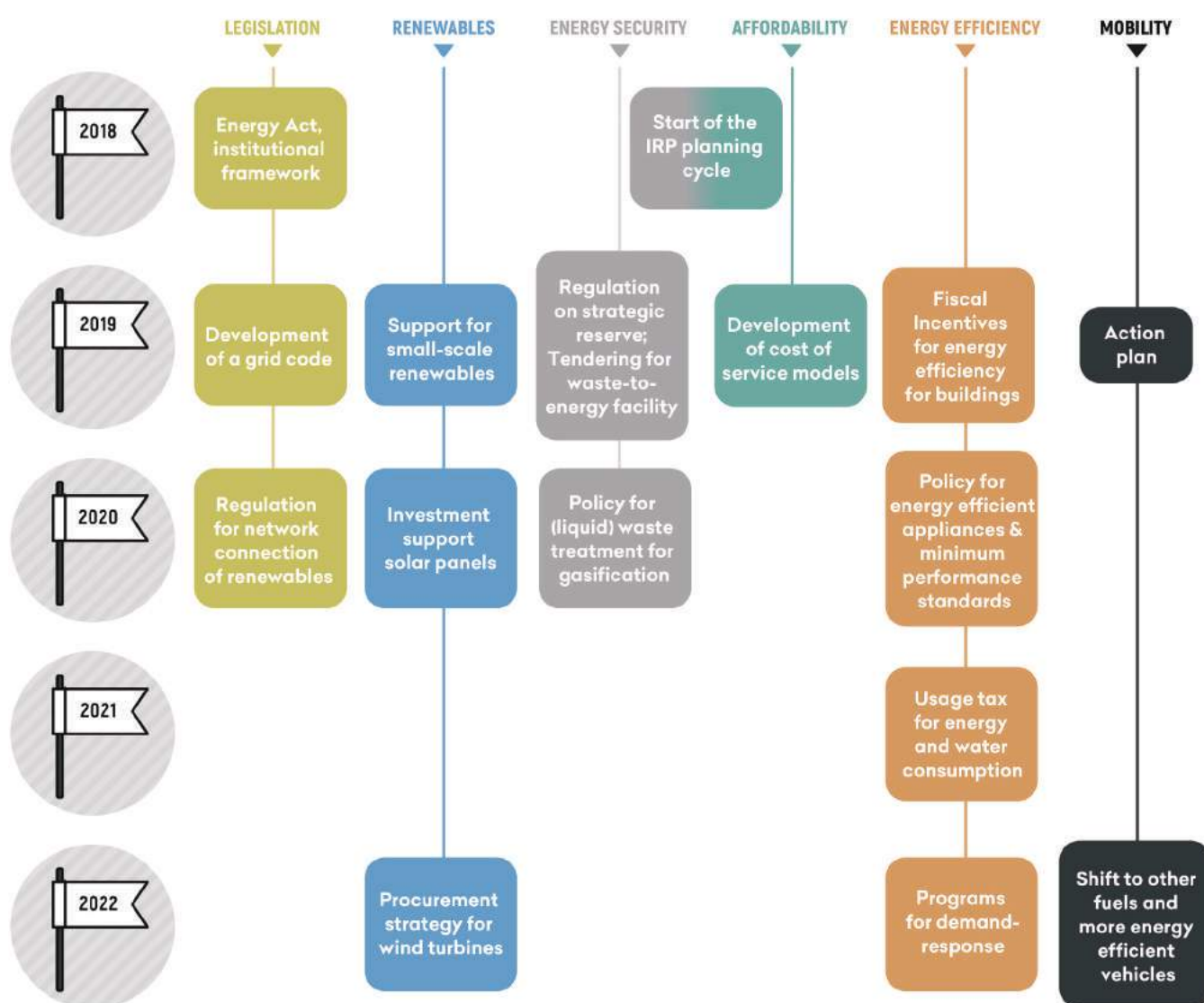
Every third year, the Energy Office will prepare a **review** of the progress made with respect to the implementation of the National Energy Policy. Where necessary and appropriate, the Energy Office will propose update for the policy objectives, define additional measures and suggest new instruments. The planning of the policy review will be linked to the planning of the Integrated Resource Plans, allowing the later to provide input for the policy review.



19 Time path

The National Energy Policy requires the Government of Curaçao to initiate many actions, starting with the development of the encompassing framework contained in the Energy Act (2018). Most of the preparatory actions will be taken by the Energy Office. The major actions foreseen for the Energy Office in the next five years are represented in Table 2. A detailed action plan is presented in part 3: Strategic Work Plan 2018–2022.

After approval of the policy by the Government, the suggested timeline for the proposed actions will be further detailed and coordinated in close co-operation with the relevant stakeholders.



↑
Major actions
foreseen for the
Energy Office in the
period 2018–2022.

Part 2

ELABORATION OF THE MISSION

1 Core principles and be financially viable

The National Energy Policy has been developed on the following premises:

- ☆ The Government acknowledges the importance of a healthy and sustainable ecosystem on and around the island of Curaçao. This will positively contribute to Curaçao's economic development and thus positively affect welfare on the island. As such the Government promotes the use of environmental best practices in the area of energy production and consumption.
 - ☆ The National Energy Policy focuses on promoting technologies that have proven to be technically and economically viable, that reduce the cost of energy and decrease the potential impacts of environmental pollution and global warming. This includes fostering the use of locally available renewable energy resources and technologies for increasing energy efficiency.
 - ☆ Energy policy measures increasing energy security and environmental sustainability will only be pursued when the net value for the country exceeds their economic costs. The net value is expressed in terms such as, for example, sustainable employment, positive impact on public health and increased quality of life. The Government will consider such particular measures on a case by case basis.
 - ☆ The Government recognizes the impact the transport sector on total energy consumption and acknowledges that regulatory measures are necessary to reduce energy consumption and/or increase energy efficiency in this sector.
 - ☆ The Government acknowledges the importance of regulation in the energy sector. To this end the National Energy Policy recognizes that the regulatory framework needs to be strengthened to comply with internationally accepted standards.
- The Government also acknowledges the importance of its utility companies, such as Aqualectra (the electric and water utility company) and Curoil (the fuel import and distribution company). These must operate in accordance with good corporate governance principles, financially viability. Both companies will adhere and contribute to implementing the policy objectives and measures.
- The Government acknowledges that making the energy sector sustainable requires joint efforts from the Government, public actors, the private sector and knowledge centers. The private parties will not only participate as energy consumer but also as investors, innovators and supporters to knowledge creation and management.
- The Government acknowledges that it will be necessary to incentivize and influence consumer behavior as this is an important aspect in energy policy. As such it will support and promote demand-side management tools to optimize energy use at the consumer side.

2 Enhancing energy security

The key energy stakeholders and the Government will ensure energy security through energy conservation, diversification, and the use of local resources. These will also contribute to the reduction of the petroleum oil dependency of Curaçao.

The Government of Curaçao wants to make as much as possible use of locally available energy resources such as wind, solar energy (photovoltaic and hot water systems) and other commercially viable technologies within the production mix, without compromising the security, reliability and quality of supply.

In the electricity production sector, Aqualetra has already achieved a significant input of renewable electricity generation through wind and solar energy. The Government's intention is to further expand renewable electricity generation capacity and to realize renewable energy use in the transport sector and other sectors in order to reduce fuel consumption.

In order to increase energy efficiency and the renewable energy transition, the Government will review its legislative and regulatory framework with the aim to improve and strengthen its legislation and regulation to facilitate effective implementation of the National Energy Policy.

This objective will be realized through:

UTILITY SCALE RENEWABLE ENERGY GENERATION²

The Government's policy focuses on encouraging the development of utility scale renewable energy for electricity generation by Aqualetra. The legislation shall where necessary be adapted to comply with international principles and standards in the electricity market. The objective is to cover at least 50 % of the island's energy needs from locally available renewable energy resources by 2035.

An evaluation will take place of the functioning of the current concession regime to ensure overall security of supply. Where necessary action will be taken to improve.

Furthermore the Government will support and highly recommend Selikor and Aqualetra to pursue as soon as possible the options to convert waste to energy, as this appears to provide a practical solution for the waste management challenges and will contribute to a more sustainable electricity supply.

DISTRIBUTED RENEWABLE ENERGY GENERATION

The Government will promote private investments in renewable energy, primarily solar, wind and ocean energy, through a fair and transparent support scheme for small-scale renewable energy systems. The Energy Office will regulate the grid connection in the grid code for distributed energy generation taking into account the grid operation policy and the technical capacity limitations of the grid. BT&P will advise the Government on a suitable eligibility scheme and a necessary capacity cap to manage a smooth renewable transition with respect to small independent power producers. Energy storage facilities will also be considered where possible and necessary.

² Utility scale renewable energy in Curaçao is renewable electricity production on a scale larger than 1 Megawatt (MW).

STRATEGIC ENERGY SUPPLY

The Government will develop strategies to ensure the presence of adequate energy supplies and products to respond to emergency situations, for example in the case of extreme weather conditions, oil spills, or international conflicts. This will be realized after consultation of Curoil and Aqualectra. It is envisaged that a minimum strategic petroleum fuel stock for at least several months shall be available.

There are quite a number of small back-up generators mainly operating on diesel fuel. These units should be registered and regulated by BT&P, as is the case with wind and solar based power generators. It should be assessed by the utilities companies and BT&P if this potential can be used in the production mix and contributes to enhancing the strategic energy supply.

THE REFINERY

The Government acknowledges the importance of the refinery with respect to its positive contribution to the economy and the energy sector. On the other hand it also acknowledges the negative impact of the refinery as a major contributor to environmental pollution. The refinery needs to upgrade its processes in order to meet internationally accepted emission standards. The Government envisages gradual upgrading or replacement of the existing refinery to a more modern refinery taking into account the highest international operational and environmental standards³.

To realize this vision the Government established a project team (the Multi-Disciplinary Project Team, MDPT) to investigate, in collaboration with other stakeholders, the best options for the future of the refinery. The main options to be pursued are: 1. upgrading of the existing refinery or 2. building a new refinery on a new location, 3. building a natural gas terminal.

The vision of the Government is that a rehabilitated refinery should use LNG (and or CNG) to fuel the different refinery processes, lowering cost and significantly reducing environmental pollution. The introduction of LNG as a main fuel for the refinery will also allow replacing heavy fuel usage in diesel plants of Aqualectra by LNG. The latter will result in significant emission reductions and cleaner electricity production. Studies will also be performed to assess to what extent LNG could be beneficial for use in transport and (as natural gas) for cooking.

It is expected that Curaçao's dependence on the refinery as a fuel source will slowly decrease, taking into account the transition to more sustainable energy resources and enhancing energy security by focusing on the use of indigenous natural resources and LNG. Nevertheless the refinery will, where possible and beneficial, continue to supply part of the fuel and energy demand for the local energy sector. Furthermore it will be evaluated to what extent the refinery will continue to contribute to the island's strategic fuel supply.

³ Emission standards set quantitative limits on the permissible amount of air pollutants that may be released from different sources over specific timeframes. They are generally designed to improve air quality and to protect human health.

GRID OPERATION

The Government acknowledges the responsibility of the electric utility company for the electricity grid to retain control of the electricity grid. For a sustainable development of the grid with distributed electricity production and storage, a grid code needs to be developed, which will allow the implementation of the National Energy Policy. The objectives of the grid operation policy are to (a) ensure efficient transport and distribution of electricity, (b) reduce net losses to acceptable levels (lower than 10 %), which will contribute to reducing petroleum fuel consumption for electricity generation and (c) provide for the admission of distributed renewable resources on the grid.

Moreover, BT&P will perform an evaluation of the current tariff structure to address the overall renewable energy and efficiency targets, while safeguarding cost recovery of the costs of the existing network.

The electric utility company should furthermore consider installing smart metering before 2030 and in the more distant future (from 2035 onwards) should work towards a smart grid concept.

RENEWABLE ENERGY PERMITTING AND PLANNING

The Government will develop a regulatory framework, including permitting and land use planning, containing regulations for safeguarding Curaçao's natural environment while allowing the development of renewable energy projects.

FUEL SUPPLY

The Government's efforts are focused on reducing Curaçao's dependence on (imported) petroleum fuels by promoting energy conservation and the use of local renewable resources. In those cases where petroleum fuels are still necessary, efforts to minimize their environmental impact and cost shall be considered. Where the introduction of natural gas into the production mix can be beneficial for the island, the use of natural gas will be promoted.



3 Reducing the national energy consumption

The Government will promote energy conservation and efficiency improvement in all economic sectors (households, commerce, tourism, transport, industry, etc.). To this end, awareness campaigns will be held to inform energy consumers of the benefits of energy conservation.

Where necessary this will be enforced by setting standards and/or requiring certification. The Government will develop regulations and standards aiming at improving the energy efficiency of new and existing buildings, appliances and vehicles. Energy efficiency measures are often cost effective and may reduce the energy costs for citizens, companies and other organizations.

This objective will be realized through:



Lighting:

The Government aims to shift for 100 % to energy efficient lighting (such as LED-lights in street lighting). The Government will work towards a phase-out of all incandescent lights before 2025. The effectivity of applying an import ban will be considered.



Procurement:

The Government will develop legislation for the procurement of more energy and water efficient appliances and vehicles in combination with awareness campaigns and energy labeling.



Efficiency in electricity generation:

The Government acknowledges that the energy transition will take time, making investments in conventional generation units necessary in the meantime. With respect to these all new and existing units shall adhere to the highest standards with respect to efficiency, emissions, quality and least cost of supply.



Demand side efficiency:

The Government will facilitate the introduction of minimum energy performance standards for buildings, equipment, appliances and vehicles. Standards will be adopted in the areas of building ratings, appliance standards and labeling as well as vehicle fuel efficiency. Voluntary and mandatory performance standards and regulations will be

developed with appropriate enforcement schemes. Where possible implementation of these standards and regulations will be supported by fiscal incentives. In due time the Government will look into possibilities to implement demand response concepts.



Energy efficiency in buildings:

New buildings will have to meet clear building and energy standards which will result in lower energy bills and at the same time support sustainability. Existing housing and buildings can be retrofitted to reduce cooling demand or implement other energy efficiency measures. The latter may include measures to promote the use of low energy consumption lighting and other appliances.



Energy efficiency in potable water use:

Roughly 10 % of the electricity consumption is used for potable water production since potable water is produced via a reverse osmosis process. Demand-side efforts in relation to water conservation will therefore get attention as well.



Energy efficiency in transport:

The Government will promote more efficient transport modes and where possible cleaner and renewable fuels if affordable. Electric or gas fueled vehicles might contribute to making transport more sustainable. The different available opportunities will be assessed. During the transition phase regulation of the import of efficient and low fuel use vehicles will receive appropriate attention.

4 Transparent and effective institutions and regulations

The Government aims to strengthen its institutional capacity to implement the National Energy Policy and address the challenges of the energy transition. Within the Government an Energy Office will be established which will be responsible for coordination, implementation and monitoring of the National Energy Policy, in close consultation with the main energy stakeholders. The Government will also establish Tiger Teams for advising the Government on specific energy issues. Furthermore action will be taken improve the transparency of the legislation and procedures and strengthen the regulation where necessary.

This objective will be realized through:



Energy Office:

An Energy Office will be established within the Ministry of Economic Development with the responsibility to coordinate, develop and monitor the implementation of the National Energy Policy. The Energy Office will advise on adapting the energy policy objectives and propose actions to keep up with international developments in the energy market.



Tiger Teams:

Where possible and useful, Tiger Teams will be established to assist the Energy Office in implementing the National Energy Policy. A Tiger Team is a team of experts functioning as a project team with the intention to speed up the implementation of specific projects.



Stakeholder consultation:

Where useful, the Government will invite stakeholders and energy consumers to comment on proposed legislation and regulation.



Legislative and regulatory framework:

The Government will introduce legislation, additional regulation and financial instruments to foster developments towards energy conservation, energy efficiency and renewable energy investments. These will include energy performance standards for buildings, appliances and vehicles, the introduction of energy efficiency labels, building codes, and other energy standards.



Energy Act:

Presently, the energy legislation consists of separate documents and laws, which are partly outdated. The Government will initiate a process to develop, update and merge all these separate publications in a new energy law.



Awareness programs:

The Government will disseminate information on sustainable energy in general, and the different energy conservation and efficiency initiatives and measures to be implemented in Curaçao. This will be done in close cooperation with the utility companies and other relevant stakeholders. Increased knowledge and understanding of performance, costs and benefits of innovative energy concepts and technologies will result in better choices by energy consumers.



Training and education for sustainable energy professions:

The Government aims to facilitate initiatives aimed at creating a qualified workforce in the field of sustainable energy. Key to the Government's policy on energy education and awareness are: 1. the dissemination of information and collaboration on sustainable energy initiatives, and 2. the optimization of the administrative processes for obtaining permits and technical and financial support to increase the implementation of sustainable energy projects.

Part 3

STRATEGIC WORK PLAN 2018-2022

1 Introduction

The National Energy Policy objectives presented in parts 1 and 2 have been translated into a series of high level strategic initiatives for the coming period of five years (for the period of 2018 to 2022):

1. Compared to 2016, the Government aims to realize an additional 10 % of the island's energy needs covered by renewable energy and energy efficiency improvement. This should be the case for the electricity and transport sector together⁴.
2. The Government will establish an Energy Office in the Ministry of Economic Development. The Energy Office will be responsible for the development of an effective monitoring and reporting system, in collaboration with BT&P, to gain insight in energy sector developments.
3. A series of feasibility studies will be conducted for the further development of renewable energy technologies to increase the share of local energy resources in the electricity and transport sectors. This will also include the installation of a waste to energy plant and, in the further future, energy storage facilities.
4. A regulatory framework will be implemented that fosters the implementation and development of energy efficiency measures and technologies to be used by all energy end-users in Curaçao.
5. The Government aims to reduce the energy consumption in the transport sector.

After approval of the National Energy Policy by the Government, the suggested timeline for the proposed actions will be further detailed and coordinated in close co-operation with the relevant stakeholders.

This Renewable Energy Strategy 2018-2022 chapter is split in two main parts namely:

1. Strengthening the institutional structures to ensure effective implementation of the objectives and tasks as indicated in the energy strategy.
2. Implementation of strategies to reduce energy consumption and raise energy security within the following areas:



Measures to enhance **security** of supply in the energy sector.



Measures to enhance **efficiency and sustainability** in the transport sector.



Measures with respect to energy efficiency and **energy conservation**.

⁴ For example, in the electricity sector, this could be realized through a 1 % yearly increase in energy efficiency, and a minimum of 5 % overall increase in energy supply with renewables up to 2022.

2 Strengthening the institutions

The Government has expressed its intention to move towards reducing its dependence on petroleum fuel imports, reduction of greenhouse gas emissions and strengthening of the energy infrastructure. Currently the expertise in the Government about energy matters is rather limited. This implies that the Government is dependent on other organizations in the energy sector, like Aqualectra, Curoil and BT&P, to prepare decisions in the field of energy policy. This includes electricity generation, fuel distribution and consumption, issues related to tariff setting and other regulatory matters. Many energy related policy documents are being prepared by external (foreign) consultants or by the abovementioned organizations.

In order to effectively implement the energy sector strategy and monitor progress made, the Government organization in charge of energy must be strengthened. It needs to possess in-house expertise to develop and assess policy choices and to make expert judgments on proposals prepared by the stakeholders. The actions with respect to institutions and instruments are structured in the areas presented in Table 3.

	POLICY	REGULATION	IMPLEMENTATION
INSTITUTIONS	Energy Office	BT&P	Ministries, Tiger Teams & Consultative groups
LEGISLATION	ENERGY ACT		
INSTRUMENTS	Policy documents, regulation, ministerial decrees	Quality & Price control	Implementation decrees, public-private partnerships
MONITORING	Every 3rd year policy evaluation and update	Annual monitoring report	Biannual report

**Table3,
Institutions and
instruments
matrix.**



2.1. INSTITUTIONS

The Energy Office

The Ministry of Economic Development (MEO) will be strengthened with an Energy Office. The Energy Office will further develop the energy policy and coordinate and monitor its implementation.

The Energy Office will be primarily responsible for developing, implementing and monitoring the National Energy Policy from the side of the Government.

The Energy Office will maintain relations with the major stakeholders and arrange for consultation, where necessary.

The Energy office will periodically perform an evaluation of the policy objectives and measures contained in the National Energy Policy.

The Energy Office will be staffed with and supported by personnel of the Ministry of Economic Development with adequate technical and economic expertise in the field of energy. It is expected that such the Energy Office should be staffed by at least **three staff members** with the following profile:



0.6 fte

A coordinator and relations manager



1.0 fte

A (technical) energy expert



0.4 fte

An economic expert

Training and capacity building will be necessary to allow the Energy Office to quickly take up its duties.

The regulator (BT&P)

Bureau Telecom and Post (BT&P) will act as energy regulator. Its main objectives are:

- The regulator needs to function as independent and autonomous organization with a clear mandate and budget, defined in the Energy Act.
- The regulator will be responsible for quality of supply and tariff setting, economic regulation and dispute settlement.
- The regulator will be responsible for developing an energy data base to support the Government in implementing the Energy Policy.

BT&P is responsible for monitoring utility compliance, based on the standards and targets set by the Government, and will advise the Energy Office on issues related to the obligations of the utility companies, fuel supply as well as tariff setting.

Many Caribbean countries have already made progress in the regulation of their electricity sector by establishing a regulatory agency empowered to independently define the service standards and tariffs. In Curaçao, BT&P is presently an advisory body making recommendations to the Minister. According to best practices BT&P should become an independent, self-financed entity with powers granted through legislation. BT&P presently seems to have considerable legal, personnel and financial constraints, all of which limit its ability to fulfill its role. An assessment and reevaluation of its functioning will be necessary.

BT&P will also support the Energy Office with actual information on energy (production, distribution, consumption, regulation etc.) allowing progress and developments in the energy sector and related fields. There is presently a clear lack of data on energy consumption which makes it difficult to assess the best opportunities for energy conservation and energy efficiency measures. A detailed study on the consumption of electricity and fuels in all sectors of the Curaçao economy will be conducted to facilitate the implementation of the National Energy Policy.

BT&P will be responsible for the development of a data collection system to enable reporting on energy imports, production, conversion and consumption. BT&P in fact already collects information from Aqualectra and Curoil on energy production and distribution. BT&P's tasks could thus be extended to prepare an energy database. Arrangements will be made with BT&P, to be able to provide the abovementioned information to the Energy Office to facilitate the latter to produce its periodic energy reports.

Government departments

It will be import to improve the knowledge and understanding on (renewable) energy among all Government organizations. There is currently a lack of expertise for dealing with renewable energy issues within the respective Government ministries and agencies limiting the opportunities for diversification of the sustainable energy economy.

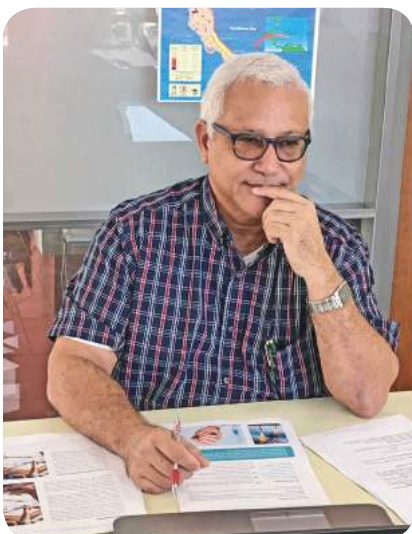
The Energy Office in cooperation with other ministries will implement workshops and training to improve their expertise on energy issues.

2.2. LEGISLATION

Attention needs to be given to updating our energy legislation and creating a comprehensive Energy Act. The main objectives of the Energy act are:

- ➔ To offer an integrated codification of energy (and water) policy, including the targets, high-level implementation choices and procedures are set.
- ➔ To provide a clear attribution of tasks to utility companies and institutions (BT&P, Energy Office, etc.).
- ➔ To provide a framework for the development of policy implementation by secondary regulation (Ministerial decrees, grid operation policies & grid code, etc.).
- ➔ To provide a clear framework for tariff and quality regulation, investments subsidies, social policies, support-mechanisms, etc.
- ➔ To provide a clear framework for a long-term planning cycle based on Integrated Resource Plans.

At this moment the energy legislation consists of separate laws and decrees, which are partly outdated. The Government will start the process to develop, update and merge all these separate publications into one (new) Energy Act.



2.3. INSTRUMENTS

The electricity, water and fuel supply are not only 'carriers' of welfare but also provide a solid basis for Curaçao's competitive position in the region. In order to be able to outperform other countries in economic attraction, the energy and water infrastructures need to be among the best in the Caribbean. This means that for predefined criteria Curaçao needs to score enough to belong to at least the top-5 countries in the region⁵.

With respect to the different policy areas the Government will assess the possibility to promote innovation by introducing budget-neutral stimuli in the form of fiscal incentives, subsidies and/or secondary regulation tools. In the case of fiscal

incentives and/or subsidies attention will be given to supporting mechanisms for the implementation of distributed small scale renewable energy systems, energy and water conservation and efficiency improvement and the transport sector.

In the case of secondary regulation attention will be given to the development of (financial) instruments to foster developments towards energy efficiency and facilitate development and implementation of renewable energy investments. These include energy performance standards for buildings, appliances and vehicles, energy efficiency labels and building codes and standards.



2.4. MONITORING AND EVALUATION

The Energy Office will publish annual monitoring reports with data on energy consumption, information on progress of implementing the National Energy Policy and relevant developments with respect to fuels, transport and energy supply and demand. The necessary data will be collected by BT&P and supplied by BT&P to the Energy Office.

Every third years a policy review will be published by the Energy Office based on the policy implementation progress. Where necessary, this review will contain proposals for corrective measures, new and/or adjusted objectives and/or instruments.

⁵ The peer countries include: Anguilla, Aruba, Bahamas, Belize, Bermuda, Barbados, Bonaire, British Virgin Islands, Cayman Islands, Dominica, Guadeloupe, Jamaica, St. Maarten, Grenada, St. Lucia, Surinam, Trinidad and Tobago, and St Vincent.

2.5. ACTIONS TO BE TAKEN

The actions for enhancing energy security relate to the following strategies presented in part 1:



STRATEGY I

Increase of solar panel electricity production.



STRATEGY II

Increase of wind energy production



STRATEGY III

Introduction of natural gas



STRATEGY IV

Investment in a waste-to-energy facility

The following actions are identified:

STRENGTHENING OF GOVERNMENT ORGANIZATION (ENERGY)	RESPONSIBLE	ACTION	IMPLEMENTATION
Personnel and capacity building of the Energy Office	ENERGY OFFICE	2018	
Implementation of modelling tools	ENERGY OFFICE	2018	
Training and education	ENERGY OFFICE	2018	
STRENGTHENING OF GOVERNMENT ORGANIZATION (TRANSPORT)	RESPONSIBLE	ACTION	IMPLEMENTATION
Personnel and capacity building of Ministry of VVRP	VVRP	2018	
STRENGTHENING OF THE REGULATORY STRUCTURE FOR THE ENERGY MARKET	RESPONSIBLE	ACTION	IMPLEMENTATION
Restructuring of BT&P into full regulator	ENERGY OFFICE	2019-2020	
Personnel and capacity building of BT&P	BT&P	2019-2022	
Development of energy reporting	BT&P	2019-2022	
Development of energy data system	BT&P	2018-2020	
Execution of a detailed energy demand-side study	BT&P	2019	
EDUCATIONAL CAMPAIGN ON ENERGY POLICY AND MARKET	RESPONSIBLE	ACTION	IMPLEMENTATION
Energy information sessions & training (continuous education)	ENERGY OFFICE	2019-2022	
Training for and certification of small renewable energy installers	BT&P	2019	

2.6. PROJECT REALIZATION

The following table 5 presents the preliminary budget estimate for organizational and regulatory measures.

Table 4.
Required budget for organizational and regulatory measures (in US dollars).

	2018	2019	2020	2021	2022	TOTAL
Strengthening of Government organization (energy)	281.500	281.500	275.500	275.500	275.500	1.389.500
Development of Energy Act and secondary regulations	315.000	540.000	430.000	230.000	230.000	1.745.000
Strengthening of the regulatory structure for the energy market	170.000	260.000	160.000	85.000	85.000	760.000
Educational campaign on energy policy and market	26.500	26.500	51.500	26.500	26.500	157.500
Development of an energy data monitoring system	50.000	25.000	25.000			100.000
Execution of a detailed energy demand-side study		100.000	50.000	50.000		200.000
Contingency public input	30.000	30.000	30.000	30.000	30.000	150.000
TOTAL	873.000	1.263.000	1.022.000	697.000	647.000	4.502.000.000



3 Measures to enhance security of supply in the energy sector

3.1. TECHNOLOGIES

CONVENTIONAL ENERGY TECHNOLOGIES

Electricity production: The Government acknowledges that it is not realistic to fully supply the energy needs at this moment by renewable technologies. Renewable energy resources (still) need to be complemented by (proven) conventional technologies. With respect to these conventional technologies the National Energy Policy focuses on promoting only technologies and fuel choices that have proven to be technically and economically viable, reduce the cost of energy, lower energy losses, decrease the potential impacts of local environmental pollution and reduce our contribution to global warming.

One objective of the strategy is to implement a fuel transition for the conventional production units to the usage of natural gas as a more environmentally friendly fuel before 2025. To this end, the conventional units should be retrofitted with a dual fuel option, in order to facilitate an easy transition from liquid fuels to natural gas.

Furthermore Aqualectra in collaboration with BT&P shall execute a technical and economic feasibility study to assess the issues and opportunities for reaching significant levels (60-75 %) of electricity generation from locally available renewable resources.

Grid operation: The utility company in close cooperation with BT&P and other relevant entities will develop a suitable grid operation policy, which allows the implementation of the National Energy Policy. The objectives of this grid operation policy are to (a) ensure efficient transport and distribution of electricity, (b) to reduce net losses to acceptable levels (lower than 10 %), which will have an important contribution to reducing petroleum fuel consumption for electricity generation, and (c) provide for uptake of electricity from renewable energy resources by the grid.

RENEWABLE ENERGY TECHNOLOGIES.

There is a considerable potential for sustainable electricity generation on Curaçao. The following opportunities for renewable energy technologies seem to be most promising for Curaçao:



Wind energy: Curaçao has favorable wind conditions. In 2017 a total of 46.5 MW of wind power was installed and in operation, providing roughly 28 %⁶ of total electricity demand of the island. However balancing demand and supply has shown to be challenging in the case of a larger share of wind energy. Recent studies have shown that for the present infrastructure the installed capacity has reached its limit for wind energy. However, with the implementation of storage capacity the share of wind energy in the electricity production mix could be further increased. Adequate storage technology is not yet available at acceptable cost. Aqualectra will perform a study, in consultation with BT&P, to analyze this issue.



Solar energy: Curaçao also has favorable solar conditions. The rapid development of better solar energy systems combined with a downward trend in production cost makes solar energy an attractive option for the near future. At this moment solar equipment is still more expensive per kWh electricity produced than wind

⁶ This percentage could be higher on specific hours, depending on the real-time demand. Peaks of as high as 40 % penetration have been registered according to Aqualectra.

power. An advantage of solar power is that it reduces the electricity peak demand for the utility company during day time.

Challenges with solar power electricity generation are: 1) that they only produce during day time, and 2) that the energy produced is an intermittent source of energy, which requires additional balancing power to be installed. In 2017, Curaçao had roughly 10.5 MWp of solar power installed, primarily through small scale, individual installations. Aqualectra is preparing the development of solar parks with an additional capacity of 10 to 15 MWp. Through the existing policy on small scale renewable energy, several companies have been investing in solar (photovoltaic) installations. The current policy on distributed solar electricity needs to be updated in accordance with the objectives and goals of the National Energy Policy.

It is foreseen that by 2020 approximately 25 MWp of solar power will be installed and in operation. It is the intention of Government to increase this gradually up to 55 MW by 2030. The increase of solar power within the production mix will require close attention to ensure an appropriate balance between power generation, electricity demand and cost. Electricity storage will be required with larger share of solar energy, as is the case with wind. Aqualectra will perform a study, in consultation with BT&P, to analyze this issue.



Ocean thermal energy: Curaçao has favorable conditions for the use of ocean thermal energy as renewable energy source. The available ocean thermal energy would allow Curaçao to become fully self-reliant on this sustainable energy resource, if it could be harvested economically.

A potential option is to use this ocean thermal energy for replacing cooling via SWAC (Sea Water Air Conditioning) and/or OWAC (Ocean Water Assisted Cooling). OTEC can be combined with SWAC when realized in the vicinity of large buildings with large cooling demand and centralized cooling systems. With respect to the implementation of seawater air-conditioning, SWAC or OWAC, the Government endorses private initiatives.

Ocean Thermal Energy Conversion (OTEC) might provide base load⁷ electricity and thus can be integrated more easily in the production mix compared to intermittent solar and wind energy production. The costs of OTEC systems are however relatively high due to the required investments in a long cold sea water pipe and large titanium heat exchangers. For these reasons, large scale OTEC will not be pursued within the timespan of the present strategy. We expect the private sector to initiate a feasibility study for a small 500 kW OTEC installation, to be followed by a 10 to 20 MW OTEC combined with SWAC and fresh water production.



Waste-to-energy (WTE): Other energy resources considered renewable are biomass and (organic) waste. Currently, Curaçao has a relatively small agricultural and fishery sector. The tourism sector, including hotels and restaurants, produces organic wastes that can easily be collected separately. These can be used to produce a high quality organic waste stream for biogas production. However, waste to energy could be costly and environmental challenging, whereas local expert stakeholders doubt the need for waste to energy solutions if Curaçao would embrace recycling, composting and import restrictions for goods that cannot be recycled or composed. These measures would reduce the overall quantity of solid waste.

On the other hand there are serious waste management challenges in Curaçao. The landfill will probably be filled up in 10 to 15 years from now and other solutions have to be found for waste disposal. Waste-to-energy seems a practical short-term solution for both the waste management challenges and making the supply of electricity more sustainable. In view of the existing costs for conventional electricity generation, a waste-to-energy facility may be a feasible option. Incineration of waste is common practice in Europe and also on a number of Caribbean islands.

⁷ Base load represents the more or less continuous part of electricity load demand.

There are several options to convert waste to energy. In order to implement the most efficient waste-to-energy options, the following actions should be taken:

1. A waste characterization and classification study should be conducted to determine the current waste composition and calorific values.
2. An effective separate waste collection and recycling option should be developed.
3. If sufficient quantities of organic waste can be collected, the feasibility of organic waste digestion should be assessed.
4. Finally, the feasibility of a WTE facility for the remaining municipal solid waste stream could be assessed. In case of an insufficient quantity of waste the import of waste could be considered.

The above studies will take all possible waste streams into account, such as domestic waste, industrial wastes and sewage sludge. A possible cooperation with Aruba and Bonaire could be considered as cost efficiencies may be realized. Aruba is already investigating waste-to-energy options and Bonaire has comparable waste management challenges although on a smaller scale. A joint waste-to-energy facility might offer the necessary economies of scale even though transporting waste between islands would be required. This cooperation among the ABC-islands could be part of further studies providing follow up to the TNO study conducted in 2014⁸.

There is a direct relationship between environment and energy. The responsibility of the environment lies with the Ministry of Health, Environment and Nature. Appropriate consultation and coordination will take place, so that the policies pursued by the ministries are aligned.

OTHER TECHNOLOGIES

The Government is willing to endorse small-scale pilots for testing innovative renewable energy technologies under the following conditions:

The technological concept has been tested both in several large-scale settings and locally on Curaçao (as pilot project) and has proven itself as reliable and commercially viable.

System and network integration is deemed possible by the utility companies involved. This means that the technology should have been selected in the Integrated Resource Plans.

The average cost of the energy or water provided by the technologies, including the costs of system integration and user adaptations, is at a competitive level with respect to technologies applied in the energy system.

Implementation of the new technologies does not entail additional costs for the energy and water users. Or, in case they do, these costs can be fully recovered by surcharges to users directly benefiting from the new technologies.

If necessary, the Government is willing to facilitate small-scale pilots by, allowing temporary deviations from regulations, i.e. exemption for a limited duration and a limited geographical region, if such is necessary for the success of the project and if it is proportional to the importance of the project for Curaçao, and as long as there is no negative financial impact for the Government budget (i.e. no tax exemptions and no subsidization).

⁸ TNO, *Assessment of waste management opportunities for Aruba, Bonaire and Curaçao*, 2014.

3.2. REGULATORY MEASURES

In order to facilitate the implementation of renewable energy systems, the Government aims at strengthening the regulatory framework for the energy sector through the following initiatives:

1. The Government will include in its spatial planning system locations where renewable projects, in particular wind and solar, are possible. Furthermore, it will describe the criteria to be taken into account when determining project applications. This transparency will reduce the transaction time and costs associated with project siting and environmental permitting.
2. The Government will evaluate the need to strengthen the regulation in the electricity sector. To this end, an assessment of the existing regulatory framework will be made.
3. BT&P will strengthen the certification scheme for small scale renewable energy installers. This will support better service and quality of the installation of renewable energy systems. This is particularly relevant for households and small businesses, where installers often act as decision-makers.
4. An evaluation will be performed by BT&P, with respect to the possible redesign of the current tariff structure to address the overall renewable energy and efficiency targets, while reasonably safeguarding the recovery of the (fixed and sunk) cost of the existing network. The electric utility company should furthermore plan towards installing smart metering before 2030 and in the more distant future (by 2035) should work towards a smart grid concept.

3.3. FINANCIAL AND FISCAL MEASURES

A recent report on the legal and institutional barriers for the implementation of renewable energy⁹ has identified a series of financial and fiscal measures aimed at facilitating and enhancing investments in the field of renewable energy. The Government will investigate the recommendations and implement effective but budget neutral measures, such as (but to be decided later on):

- Tax reform to create fiscal incentives aimed at facilitating renewable energy investments in the commercial sector.
- Facilitating credit lines for renewable energy investments, that clearly reduce petroleum fuel imports and thus reduce the required foreign currencies for fuel imports.
- Creating incentives for third party financing of investments in renewable energy technologies.

3.4. ACTIONS TO BE TAKEN

The actions for enhancing energy security relate to the following strategies presented in part 1:



STRATEGY I

Increase of solar panel electricity production.



STRATEGY II

Increase of wind energy production



STRATEGY III

Introduction of natural gas



STRATEGY IV

Investment in a waste-to-energy facility

The following actions are identified:

⁹ Economic Commission for Latin America and the Caribbean's (ECLAC) and German Cooperation, *An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Curaçao*, 2013.

STRATEGY I. INCREASE OF SOLAR PANEL ELECTRICITY PRODUCTION	RESPONSIBLE	ACTION	IMPLEMENTATION
Analyze options for budget-neutral support of private small-scale renewables by, e.g., 1. Fiscal support, 2. Tariff support, 3. Implementation of a renewable energy surtax, 4. Lease construction for equipment.	ENERGY OFFICE	2019	2020
Develop policy for additional investments in solar panels.	ENERGY OFFICE	2019	2020
Review regulations on network connection of small renewable resources.	ENERGY OFFICE	2019	2020
Study network integration for large increase of electricity from solar panels, leading to adjustments of the investment plans for the grids.	AQUALECTRA	2018 + each 5th year	2019
Study storage and balancing needs to accommodate large increase of PV. Analyze possible contribution of EV for temporary storage.	AQUALECTRA	2022	
Implementation projects of large-scale and small-scale of PV (Aqualectra, 2020).	AQUALECTRA	2020	
STRATEGY II. INCREASE OF WIND ENERGY PRODUCTION	RESPONSIBLE	ACTION	IMPLEMENTATION
Evaluation of impact of recent increase in wind energy capacity.	AQUALECTRA	2020	
Network integration and stability study for higher share of wind energy in the system.	AQUALECTRA	2022	
Investment plan for network expansion and siting study/decision for new wind plant.	AQUALECTRA	2022	2023-2025
Decision on procurement strategy (capacity development by Aqualectra or external tendering).	ENERGY OFFICE	2022	
Start tendering procedure for procurement of wind capacity.	ENERGY OFFICE / AQUALECTRA	2023	
STRATEGY III. INTRODUCTION OF NATURAL GAS	RESPONSIBLE	ACTION	IMPLEMENTATION
Development of an institutional framework of a gas infrastructure (Energy Act).	ENERGY OFFICE	2018	
Define monopoly function for gas transport and distribution for the gas utility, including appropriate regulation (Energy Act).	ENERGY OFFICE	2018	
Institutional design of an LNG terminal: siting, concession agreement, pricing structure, etc.	MULTIDISCIPLINARY TEAM	2018	
Redesign role of refinery for the energy supply.	MULTIDISCIPLINARY TEAM	2018	
Develop a plan for introduction of gas as a fuel for different usage categories (power production, refinery, industry, transports, and households).	CUROIL	2020	
Design of an efficient gas distribution infrastructure for Curaçao for the different gas users (pipeline or others).	CUROIL	2021	
Investments in new electricity generation only based on dual fuel equipment.	AQUALECTRA		2018 and onwards
STRATEGY IV. INVESTMENT IN A WASTE-TO-ENERGY FACILITY	RESPONSIBLE	ACTION	IMPLEMENTATION
Perform waste classification study (calorific value, estimates of quantities, most effective separate waste collection and recycling options).	MINISTRY GMN	2018	
Perform a study into the best available and applicable technology for waste incineration for power production.	AQUALECTRA AND SELIKOR	2018	
Siting and network integration study of a 7-15 MW waste-to-energy.	AQUALECTRA	2018	
Investment decision for procurement and design of concession arrangements, gate fee, PPA and electricity offtake price).	GOVERNMENT (advice by Energy Office)	2019	
Tendering of contractor (BOO or BOOT) with facility.	ENERGY OFFICE in cooperation with stakeholders	2019	
Signing of waste supply contract and electricity offtake contract with facility.	SELIKOR AND AQUALECTRA		2020
Develop a policy for (liquid) waste treatment, e.g. for gasification.	MINISTRY GMN in cooperation with Energy Office	2020	

3.5. PROJECT REALIZATION

It is to be expected that the results of the above studies will lead to the implementation and realization of several renewable energy projects. Depending on the innovative character of the projects, their feasibility and the developments in the (world) petroleum fuel markets, further support might be required to ensure effective integration of these technologies in the Curaçao electricity system. Moreover, additional technical and regulatory measures may be required, in combination with training and capacity building programs to enhance local involvement and employment.

Table 5
Presents a
required budget
for actions in the
field of energy
security and
sustainable
energy supply (in
US dollars).



	2018	2019	2020	2021	2022	TOTAL
Development of a spatial planning system for RE realization	50.000	25.000	25.000	25.000		125.000
Development of regulatory framework for the regulating body	10.000	90.000	10.000			110.000
Development of budget neutral fiscal stimulation measures		60.000	40.000			100.000
Feasibility study additional wind and solar up to 60/75% of electricity generation	110.000					110.000
OTEC, combined with SWAC and fresh water production		100.000	100.000			200.000
Feasibility study WTE facility, improved waste management and biowaste digestion	330.000	15.000.000	65.075.000			80.405.000
Project realization and implementation	5.675.000	7.525.000	2.525.000	25.000	25.000	15.775.000
Contingency public input	40.000	40.000	40.000	40.000	40.000	200.000
TOTAL	6.215.000	22.840.000	67.815.000	90.000	65.000	97.025.000

4 Measures to enhance efficiency and sustainability in the transport sector

4.1. TECHNOLOGIES

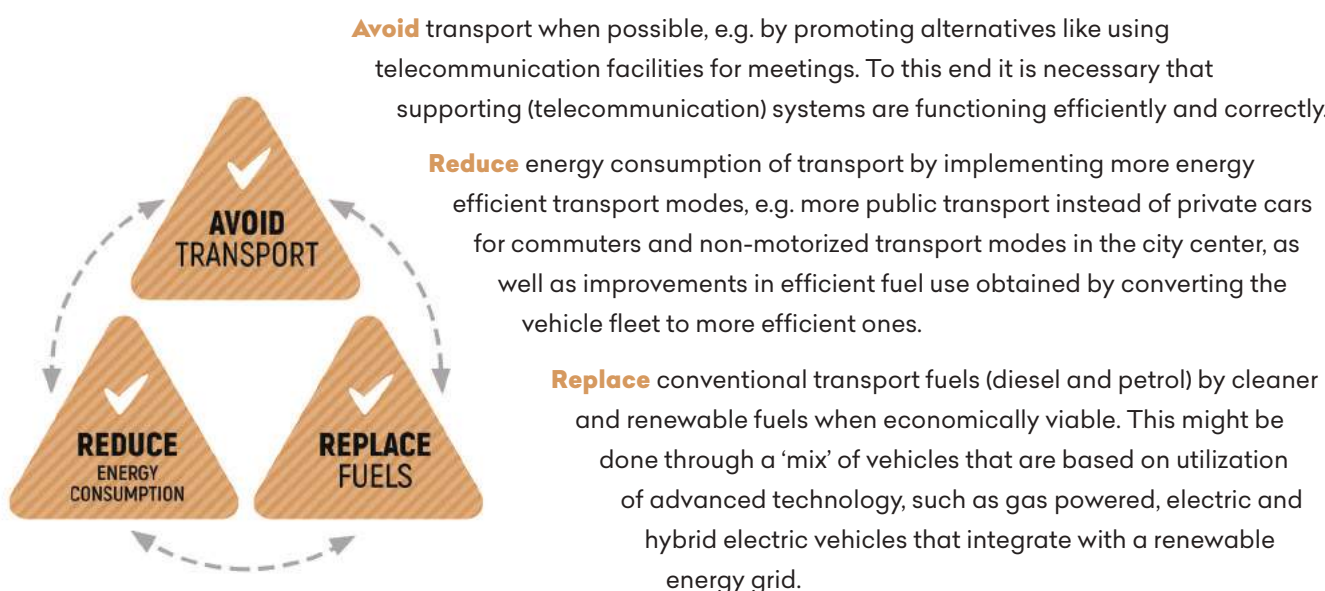
Conventional energy measures for the transport sector

The transport sector on Curaçao is based on conventional vehicle technologies operating within a dense, modern road network (approximately 124 km per 100 km²). This road network connects producers to consumers, it connects people to work, and children to schools. In short, the transport infrastructure allows a wide and varied range of leisure and business activities, including tourism.

Despite the relevance of the transport sector for total energy use (roughly consuming half of the total fuel consumption on the island), much of the energy planning in Curaçao has largely neglected transport and focused solely on the electricity production sector. Though some regulations are in place, there are apparent inefficiencies in the transport sector that need to be tackled in order to achieve energy efficiency. There is also a need for training, capacity building and awareness programs. Promoting the use of energy efficient vehicle technologies and efficient transport patterns is also necessary.

The transport sector is currently focused on the marketing and distribution of conventional vehicles as well as the fuels to power them. The sector is one that is largely disaggregated, with many diverse actors ranging from the Ministry of Traffic, Transportation and Urban Planning (Ministry of VVRP), which is responsible for the sector, The Ministry of Economic Development, which is responsible for the economic and energy aspect of the sector, Curoil which is the sole fuel distributor, BT&P which is responsible for regulation of fuel quality and fuel prices, a variety of vehicle distributors and sellers, and also public, commercial and private vehicle operators.

Policies that support suitable vehicle technologies, such as electric vehicles and hybrid vehicles are deemed to contribute to the achievement of a drastic reduction in per capita energy consumption. Low-carbon transport solutions for Curaçao will therefore be based on the following three pillars:



In the transport sector the renewable energy options are less obvious when compared to the electricity sector. Nevertheless, there are a number of opportunities that match well with Curaçao's sustainability objectives:

- ➡ Policies will be developed to shift to more efficient vehicles, e.g. to replace the most inefficient and polluting cars (mostly the older cars on the island) by cars with a considerably lower fuel consumption.
- ➡ Improve public transport to prevent and reduce the use of private vehicles.
- ➡ Curaçao has a good potential for implementing more electricity generation based on local renewable resources. This provides a real incentive to foster the use of electric transport. Currently, there are only a few, privately owned electric cars on the island. Although tax and duty incentives were developed, there will be no real adoption of electric transport as long as the required infrastructure is not available. Curaçao should investigate how electric transport (individual and public) could be introduced. It seems logical that Aqualetra takes the lead, e.g. by introducing electric transport for its own purposes. Other companies and organizations may then follow as soon as a start has been made with realizing the required infrastructure.
- ➡ Another alternative fuel that could be of interest for use in cars is natural gas. Presently the Government is negotiating the construction of a natural gas terminal on the island. This plant may also deliver natural gas for the local market. Currently there is a company on the island that converts gasoline cars in dual fuel cars, adding the option to drive on LPG. A study should be done to assess whether natural gas provides an interesting transport fuel. To this end the Government will cooperate with Curoil to facilitate developments in this field.

- ➡ Other fuel alternatives such as hydrogen and biofuels are not expected to be of interest for Curaçao within the time span of the present strategy. Nevertheless, the international developments in this area will be closely monitored.

Renewable energy measures for the transport sector

The transport sector consumes roughly 50 % of the total petroleum fuel imports of Curaçao. There are no easy technological measures to promote a shift to renewable fuels, the use of electrical vehicles or to effectively reduce transport activities. The following measures have nonetheless been identified:

1. Perform a consultation, jointly with the ministry of VVRP, of experts in the transport field to aid in developing and implementing appropriate regulatory, fiscal and technical measures to optimize and effectively reduce petroleum fuel consumption for transport.
2. Dissemination of information on energy efficiency and fuel saving in the transport sector. Individuals, companies and other organizations should be made aware of the environmental and financial impacts of car transport and fuel usage to create an enabling environment for policy measures in this sector.
3. Preparation of a regulatory framework including energy-labeling, fiscal constraints and technical requirements for the import of conventional fuel vehicles in order to incentivize the purchase of more energy efficient vehicles (like electric vehicles).
4. The use of biofuel for transport. Curaçao has many small and larger restaurants, hotels and fast food kitchens who offer waste streams of vegetable oil. Used vegetable oil can be upgraded for use as a fuel in power generation or mixed with diesel fuel for use in vehicles. The overall quantity of used vegetable oil on Curaçao is not known. Therefore, a study needs to be conducted to assess the overall quantity of used vegetable oil on Curaçao and the required investments to upgrade this oil to a fuel for power generation or diesel engine fuel.
5. A gradual shift to electric vehicles for private and/or public transport should be considered. If renewable electricity will become increasingly available on Curaçao, electricity may also be used for transport purposes. This will however require procurement of (small and large) electric buses and electric private vehicles as well as investment in the infrastructure for the battery charging stations. A study will be conducted to determine the most effective and efficient opportunities for electric transportation on Curaçao. For example, electric vehicles may be introduced first for public transport and/or for Government vehicles as first movers and trendsetters.

Although experiences in other, tropical regions have shown that the lifetime of the batteries for electric vehicles is less in tropical climates, technological innovation to deal with this issue is progressing quickly. Furthermore, battery storage capacity from electric vehicles may facilitate the uptake of excess electricity from variable renewable energy resources. A feasibility study will be initiated to assess the main opportunities and issues associated with the introduction of electric vehicles.

6. Stimulate the use of public transportation to reduce individual car usage. The availability of a proper public transport system may significantly contribute to the reduction of fuel imports and emissions. A public transport planning study needs to be conducted with the assistance. This study will include the preparation of an overview of available technical options for a shift to energy efficient or electric vehicles. This study should include improved public transport planning, energy efficient, electric and/or gas operated public transport and the use of other renewable transport fuels.

4.2. ACTIONS TO BE TAKEN

The actions for energy efficiency in the transport sector relate to the following strategy presented in part 1:



STRATEGY V

Energy efficient transport.

The following actions are identified:

STRATEGY V. ENERGY EFFICIENT TRANSPORT	RESPONSIBLE	ACTION	IMPLEMENTATION
Development of an action plan for implementation of the actions in the field of transport.	MINISTRY OF VVRP	2019	2020 (pilots)
Raising public awareness of the downside of transport with the intention to avoid fuel use through the usage of broadband services for meetings and access to public services.	MINISTRY OF VVRP (assisted by the Energy Office)	2021	
Reduce fuel use by shifting to increasing public transport systems for commuters and to non-motorized transport modes in-city, as well as by improvements in efficient fuel use obtained by converting the vehicle fleet to more efficient vehicles.	MINISTRY OF VVRP (assisted by the Energy Office)	2022	
Introduction of minimum energy performance standards for vehicles, including labelling where possible.	MINISTRY OF VVRP (assisted by the Energy Office)	2022	
Development of a plan to replace conventional fuel use to a mix of alternatives such as gas powered, electric and hybrid electric vehicles that integrate with a renewable energy grid.	ENERGY OFFICE	2022	

4.3. PROJECT REALIZATION

In Table 6, a preliminary budget estimate for actions in the transport sector is presented.

Table 6.
Required budget for energy efficiency in the transport sector (in US dollars).

	2018	2019	2020	2021	2022	TOTAL
Strengthening of Government organization (transport)	180.000	230.000	180.000	180.000	180.000	950.000
Information dissemination and awareness raising			55.000	105.000		160.000
Regulatory framework including energy labeling and fiscal scheme				100.000	200.000	300.000
Sustainable public transport planning study			150.000	50.000		200.000
Investments for sustainable public transport	50.000	1.100.000	1.550.000	520.000	20.000	3.240.000
Contingency public input	80.000	80.000	80.000	80.000	80.000	400.000
TOTAL	310.000	1.410.000	2.015.000	1.035.000	480.000	5.250.000

5 Measures with respect to energy efficiency and energy conservation

5.1. PROPOSED MEASURES

In order to make progress in the field of energy efficiency the following measures are proposed¹⁰:

1. Information dissemination and awareness raising. Consumers (households and companies) are generally insufficiently informed about the pro's and cons of available technologies and their costs with respect to their energy use. In most cases, energy costs represent a relatively large (10–30 %) share of overall costs. The lack of adequate information about potential energy efficient measures and technologies slows down investments in energy efficiency. The Government, assisted by BT&P, will propose awareness raising programs on energy efficiency and energy conservation¹¹. There is a significant potential for market driven energy-efficient technologies, especially for households and small businesses.
2. The Government will investigate the possibilities to implement measures that discourage the use and/or import of inefficient appliances. This will be done through:
 - Tax reforms to create fiscal incentives aimed at facilitating energy efficient investments in the commercial and private sector.
 - Import bans on inefficient appliances, or tax measures to discourage inefficient appliances.
 - Facilitating credit lines for energy efficiency investments that clearly reduce petroleum fuel import and thus reduce the required foreign currencies for fuel imports.
 - Creating incentives for third party financing for investments in efficiency measures.

The Government will investigate the possibilities to implement measures that discourage inefficient energy use and/or introduce minimum energy performance standards for buildings, equipment and appliances. Minimum energy performance regulations should be developed and introduced to include options for building ratings, appliance standards and labelling.

It is recommended to issue an amendment to the building code to include energy efficiency requirements for buildings. These will entail schemes that involve the issuance of certificates for buildings and building technologies that meet the energy performance requirements and additional levels of certification for those with superior performances. Similarly, the introduction of energy efficiency standards and labelling schemes for household and commercial appliances are necessary.

¹⁰ Based on: Economic Commission for Latin America and the Caribbean's (ECLAC) and German Cooperation, *An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Curaçao*, 2013.

¹¹ This will be done by, among others, making information available on the internet. See <http://energiakonsiente.com>.

Promote pilots by private parties for innovative technologies, where possible and economically viable, e.g. for the implementation of SWAC and/or OWAC installations for cooling purposes. Effective implementation will require siting studies (availability of cooling demand), feasibility studies and an economic assessment at potentially interesting sites.

5.2. ACTIONS TO BE TAKEN

The actions for energy efficiency and energy conservation relate to the following strategies presented in part 1:



STRATEGY VI

Energy efficient buildings.



STRATEGY VII

Demand-side energy efficiency.



STRATEGY VIII

Efficient system operation.



STRATEGY IX

Efficient system planning.

The following actions are identified:

STRATEGY VI. ENERGY EFFICIENT BUILDINGS	RESPONSIBLE	ACTION	IMPLEMENTATION
Preparation of an inventory of the national (consumer) energy use differentiating at least: energy needed for transportation, buildings (cooling), and appliances.	BT&P	2019	
Definition of future policy targets for energy consumption by buildings (cooling and lighting).	MINISTRY OF VVRP (with Energy Office)	2019	
Amend the building code for energy used by new and refurbished buildings in conformity with the policy targets for energy consumption by buildings. The building code will include energy efficiency requirements, with a scheme that involves the issuance of certificates for buildings and building technologies that meet the energy performance requirements and additional levels of certification for those with superior performances.	MINISTRY OF VVRP (with Energy Office)	2020	2021
Promote (but not invest in) the implementation of sea water air conditioning (SWAC/OWAC) installations by facilitating private initiatives.	ENERGY OFFICE	2020	
Develop appropriate fiscal incentives for energy efficiency and provide information to promote public awareness on energy efficiency for commercial buildings and households.	ENERGY OFFICE	2019	2020
STRATEGY VII. DEMAND-SIDE ENERGY EFFICIENCY	RESPONSIBLE	ACTION	IMPLEMENTATION
Development of policy and legislation for procurement of more energy efficient appliances.	ENERGY OFFICE	2020	
Adaptation of the energy tariff structure and gradual implementation of a usage tax for energy and water consumption above a threshold value per households.	ENERGY OFFICE in cooperation with Ministry of Finance	2021	2022
Introduction of minimum energy performance standards for equipment and appliances, including labelling where possible.	ENERGY OFFICE	2020	2021
Import ban on inefficient appliances, or tax measures to discourage inefficient appliances. Full shift to energy efficient lighting (such as LED-lighting) by banning environmental burdening lighting.	ENERGY OFFICE in cooperation with Ministry of Finance		2025
Awareness programs for efficient energy and water consumption.	ENERGY OFFICE		2019
Demand response study & implementation of programs for demand response and time-dependent tariffs.	ENERGY OFFICE cooperation with BT&P		2022

STRATEGY VIII. EFFICIENT SYSTEM OPERATION	RESPONSIBLE	ACTION	IMPLEMENTATION
Legal framework for regulation (Energy Office) + development of cost of service models for the utility companies and cost-reflective tariff structures for energy, water and fuel users (BT&P).	ENERGY OFFICE, BT&P	2019	
Development of a grid code for electricity and water transport and distribution (+ formal approval by Minister of Economic Development)	BT&P, ENERGY OFFICE	2019	
Development of a grid operation policy, which (a) provide for the admission of increased generation from renewable energy resources to the grid, (b) ensures efficient transport and distribution, and (c) contributes to reducing network losses to acceptable levels (lower than 10%).	AQUALECTRA	2020	
Reduction of total losses in the electricity distribution system to less than 10 % by 2025 (and less than 8 % in 2035), which will be partly achieved by a reduction of administrative losses (non-payment of energy consumed).	AQUALECTRA		2025
Reduction of physical network losses in the water distribution system to less than 15 % by 2025.	AQUALECTRA		2025
Rolling out of smart meters, i.e. time dependent metering with distant meter reading capabilities.	AQUALECTRA		2020-2030
Study of the potential benefits of implementation of a smart grid, to be performed by Aqualectra by 2022.	AQUALECTRA	2022	
STRATEGY IX. EFFICIENT SYSTEM PLANNING	RESPONSIBLE	ACTION	IMPLEMENTATION
Development of an Integrated Resource Plan for fuel distribution and purchase including security of supply, an adequate strategic reserve and an emergency plan, starting in 2018 with updates every 3rd year.	CUROIL	2018	
Development of an Integrated Resource Plan for electricity generation and water production (IRP) and an emergency plan, starting in 2018 with updates every 3rd year.	AQUALECTRA	2018	
Development of an integrated planning cycle, in which the Government (Energy Office) and the regulator (BT&P) approve the investment plan. The Government (Energy Office) approves the IRP and BT&P advises and monitors investments in between updates of the IRP.	ENERGY OFFICE AND BT&P	2018	
Development of a framework for concurrent development of energy system planning with land and water use planning and permitting, while safeguarding Curaçao's natural environment.	ENERGY OFFICE, MINISTRY OF VVRP	2018	
Conversion of electricity generators to dual fuel operation to allow electricity production on natural gas dependent on planning for availability of LNG.	AQUALECTRA	2021	
Maintaining a strategic reserve for fuels (HFO, LNG, ...) for a predefined period (to be defined, see item a; Energy Office), including regulatory treatment for the involved costs (BT&P).	ENERGY OFFICE, BT&P	2019	

5.3. PROJECT REALIZATION

The following table 7 summarizes a preliminary budget estimate for actions in energy efficiency.

Table 7.
Required budget for actions on
energy efficiency (in US dollars).

	2018	2019	2020	2021	2022	TOTAL
Energy efficiency information dissemination and awareness raising program	50.000	235.000	35.000	35.000		355.000
Energy performance standards for buildings and building code		50.000	150.000			200.000
Energy performance standards for appliances and energy-labeling scheme		50.000	100.000	50.000	50.000	250.000
Analysis of opportunities and potential for SWAC/OWAC implementation.	100.000	50.000	50.000			200.000
Initiate energy efficiency	50.000	600.000	600.000	600.000		1.850.000
Support social housing zero energy demonstration project	1.000.000	1.000.000				2.000.000
Contingency public input	40.000	40.000	40.000	40.000	40.000	200.000
TOTAL	1.240.000	2.025.000	975.000	725.000	90.000	5.055.000

6 Budget and financing

The actions presented above will be financed from three sources: the Government of Curaçao, private parties and external funding. The latter also includes the contribution from the utility companies. An overview of the expected investments and costs is included in Table 8.

Table 8.
Financial overview of the
implementation costs (in US dollars).

	2018	2019	2020	2021	2022	TOTAL
Organizational & regulatory measures	873.000	1.263.000	1.022.000	697.000	647.000	4.502.000
Energy security & sustainable energy supply	6.215.000	22.840.000	67.815.000	90.000	65.000	97.025.000
Energy efficiency & renewables in the transport sector	310.000	1.410.000	2.015.000	1.035.000	480.000	5.250.000
Energy efficiency and information dissemination and awareness raising program	1.240.000	2.025.000	975.000	725.000	90.000	5.055.000
TOTAL	8.638.000	27.538.000	71.827.000	2.547.000	1.282.000	111.832.000

Considering the presented projects and initiatives in the different chapters above, the overall budget of the implementation of the Strategic Work Plan 2018–2022 is presented in Table 9.

TASK	TOTAL, \$
Organizational & regulatory measures	4.502.000
Energy security & sustainable energy supply	97.025.000
Energy efficiency and renewables in the transport sector	5.250.000
Energy efficiency and information dissemination and awareness raising program	5.055.000
TOTAL	111.832.000

Table 9.
Budget for the implementation of the Strategic Work Plan 2018–2022 (in US dollars).

Considering the presented projects and initiatives in the different chapters above, the overall budget of the implementation. The costs will be covered from different financial sources. These are presented in Table 10.

TASK	AMOUNT, \$	AMOUNT, €
Curaçao Government budget	2.567.500	2.203.863
Contributions from European and other funds	19.459.500	16.703.433
Private financing for project development and realization	89.805.000	77.085.837
TOTAL	\$111.832.000	€95.993.133

Table 10.
Sources for funding the implementation of the Strategic Work Plan 2018–2022 (in US dollars and euros; exchange rate: EUR 1 = USD 1,165).

7 Monitoring and evaluation

Progress made in the field of energy will be closely monitored by the Energy Office of the Ministry of Economic Development. The Energy Office, in close cooperation with the BT&P, will prepare periodic progress reports which will be discussed with stakeholders. The main elements for the monitoring and evaluation are:

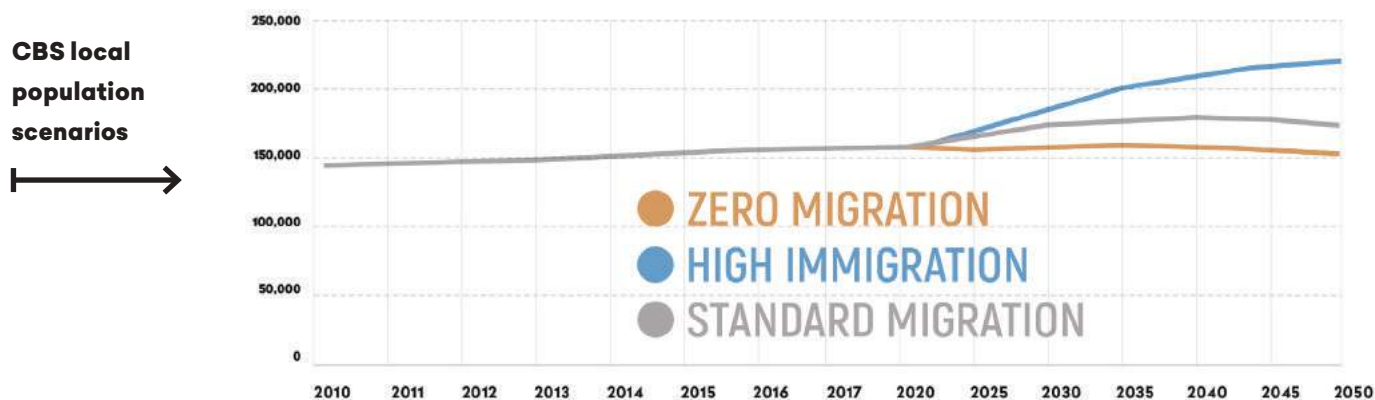
1. Progress with respect to the mission to realize before 2023 transparent and effective institutions and regulations for the energy sector. Specific issues for monitoring:
 - Transformation and equipping of BT&P as independent regulator.
 - Development of the Energy Act.
 - Development of the regulatory instruments.
2. Progress with respect to the mission to cover at least 50 % of national energy needs from locally available renewable energy resources by 2035.
3. Progress with respect to the mission to reduce the national energy consumption per capita with at least 25 % before 2040 (compared with 2016)
4. Quantitative score (based on actual data) with respect to the six policy objectives on reliability of the energy supply, security and adequacy of supply, quality of supply, energy conservation, sustainability and emission reduction, and affordability of supply.

APPENDICES

1 General

Economic growth, welfare, energy costs, tourism and population growth seem to be the main drivers influencing the development in energy demand. Curaçao's economy has been growing slowly in the past decade, with an average of 0.9% real GDP growth over the past six years (CBS). In the past two years, economic growth has stagnated and showed a contraction (-1% in 2016). It is projected that the GDP growth will pick up again slowly reaching 2% in 2022 (The Ministry of Economic Development, 2017).

Based on past research done by Aquallectra the electricity and water demand appears to react roughly with a time lap of two years to changes in the economic development. With respect to transport we observe that personal car use decreases when fuel prices rise. Furthermore there is a direct correlation between population growth and energy consumption. Depending on household income it is expected that the energy consumption per household will increase.



A recent trend has been identified where more and more households participate in the tourism industry by offering low cost apartments and rooms to tourists. This increases overall energy use for households. At this moment there is no clear information on the absolute effect of this development. For the projected population growth, the energy policy follows the standard migration scenario published by the CBS 2016¹².

The two major consumers of petroleum fuels in Curaçao are the transport sector and electricity production (excluding the refinery). For transport the fuel consist mainly of Mogas and low sulfur diesel. For electricity it consists of fuel oil and gasoil and a portion of renewables.

Renewable energy technologies have historically been used both in small, isolated and utility scale applications in Curaçao since the 1950's. In particular, wind and solar photovoltaic electricity generation, as well as solar thermal systems have been used at some scale. There is still significant scope, however, for increasing the penetration of these technologies as well as the introduction of energy conversion of municipal and commercial combustible waste, and ocean water technologies for cooling and electricity production. Curaçao has been at the forefront of efforts to develop renewable energy solutions within the Caribbean. The Tera Kòrá (1993) and Playa Kanoa (2000) wind parks were among the first commercial wind parks in the region.

¹² Published in 2016 by CBS Curaçao under statistical publications titled "Population indicators standard migration variant, 2010-2050"

2 The Renewable Energy Policy of 2011-2015

Curaçao prepared a Renewable Energy Policy focusing on the electricity sector in 2009, which sought to establish targets to meet at least 40 % of the island electricity consumption with renewable energy resources (RES) by the year 2030.

The Renewable Energy Policy 2011-2015 had the following

- **objectives:**

- the realization of an affordable provision of service
- through a stable development of tariffs;
- the realization of a reliable provision of service regarding the availability of electricity for the benefit of the business community and the private market;
- the structural safeguarding of the interests of the end consumers of electricity;
- the introduction of more market dynamics into (parts of) the electricity sector and
- the realization of more sustainable provision of energy and the realization of the necessary medium-term conservation of energy and the introduction of an



Since the start of the Curaçao Renewable Energy Policy 2011-2015, the share of renewable energy in electricity generation, especially of wind energy, has increased considerably from roughly 5% in 2011 to 18% in 2015, and in July 2017 with the capacity expansion of the Tera Kora wind farm with 16.5 MW ultimately to 27-28 % on average. With respect to solar energy the installed capacity increased from almost zero in 2010 to roughly 10 MWp in 2017. In the transport sector and the field of energy efficiency, however, no real progress has been made except for some small private initiatives. In 2009 an energy regulator has been established (Bureau Telecommunicatie & Post, BT&P).

In a study performed on behalf of the Government ECLAC had identified in 2013 the issues limiting the effectiveness of energy policy development and implementation¹³.

ECLAC formulated the following critical attention points for the Government with respect to the energy policy:

THE ABSENCE OF A COMPREHENSIVE, MODERN ENERGY POLICY

Although a policy framework had been articulated by the previous administration in 2011, progress has been stymied by the lack of political continuity within the country, as well as the limited capacity available to the Government for the efficient development and subsequent implementation of the policy.

¹³ ECLAC, *An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Curaçao*, 2013.

THE ABSENCE OF A SINGLE AUTHORITY WITH THE RESPONSIBILITY FOR STRATEGIC PLANNING WITHIN THE ENERGY SECTOR

As a consequence, it was not clear which entity had a mandate to formulate and coordinate energy sector policies, sub policies and activities. Although some energy subsectors, such as electricity, water and fuels, fall under the (regulatory) mandate of BT&P, policy development is not the role of an independent regulator. Therefore, the design and development of policies and sub-policies for the energy sector have not been consistently pursued.

SIGNIFICANT ADMINISTRATIVE HURDLES EXIST WHICH DETER INVESTMENT IN THE SUSTAINABLE ENERGY SECTOR

In principle, all renewable energy generation technologies, even small-scale systems, are impacted by administrative barriers which, one way or another, increase transaction costs for the renewable energy developer and society as a whole. Frequently, the involvement of many authorities and administrative procedures and complicated framework for approval serve to lengthen the decision-making process and increase cost, especially within a country where the availability of technical expertise is limited and project developers may require the assistance of 'expensive expatriates'. In particular, the following hurdles, have been identified and are deemed relevant:

- Lack of capacity for expeditious implementation of the Renewable Energy Policy and its further development;
- Lack of coordination among different public authorities and agencies. The involvement of multiple Government ministries and agencies complicates decision making;
- Long lead times and high costs in obtaining authorizations and permits: In fact, the Government of Curaçao, in cognizance of this issue, sought to reduce bureaucracy for obtaining business licenses and permits, as a prerequisite to attracting more investments, through a *From Red Tape to Red Carpet Policy* for local and foreign investors.

The National Energy Policy for Curaçao addresses these and other issues.



3 Structure of the energy sector

Curaçao is a small island with a small economy, on a land surface of 444 km² and a population of roughly 150,000 people. The energy structure of Curaçao is relatively simple with a limited number of actors which are strongly interrelated. The six main stakeholders of the Curaçao energy sector are:

1. The fuel import and distribution company Curoil;
2. The electricity and water production utility Aquallectra;
3. The refinery, now operated by PDVSA, as main provider of fuels to Curoil and Aquallectra.
4. The Government.
5. The Regulator, Bureau Telecommunicatie & Post.
6. The Consumers.

Curoil¹⁴: Curoil is a state-owned company and has a central role in the overall energy system as the sole distributor of fuels for different purposes (electricity production; transport; other fuel usage and fuel export). Curoil also imports low sulfur quality diesel for transport, as this cannot yet be produced in the Curaçao refinery.

Curoil operates a series of fuel stations where petrol, diesel, LPG and kerosene can be procured by households (LPG for cooking), and for transport. Curoil also supplies privately owned fuel stations and Aquallectra with fuels for electricity and water production. Curoil also provides several larger companies with fuels for their (back-up) electricity generators. Furthermore, Curoil is responsible for bunkering of ships, delivering jet fuel for the airport and exporting fuels to the region.

Aquallectra¹⁵: Aquallectra is a state-owned company responsible for the production and distribution of water and electricity on the island. The production mix consists of diesel generators, a gas turbine and the integration of renewable electricity production through PPA's (Power Producer Agreements with third parties: 46.5 MW wind and roughly 10 MW of solar). The diesel and gas turbine use fuel oil and gasoil, delivered by Curoil. Aquallectra also purchases electricity from a utility on the refinery (CRU) and purchases solar electricity from small independent power producers (SIPP's).

Aquallectra consists of three main entities:

Aquallectra Production, responsible for the generation of electricity and production of water;

Aquallectra Distribution, responsible for transport and distribution of electricity and water;

Aquallectra Holding, the owner and management company of the first two companies.

The refinery¹⁶: The refinery is supplied with water, electricity, steam and compressed air through the state-owned utility Refineria di Korsow (RdK). Through the Curaçao Refinery Utility company (CRU) supplies excess electricity is supplied to Aquallectra. RdK is the owner of the refinery, which it leases on behalf of the Government to the Venezuelan oil company PDVSA who operates the refinery. The lease contract ends in 2019, and there are presently open negotiations for a new lease contract for 40 years. It is the intention that in the future (after 2019) the refinery will own and operate its own utility plant. It is not yet certain if there will be a grid connection with the grid of Aquallectra.

¹⁴ See www.curoil.com.

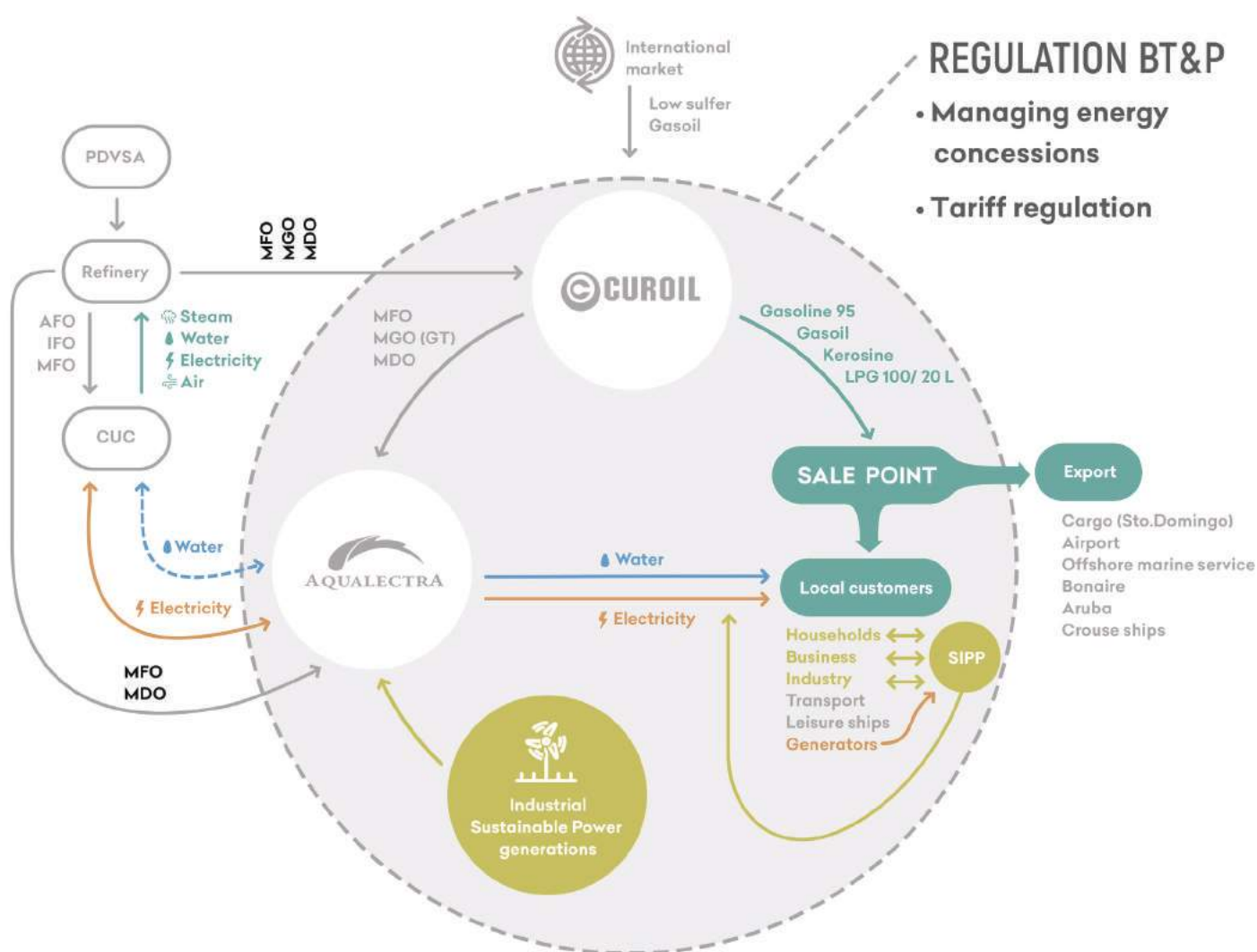
¹⁵ See www.aquallectra.com.

¹⁶ See www.refineriadikorsou.com and www.refineriaaisla.com.

At this moment the refinery is the sole supplier of hydrocarbon fuels on the island for electricity production, which is considered an security of supply risk.

For a schematic overview of the energy structure, the companies, the energy flows and the main stakeholder's responsibility see figure A.1.

Figure A.1
Schematic overview of the energy structure,
companies and energy flows (situation
representing 2017).



The Relationships between these stakeholders in the energy sector can be summarized as follows

- PDVSA, the operator of the refinery, delivers heavy fuel oil and gasoline to Aqualectra, Curoil and CRU (the Curaçao Refinery Utility company);
- CRU's main activity is to provide utilities (electricity, water, steam and compressed air) to the refinery. A surplus of electricity production is delivered to Aqualectra;
- Curoil distributes imported fuels (low sulfur diesel) and fuels produced by PDVSA (heavy fuel oil, gasoil and gasoline) to gas stations (end-users) and to Aqualectra. Curoil also supplies the airport with jet fuel and supplies ships with bunkering;
- Aqualectra produces electricity and water for end users using fuels from Curoil and electricity procured from CRU, the wind parks and solar electricity production. Electricity from wind parks is all sold to Aqualectra. Electricity from solar systems is partly used by the (private) owners, partly sold to Aqualectra;

The Government¹⁷: Currently the responsibilities with respect to energy within the Government are split between the Ministry of Economic Development and the Ministry of General Affairs.

The Ministry of Economic Development (MEO) is responsible for developing an energy policy and its implementation. MEO is in the process to set-up an Energy Office for these tasks. MEO also prepared and maintains the regulatory framework for the energy sector and is currently responsible for the monthly approval of fuel, electricity and water tariffs.

The Ministry of General Affairs is responsible for the refinery. This Ministry manages the Government's interests via the company Refineria di Korsow (RdK) and a group of specialist in the field known as the 'MDPT' (the Multi-Disciplinary Project Team) who is responsible for managing the transition of the refinery for the period after 2019 (when the existing lease agreement with PDVSA has ended).

The Bureau of Telecommunications & Post (BT&P)¹⁸: BT&P performs the role of utility regulator, also with respect to the utilities in the energy field. BT&P assists the Ministry of Economic Development in setting the fuel and electricity tariffs and monitoring the concessions. BT&P collects data on energy consumption and costs in order to calculate the tariffs. BT&P also advises the Government on the development of regulations in the field of energy. BT&P is financed through a surcharge on the energy tariffs and rates (and functions therefore independent from the Government budget).

Given the small size of the energy system on Curaçao, the current structure consisting of two major utilities, Curoil for fuels and Aqualectra for electricity production and distribution, seem logical and will be maintained. As these companies provide monopolistic services, regulation is necessary, which is today performed by the Ministry of Economic Development based on recommendations of BT&P. The move towards an independent, autonomous regulator is however the preferred (given international experience in the field of regulation)¹⁹.

¹⁷ See www.gobiernu.cw.

¹⁸ See www.btnp.org.

¹⁹ See R.A. Hakvoort, S. Martina, and M. Goede (ed.), *Reflections on a utility regulator for Electricity and Water on Curaçao*, University of the Netherlands Antilles & D-Cision, ISBN: 978-99904-0-953-6, 2009.

4 Regulatory framework of the energy sector

Within the energy sector the regulatory framework presently focuses on the electricity and fuel sectors. Transport is not regulated. As a result of increasing rates and the suboptimal availability of electricity supply (brownouts), a revision of the legal framework is required.

The existing legislation may be broadly subdivided into two categories:

1. A national decrees with resolutions relative to the concessions for electricity production, and a
2. National decrees and resolutions for the implementation of a system for the independent setting of the rates for electricity supply to ensure a fair tariff policy.

The most important framework documents on the electricity production concessions are:

- Transitional National Ordinance XXVI: Electricity concessions (P.B. 1991, no.102);
- Ordinance 12/3808 of 30 July 2012 providing a concession to Aqualetra;
- Ordinance 12/1261 of 19 June 2014 modifying the concession 12/3808 to Aqualetra.

Important elements of the utility concession to Aqualetra are:

- Aqualetra will be responsible for ensuring an efficient and cost-effective provision of electricity on Curaçao;
- Aqualetra has to prepare multi-year programs showing how the security of electricity supply can be safeguarded;
- Aqualetra will provide all requested information to BT&;
- In case of extension of the production capacity, Aqualetra will apply public procurement procedures to ensure cost-effective investments.

The concession for Aqualetra was modified in 2014 on a number of points:

- The new concession clearly sets the minimum and the maximum available production capacity of Aqualetra between 125 MW and 175 MW. (The previous concession of 2012 did not indicate a production capacity).
- The requirement for applying public procurement procedures when extending the installed production capacity has been removed (since such a thing cannot be arranged in a concession.)

The current legislation on electricity concessions is considered to be outdated and should be improved to meet the requirements of a modern electricity production system. This would include, where appropriate, competition in the procurement of important components of the production and distribution system to guarantee that the most cost effective options are being selected.

The most important components of the existing legal framework relative to the determination of the energy rates are the following:

- Transitional National Ordinance XXV: regulating the prices of goods and services and the closing hours of stores (P.B. 1991, no. 100) (to be referred to hereafter as: the ‘Ordinance on Pricing’).
- Resolution of the Executive Council no. 2000/29272 regarding the restructuring of the electricity rates, whereby the ‘all-inclusive tariff’ was introduced as tariff structure as per December 1st, 2000 (viz. also the Protocol on tariff amendments of June 2001).
- Resolution of the Executive Council no. 2002/29843 regarding the conversion of the ‘all-inclusive tariff’ into an ‘all-inclusive cap tariff’ per January 1st, 2003 and the determination of the requirement of yield at 8 %.
- Resolution of the Executive Council no. 2008/61486 regarding the maintenance of the “all-inclusive cap tariff” per January 1st, 2009 and the implementation in the future of an independent regulatory system.
- Bill on Regulation of Electricity Provision Curaçao 2011-2015, and
- Bill on Small-scale Sustainable Electricity Provision of November 16, 2011.

The Ordinance on Pricing enables the Government of Curaçao to intervene in the development of prices for goods and services by establishing minimum and maximum prices. In the case of electricity or fuel supply, this concerns the setting of maximum prices.

Furthermore, the Government of Curaçao has established a regulatory framework for the assessment, determination and establishment of the tariffs for (water and) electricity. As indicated earlier transport is not regulated.

5 Overview of the energy market

Overall, only a limited amount of data is available on energy supply and consumption at Curaçao. Although BT&P collects information on electricity supply, fuel imports and distribution, this information is not shared and thus not available to policy makers. No information is available on electricity consumption from a demand perspective or on fuel use. The Ministry of Economic Development has initiated a process to set up and develop an energy data monitoring system that can be used for policy development and implementation.

In general the primary energy is used by:

Electricity supply and consumption.

No detailed information is available on electricity consumption in different economic sectors (households, offices, tourism, industry, agriculture, etc.).

Transport

(private and public transport, fishery, bunkering, etc.).

The refinery of Curaçao

(utility and transport). The refinery is currently also the major provider of fuels for Curaçao.

Curaçao faces energy security issues caused by its reliance on imported fuels, its dependence on one single supply country (Venezuela), and the non-guaranteed supply of the refineries utility. Furthermore, security of electricity supply is at risk due to the insufficient amount of available generation capacity. Additional capacity investments are necessary and foreseen in the near future.

A series of studies concerning the future of the refinery have been conducted by RdK, the state-owned company leasing the refinery to PDVSA, and the Multi-Disciplinary Project Team (MDPT) established by the Government of Curaçao to investigate the best options for the future of the refinery. In 2016 the Prime Minister has informed political parties that the lease contract to PDVSA ending in 2019 will not be extended. Negotiations have started with potential new operators. There are three major developments: 1. The existing refinery needs upgrading. 2. A new refinery might be built on a new site. 3. A natural gas transshipment terminal will be built.

The vision of the Government is that a rehabilitated refinery should use liquid natural gas (LNG) or compressed natural gas (CNG) to fuel different refinery processes, lowering cost and significantly reducing environmental pollution. The introduction of LNG as a main fuel for the refinery will also allow replacing heavy fuel usage in diesel plants of Aqualectra by LNG, which will result in significant emission reductions and cleaner electricity generation. The Government promotes these developments.

Although the refinery currently forms the main supplier of fuels for the island, it remains unsure how this will be in the near future. It is expected that the dependence of the refinery as fuel supplier will slowly decrease, taking into account the ambition of the Government for an energy transition by adopting more sustainable energy options and enhancing energy security by focusing on the use of local natural resources.

The new energy policy shifts the mindset in reducing the role of the (future) refinery as a main supplier of petroleum fuels. It will become a main economic entity for exporting fuels and, only where beneficial, also for supplying a part of the fuel demand of the energy sector on Curaçao. Curoil should play an important role in the export regionally, shifting its focus from local business to a more international presence.

When looking at the other parties in the energy sector it is obvious that the focus lies on the following three elements of energy production and consumption:

Electricity production

(with Aqualectra as the main electricity production and distribution company).

Transport

(with Curoil as the main fuel importer and distribution company).

Energy efficiency.

In addition, the business sector also generates electricity using their back-up generation capacity. Currently, back-up generators are not regulated. In the near future this could change. No data is available on fuel consumption and electricity production by companies that have back-up generators.

The overall fuel consumption of Curaçao (excluding fuel consumption by the refinery) is presented in Figure A.2 and Table A.1 and A.2.

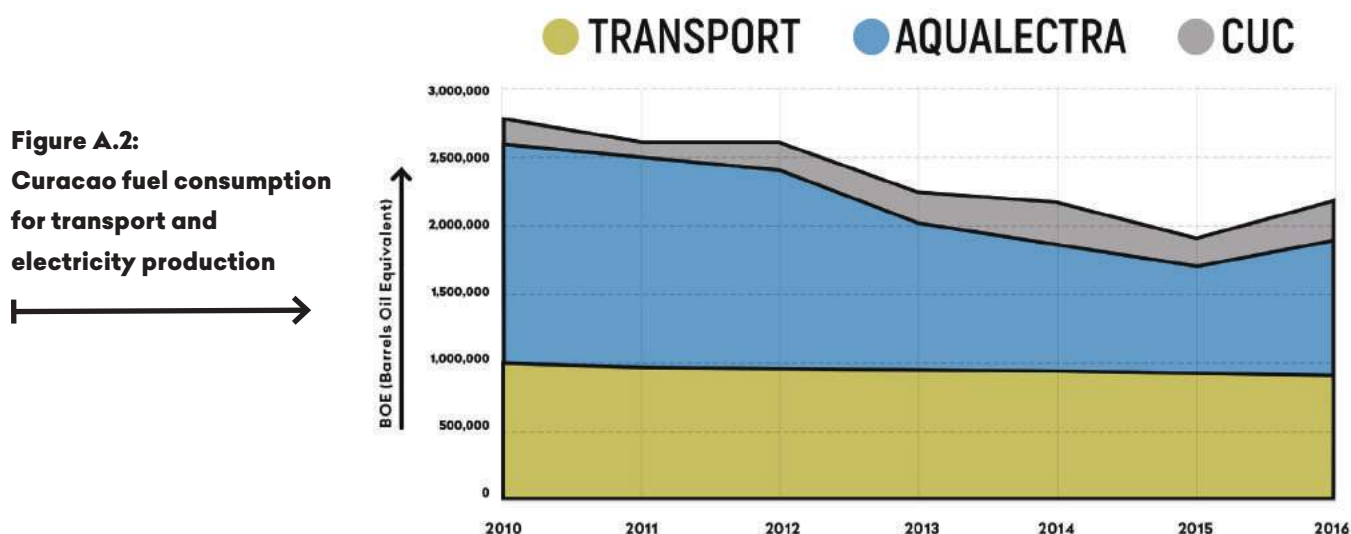


Table A.1
Overall net fuel consumption of Curaçao (excluding the refinery but including CUC; Source data provided by Aqualectra and Curoil)

	2010	2011	2012	2013	2014	2015	2016
ELECTRICITY PRODUCTION	1,705	1,569	1,587	1,261	1,199	978	1,139
TRANSPORT FUELS	984	993	972	942	912	951	969
TOTAL (000 BOE)	2,689	2,562	2,559	2,203	2,111	1,929	2,108

There is a relative steep reduction in fuel consumption for electricity production. This is the result of the Government's policy since 2010 to implement more efficient production units and make use renewable resources (especially wind and solar energy) in the production mix. There is also a slight decrease in fuel consumption for transport. It is assumed that this is the result of the import of modern and thus more efficient vehicles. Based on 2016 energy prices, energy costs compared to 2010, have been lowered by roughly US\$ 70 million on an annual basis: US\$ 2 million in transport and US\$68 million in electricity and water production.

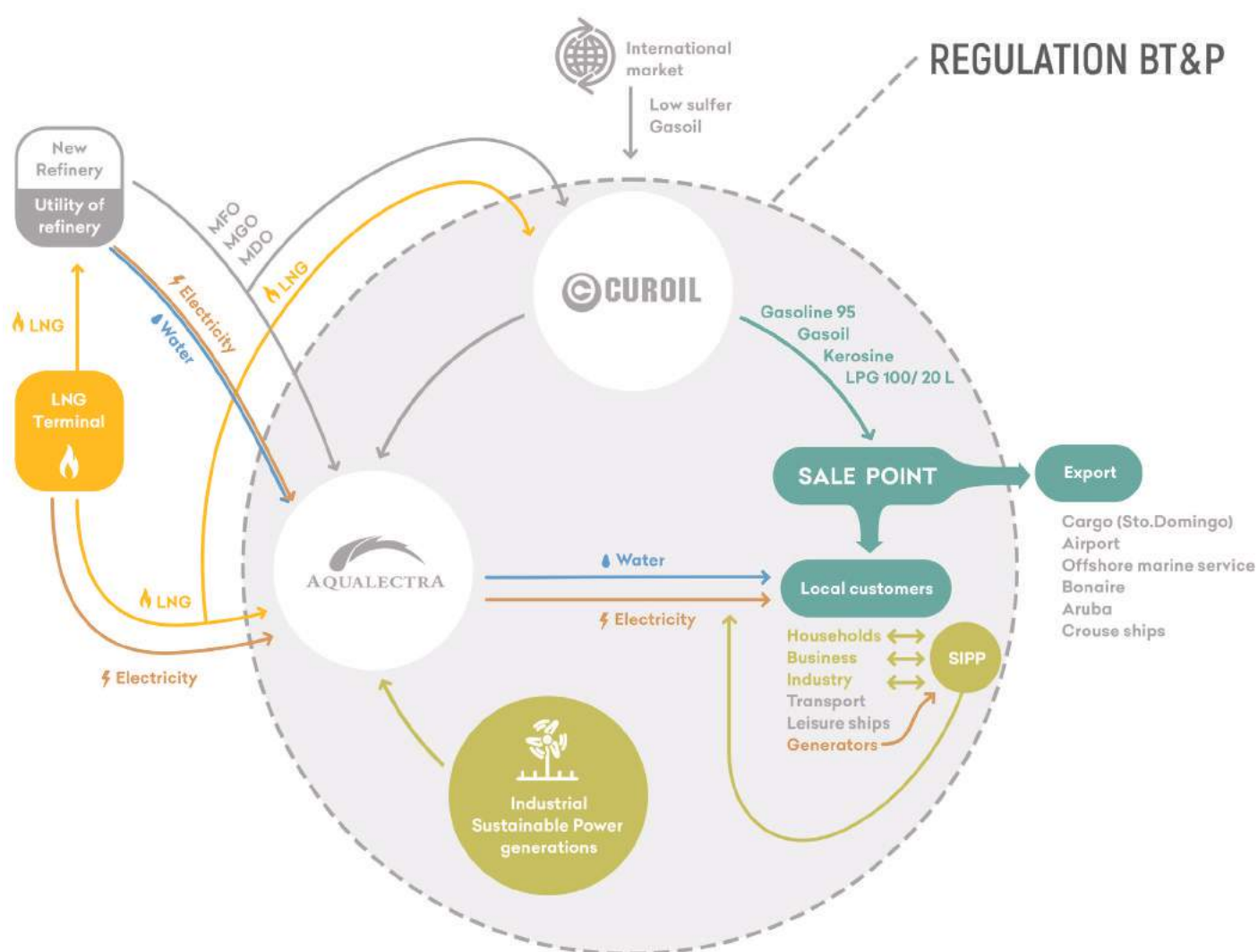
In order to further reduce the macro-economic burden of petroleum fuel imports on the Curaçao society, the Government envisions a significant increase in raising the energy efficiency and increasing the use of sustainable energy resources. At current price levels of petroleum fuels, development and implementation of these renewable energy resources can be realized through feasible and economically attractive projects. In addition, an important increase in energy efficiency will contribute to reducing Curaçao's dependency on petroleum fuels imports. Measures in the areas of sustainable energy provision and energy efficiency improvement will be taken in all sectors of the Curaçao economy, including the transport and fishery sectors.

Table A.2
Foreign currency expenditures for imports of fuels, excluding CUC (based on data from Curoil)²⁰.

	2010	2011	2012	2013	2014	2015	2016
ELECTRICITY PRODUCTION	130	139	136	131	126	132	134
TRANSPORT FUELS	146	134	126	87	77	51	79
TOTAL CURRENCY COSTS (M US\$)	284	273	262	218	203	183	213

Curaçao expects a further reduction of foreign currency expenditures for fuel imports of US\$ 35 million to US\$ 64 million before 2035 through an increase of renewable energy implementation. Additional reductions can be realized through energy efficiency measures and improvements in the transport sector. Realization of this potential, however, can only be achieved through effective cooperation between the main stakeholders on the island. The expected new overall energy structure is shown in figure A.3.

Figure A.3
Schematic overview of the energy structure, companies
and energy flows (situation representing 2017).



20 This is calculated on the basis of average 2016 fuel prices.

6 Electricity sector

6.1. GENERATION

Aqualectra is the electric utility for Curaçao. In the past Aqualectra was the only provider of electricity, but through regulatory changes implemented in 2011, the entry of independent power producers (IPPs) has been allowed. Aqualectra also has Power Purchase Agreements (PPAs) with NuCapital, the owner and operator of two utility scale wind parks (31.5 MW and 15 MW). Aqualectra owns and operates the majority of other generation capacity on the island. They supplement their generation portfolio (roughly 30 %) by contracting additional electricity from the utility associated with the refinery (which is owned and operated by Refineria di Korsow).



As mentioned earlier the introduction of natural gas as a main fuel for the refinery will allow replacing heavy fuel usage in diesel plants of Aqualectra by LNG, which will result in important emission reductions and cleaner electricity production. Aqualectra has taken the transition to LNG into account when purchasing its new generation capacity. For more information see the Aqualectra production mix as summarized in table A.3

All electricity production facilities are located around the Schottegat, the large bay of Willemstad where the refinery is also situated (see figure A.4).

Table A.3
Aqualectra recent
production mix
(October 2017).

PRODUCTION MIX			
PLANT NAME	RATED/AVERAGE OPERATED CAPACITY	FUEL TYPE	REMARK
IDPP at Refinery	4 x 8.3 / 7.5 MW	IFO/MFO	Adapted for LNG
Dokweg I	6 x 6.25 / 5.5 MW	IFO/MFO	Conversion to LNG to be investigated
	1 x 5.2 / 4.5 MW	IFO/MFO	Conversion to LNG to be investigated
Dokweg II	4 x 8.9 / 8 MW	IFO/MFO/LNG	
Wind Playa Kanoa	5 x 3.0 MW	N.A	PPA
Wind Tera Kora	5 x 3.0 MW + 5x 3.3 MW	N.A.	PPA
Small independent PV	12 MW _{peak}	N.A	
CUC	22 MW		PPA
POTENTIAL NEAR FUTURE EXPANSION			
Additional diesel motors	40 MW	GO/LNG	Expected Operational 2018
Addition GT	20 to 25 MW	GO/LNG	Expected Operational date not available
Additional PV owned by Aqualectra	10 MW	N.A	Expected Operational 2018

6.2. RENEWABLE ENERGY

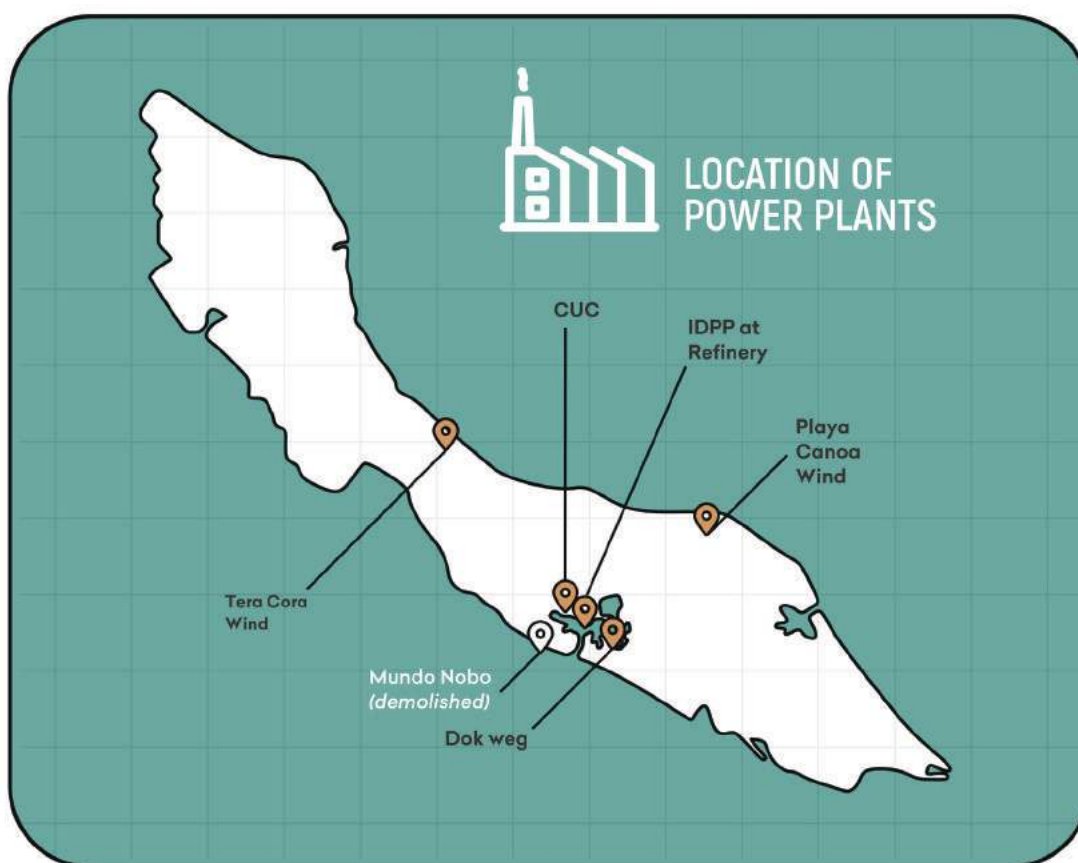


Figure A.4
Geographic
location of
power plants

Aqualectra contracted the electricity of two wind parks. Both wind parks are owned by NuCapital and have been developed on a commercial basis, without investments by Aqualectra or subsidies by the Government of Curaçao. Aqualectra entered into a power purchase contract (PPA) with the commercial developers who sell the output for an agreed price per kWh supplied to the grid. The wind park capacity at Tera Kora was expanded and went operational in July 2017. The expansion consisted of 5 wind turbines of 3.3 MW each, for a total of 16.5 MW (the construction started on the 29th of July 2016).

There is roughly 10 to 12 MWp of PV solar connected to Aqualectra's grid. This is mainly produced by small independent power producers. Aqualectra itself owns three (3) small photovoltaic solar plants. A 1.1 kWp and a 20.1 kWp installation directly connected to the grid and one 3.8 kWp standalone unit on the Tafelberg, supplying energy for the water reservoirs.

Solar energy is stimulated through the policy on Small-scale Renewable Energy. With the previous rates for electricity supplied to the grid from solar installations, investments in solar energy were very profitable with payback times of less than four years. This resulted in a fast but haphazard development of solar energy. Due to the resulting risks for the overall electricity generation process by Aqualectra, these rates were adjusted from January 1, 2015. The new rates also applied to the already realized solar installations. With the new rates the payback time for a small solar installation has become approximately 8 years, which seems reasonable for households.

Unfortunately the revision of the rates after a relatively short period also makes investors reluctant to invest in renewable energy systems. This could be prevented by developing a system that provides sufficient guarantees to investors (households, businesses). For new tariff adjustments, it could be envisaged that these would only apply to new projects.

When designing policy and feed-in tariffs for distributed renewable energy (DRE) supply it needs to be taken into account that small-scale renewable electricity production may positively contribute to the energy system:

- They can increase system reliability and improve power quality.
- They can function as an emergency supply of power.
- They can contribute to a reduction of investments to supply capacity during the system peak.
- They can offset investment in generation, transmission, and distribution facilities that would otherwise be recovered through rates.
- They can supply ancillary services and reactive power.

Moreover, small-scale renewable electricity systems may also contribute to reduce the land-use required for siting generators and may improve the infrastructure's resilience in the case of emergency (calamity) situations.

A further increase in wind and photovoltaic solar electricity will depend on the demand growth, the rate structure for such systems and the possibility to integrate (economically viable) energy storage facilities. To this end it is necessary to reevaluate the current tariff structure.

6.3. PRODUCTION MIX PROJECTIONS AND EXPANSION PLANS

The peak electricity demand is presently roughly 135 MW, which can be provided by the available conventional production capacity. Such conventional capacity is necessary as wind and solar energy fluctuate during the days and months. During periods of less wind or sun, the conventional capacity must be able to ensure a continuous and reliable supply. The conventional capacity is also required to balance demand and supply.

Since 2011 the share of renewable energy in electricity production has grown from almost zero to 18% in 2016. A further increase to more than 25 to 30 % in 2020 is expected. The projected development of the available production capacity from the end of 2015 until 2020 is shown in the table A.4 below.

GENERATOR TYPE	2016			2020		
	MW CAPACITY	MWH	% OF TOTAL	MW CAPACITY	MWH	% OF TOTAL
Diesel engines	115	723.000	82%	150	665.000	75%
Gas turbines on diesel	20			0		
CUC	22			22		
Wind power	30	144.000	16%	46.5	180.000	20%
Solar	12	18.000	2%	25	45.000	5%
TOTAL	227	885.000		243.5	890.000	

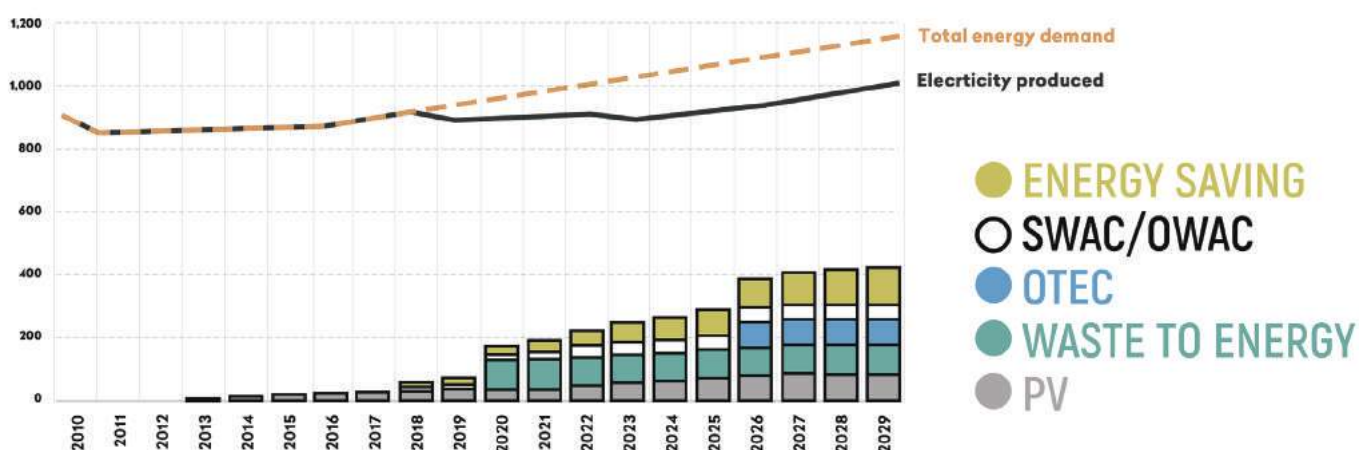


Table A.4

Electricity production capacity and expected development (data provided by Aqualectra).

Figure A 1.5
Energy demand
projections

Within the available Aquallectra projections there are presently no provisions for other innovative technologies such as waste to energy, OTEC, SWAC, OWAC or energy efficiency measures. The energy policy now takes appropriate steps in this direction.



The baseline demand projections are in line with the expected economic growth which means that an average annual demand growth of 2 % has been assumed. From 2019 onward we assume a realized demand side saving of 1 % per year²¹. Furthermore we expect the energy distribution losses to reach a level lower than 10%. The resulting baseline is shown in figure A.5. The dotted line represents the energy demand if no demand side activities would take place. The expected production taking into account the demand side efforts is represented by the solid line.

Another opportunity that should be taken into consideration is the installed capacity of back-up generation. There are quite a number of solar panels as well as back-up generators (the latter mainly operating on diesel fuel). These are not registered and monitored. Based on information from sellers of these generators the available installed capacity may range between 20 and 40 MW²². It should be assessed by the utility company whether this potential can be to contribute to enhance the strategic energy supply. The Government will endorse regulation and registration for these generators.

6.4. DISTRIBUTION

The electricity distribution system spans the entire island (resulting in 100 % coverage of service area). The conventional power plants are all connected to the transport network at 66 kV. The wind parks are connected to the 30 kV network and the small solar systems are connected to the low voltage distribution grid (see figure A.6).

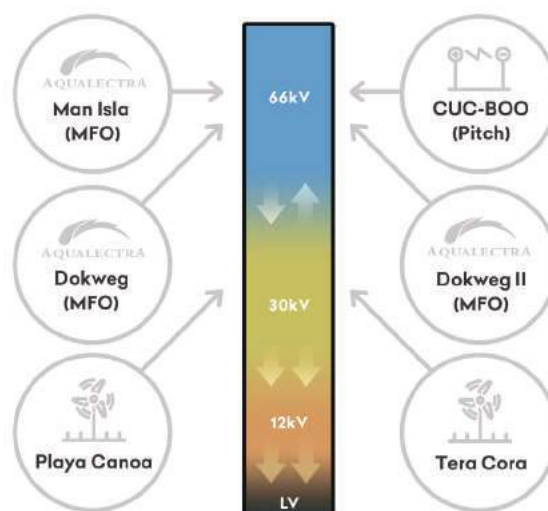


Figure A.6
Main electricity
production
plants and
connection
to the grid²³
(Ref. 21)

²¹ This effect is assumed to result from energy efficiency measures, energy conservation, implementation of SWAC/OWAC and other demand side activities.

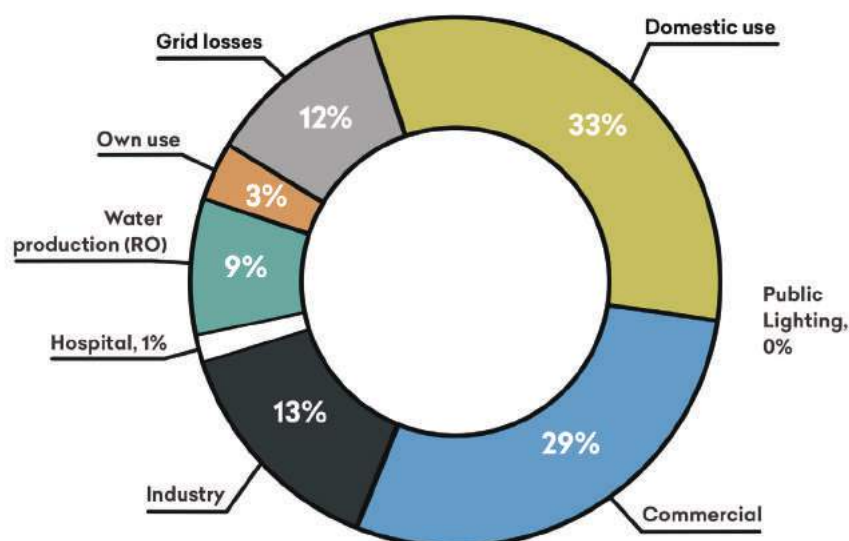
²² This estimate takes into account all back-up generators including movable units.

²³ Aquallectra Power and Water, speech Board of Directors, March 2015

ELECTRICITY DISTRIBUTION CHARACTERISTICS			
LEVEL	VOLTAGE	CONFIGURATION	CHARACTERISTICS
Transport	66 kV	Transmission grid	Underground
	30 kV	Sub Transmission grid	Underground
Main Distribution	12 kV	Main Transmission grid	65% underground 35% overhead
Distribution / End use	380 V	Radial structure	Underground
	220 V	Radial structure	40% underground 60% overhead
	127 V	Radial structure	30% underground 70% overhead
OTHER CHARACTERISTICS: <ul style="list-style-type: none"> • System frequency 50 Hz • Roughly 80% of the connections to the grid are Urban and 20% rural 			

The main characteristics of the power system on Curaçao are presented in table A.5.

Table A.5
Electric network characteristics.



Today there is limited information on electricity consumption patterns and flows. Therefore, no detailed information is available with respect to energy consumption. Aquallectra does however register the overall consumer's electricity distribution (see figure A.7).

Figure A.7
Overall distribution of electricity consumption (data for 2015).



It is interesting to note that roughly 9 % of the electricity is used for potable water production. There is a direct relation between potable water consumption and electricity as the potable water is produced via an (energy intensive) reverse osmosis process. Implementing water conservation measures will therefore have a direct effect on the energy consumption.

The grid losses in the figure are reported to amount to 12 % (in 2015). The total system losses over the years have been fluctuating between 12 to 15 %. This is relatively high and deserves attention. the Government's ambition is to reduce these losses to an acceptable level, which is lower than 10 %.

6.5. ELECTRICITY RATES

Electricity rates in Curaçao are considered to be relatively high. ECLAC has published a benchmark on the electricity tariffs in the Caribbean, which is given in Figure A.8²⁴.

Figure A.8

Comparison of electricity tariffs for CARICOM and Curaçao (US cents per kWh)
Source: ECLAC.

● RESIDENTIAL
● COMMERCIAL
● INDUSTRIAL



The figure shows that the electricity rates in Curaçao are among the highest in the region. Due to the relatively small-scale of the energy system, it is expected that the electricity tariffs will be higher than in well larger countries with more efficient generation. Nonetheless, it is important that the Government addresses this issue by implementing measures to reduce costs and to increase efficiency. Caused by the reduction of oil prices on the world market, current electricity rates are considerable lower than those presented in Figure A.6. Table A.6 show the electricity rates as set by BT&P from January 2014.

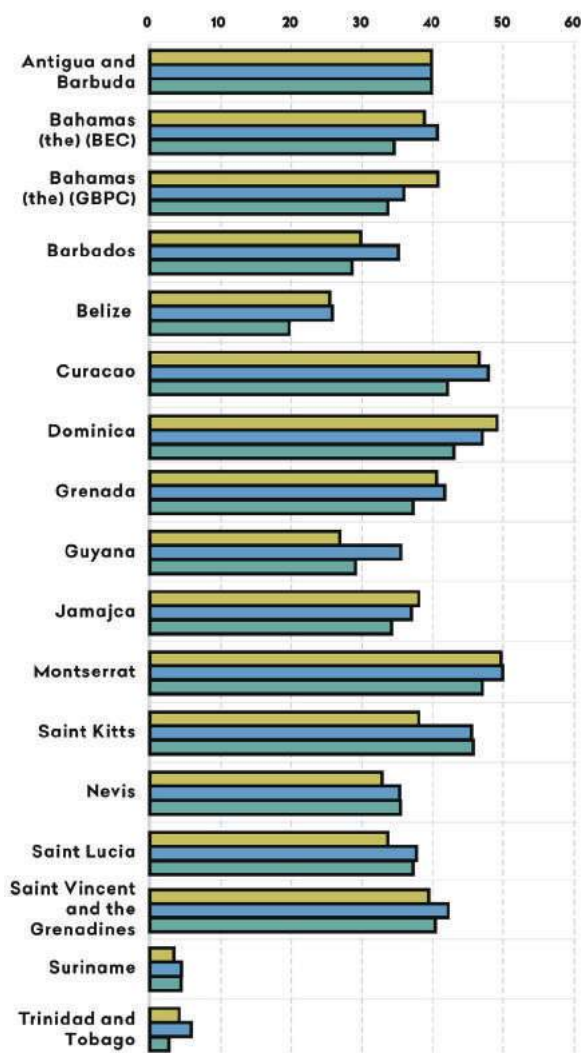


Table A.6

Electricity tariffs development in ANG in the period from January 2014 to January 2017 (Source: BT&P).



TARGET GROUP	JAN 2014	JUL 2014	DEC 2014	JUL 2015	DEC 2015	JUL 2016	DEC 2016	JAN 2017
Households low	0.7373	0.7373	0.5916	0.5960	0.5017	0.4489	0.4688	0.5219
Households high	0.8878	0.8878	0.7421	0.7465	0.6522	0.5994	0.6193	0.6724
Commercial	0.8470	0.8470	0.7013	0.7057	0.6114	0.5586	0.5785	0.6316
Industrial standard	0.7473	0.7473	0.6016	0.6060	0.5117	0.4589	0.4788	0.5319
Industrial export	0.6174	0.6174	0.4717	0.4761	0.3818	0.3290	0.3489	0.4020
Industrial import	0.6821	0.6821	0.5364	0.5408	0.4465	0.3937	0.4136	0.4667
Hospital	0.5940	0.5940	0.4483	0.4378	0.3435	0.3056	0.3255	0.3786

²⁴ ECLAC, *An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Curaçao*, 2013.

From table A.6 we may conclude that electricity rates are still relatively high in Curaçao. The rates also show a high volatility which is a direct consequence of the crude oil prices on the world market. The high oil prices until mid-2014 are visible as well as the price fall starting in the second half of 2014. The efficiency improvements in the production mix implemented by Aqualectra has also contributed to the tariff decrease.

Table A.7 presents an overview of the electricity tariffs for residential customers in the Caribbean region consuming respectively 100 and 400 kWh per month.

Table A.7
Electricity rates (US\$) in the Caribbean
region in 2015 (source: CARILEC).



COUNTRY	UTILITY	CUSTOMERS USING 100 KWH PER MONTH				CUSTOMERS USING 400 KWH PER MONTH			
		BASE RATE	CHARGES	FUEL SUR-CHARGE	TYPICAL BILL	BASE RATE	CHARGES	FUEL SUR-CHARGE	TYPICAL BILL
Turks and Caicos	Fortis TCI	26.21		15.56	41.77	104.83		62.26	167.09
Belize	BEL	15.50			15.50	70.50			70.50
Virgin Islands	BVIEC	23.40	2.50	5.72	31.62	90.90	2.50	26.86	120.26
Curaçao	Aqualectra	15.96		12.63	28.59	73.80		50.53	124.33
Bermuda	Belco	15.75	15.00	13.00	43.75	96.00	25.00	52.00	173.00
Bonaire	Contour Global	10.40	24.50		34.90	41.60	98.00		139.60
Dominican Republic	Domlec	22.97		10.23	33.20	96.95	15.70	40.94	153.59
Montserrat	MUL	18.31	0.00	18.40	36.71	79.04	0.00	73.61	152.65
Jamaica	JPSCO	11.32		9.73	21.05	64.38	2.26	38.92	105.56
Suriname	NV. EBS	6.40	2.99		9.39	9.60	4.47		14.07



6.6. BARRIERS FOR RENEWABLE ELECTRICITY GENERATION

The ECLAC study identified several regulatory and fiscal barriers for further promotion of electricity generation from renewable resources²⁵:

Lack of institutional capacity for project evaluation and approval: There is a lack of expertise for dealing with renewable energy issues within the respective Government ministries and agencies, which leads to confusion, delays or unmotivated denials of approvals. This has served to limit the opportunity to move towards a sustainable energy economy. Until today renewable energy integration has focused on the implementation of utility-scale wind power generation and small solar photovoltaic systems.

Lack of spatial planning for renewable energy systems: The spatial planning systems should provide guidance on the locations where renewables, in particular wind and solar electricity generation, are appropriate. This will reduce grid integration costs. Furthermore, there is a need for transparent criteria to be taken into account when developing renewable energy projects. These will serve to reduce the transaction costs associated with project siting and environmental permitting.

Weaknesses in the regulation of the electricity sector: Many Caribbean countries that have made progress in the regulation of their electricity sector have an independent regulatory agency for setting the tariffs and service standards. In Curaçao BT&P only advises the Minister on tariff setting.

Absence of legal framework for utility-scale renewable energy generation: The absence of a legal framework clarifying the 'rules of engagement' for new utility-scale renewables to the grid may deter investors since each project requires individual approval (and licenses) from the Government and will need to negotiate its own power purchase agreement with the utility on an ad hoc basis. This complicates planning for potential project developers and imposes additional financial risks to renewable energy projects.

Lack of competent and certified installers for small-scale renewable energy: There is presently a lack of trained and competent installers for small-scale renewable energy installations, such as solar photovoltaic systems and solar water heaters. This impacts particularly households, where installers often act as the decision maker for the type of sustainable energy installations to be purchased. If the installers are not trained and qualified, they may provide poor advice and services, with a negative impact on the functionality of the system.

Lack of institutional incentives for renewable investments: The Curaçao Economic Development Board aims to facilitate economic development through investment promotion and attraction of both local and foreign investments. Most investment incentives are however primarily designed for the commercial sector, in particular tourism and commerce. There is no package of fiscal incentives tailored and directly applicable to the renewable energy industry. Investors are thus required to seek appropriate incentives and waivers from the line Minister on case by case basis.

Lack of incentives for third party financing: The development of integrated renewable energy systems in buildings are incentivized through customs and value added tax (VAT) regulations. These offer exemptions for several small-scale renewable energy technologies. Integration of renewable energy technologies, such as solar photovoltaic, hybrid photovoltaic, and solar thermal systems for cooling and water heating, may however increase the total building costs by 10 to 20 percent. Meanwhile, there is very little or no cognizance among mortgage banks and insurance companies for the enhanced lifecycle of buildings with renewable energy technologies. The 'additional' investment required for renewable energy systems is thus prohibitive and may require third party financing.

²⁵ ECLAC, *An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Curaçao*, 2013.

7 The transport sector

7.1. GENERAL

Curaçao has one of the highest standards of living in the Caribbean²⁶, which is built on tourism, the refinery (the main employer on Curaçao), trade, transport and the financial services industry. The role of transport planning and logistics is, therefore, crucial to the country.

With respect to roads and other infrastructure, Curaçao has an efficient, modern infrastructure consisting of roughly 550 km of roads of good quality. Land transportation is primarily based on petrol vehicles and a public transport system mainly consisting of diesel vehicles. The bus company, Autobus Bedrijf Curaçao (ABC), consumes over 2.6 million gallons of diesel per annum and transports approximately 3 million passengers (which amounts to 1.15 gallons of diesel per passenger over twenty-four routes). Furthermore, there is a limited amount of diesel dominated freight movement. Land freight activities mainly relate to the transport of imported goods earmarked for local consumption, from the ports to inland distribution and retail centers²⁷.

The marketing and distribution of all fuels in Curaçao are the responsibility of the state-owned company Curoil. Curoil fuel distribution consists of two market segments, namely:

1. The local market, including Bonaire, local transportation, commercial users and utility companies (Aqualectra) and fuels for household use.
2. The international market, export, bunkering and aviation.

The local fuel mix sales in 2015 were as shown in Table A.8.

FUEL USAGE	VOLUME M3	ENERGY (GJ)
Petrol stations: diesel	57.300	2.050.000
Petrol stations: petrol	123.500	3.804.000
Petrol stations: LPG	17.000	393.000
Petrol stations: Kerosene	200	7.000
Aqualectra: diesel	1.700	61.000
Aqualectra: gasoil	9.000	325.000
Aqualectra: Heavy fuel oil	81.200	2.830.000

Table A.8: Curoil fuel distribution (estimate for 2015; data provided by Curoil).



²⁶ The estimated per capita GDP of Curaçao amounts to US\$ 19,524 in 2016.

²⁷ Strategies for long term sustainable economic development in Curaçao, TAC, Applied Economic and Financial Research, November 2014.

Fuel supply to Aqualectra has decreased considerably since Aqualectra started implementing renewables in its production mix. Although transport takes up roughly 50 % of the island's energy consumption (excluding the refinery), until now, only very limited measures have been taken to increase the efficiency of local transport or to shift to renewable energy options. Two possible actions in this field are:

Curoil has examined whether used vegetable oil could be mixed with diesel to replace part of the fuel. The pilot has shown that adding treated, cleaned used vegetable oil would not lead to technical problems if the percentage would not exceed 5 %. Curaçao has a large number of hotels and restaurants where used vegetable oil could be collected. Separate collection of used vegetable oil is highly recommended also from a waste management point of view.

There are some initiatives to introduce electric cars in Curaçao. Through fiscal measures the purchase of hybrid and electric cars is stimulated. However, when the infrastructure for charging, maintenance support etc. is not available, it is not expected that there will be significant growth in this area.

7.2. BARRIERS FOR OPTIMIZING THE TRANSPORT SECTOR

According to the ECLAC study (Ref. 1) there are a number of regulatory and fiscal barriers limiting opportunities for renewable energy technologies in the transport sector²⁸:

Absence of a sustainable public transport strategy: Public transport planning in Curaçao is very traditional and is based on traffic management and scheduling. Consequently, there is very little exploration of options for advanced vehicle technologies, such as electric vehicles and hybrid-electric vehicles, or renewable energy use within the sector. In particular, there are obvious opportunities for replacing significant amounts of the 2.6 million gallons of diesel consumed annually with renewable options such as fatty acid methyl-esters, also known as biodiesel, that is derived from the transesterification of oils.

Renewable energy vehicles, including electric and hybrid-electric vehicles, though identified as being important to the Curaçao sustainable energy framework, have not been substantially integrated therein: Despite the appropriate match of electric vehicles and hybrid-electric vehicles for Curaçao and their ability to integrate seamlessly into an energy economy that is built on a renewable power grid, there have been some degree of incentive, such as duty exemptions, but no regulations that support their programmatic introduction into the island.

Price control mechanisms are utilized by the Government as a strategy to contain transportation cost for goods and people: This degree of pricing regulation within the conventional fuel sector, though not sufficient to discourage the use of renewable fuels and vehicle technologies, serves nonetheless to distort the markets and increase the barrier for renewable energy use within the transport sector.

Lack of information with which to make informed vehicle choices: Consumers are essentially limited by the available technology options as well as the available infrastructure for fuel distribution. In the case of fleet vehicles purchases, unlike the case of domestic vehicles, decision-makers are less limited by the in-country technology options but are nonetheless limited by the available information of applicable options as well as the available infrastructure for fuel distribution. Both are creations of the regulatory environment for motor vehicles within Curaçao, which has experienced very little change over the past three decades.

²⁸ Economic Commission for Latin America and the Caribbean's (ECLAC) and German Cooperation, *An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Curaçao*, 2013.

Lack of competitive pricing: Most renewable energy vehicles are manufactured on assembly lines, where mass production can greatly reduce costs. But the global infrastructure for fuel production, distribution and supply is based on petroleum vehicles and renewable vehicle technologies are, on average, 30 per cent more expensive than their conventional counterparts; Curaçao does not provide incentives for renewable energy vehicles.

The ECLAC study mentioned above also identified the following regulatory and fiscal barriers inhibiting efficient practices and vehicle technologies in the transport sector²⁹:

Absence of minimum energy performance requirements: There are presently no regulations on the minimum energy performance of motor vehicles. Consequently, the import tariff structures take neither the promotion of efficient fuel use nor advanced vehicle technologies into account.

Absence of emission standards for vehicles: Emissions of fuel combustion reduce the air quality (pollution) and adversely affect human and ecosystem health. Vehicle emissions tend to be inextricably linked with the engine efficiency. The introduction of emission standards would lead to removing a significant number of inefficient vehicles from circulation.

Lack of transport planning: There is very little capacity on Curaçao, and indeed in the Caribbean, for developing transport planning such as transport demand management that may provide domestic vehicle users with judicious decisions on route and lane selection for efficient travel. Consequently, transport planning has been limited to traffic management. Efficient transport networks and systems promote efficiency in mobility and fuel use.

Lack of public transport policy: Presently, there is no public transport policy that includes an explicit public service obligation for the public transport service that is currently being provided by Autobusbedrijf Curaçao. This makes it difficult to establish whether the present level of subsidy is justified and whether the service could be more efficient.

Lack of fiscal incentives for efficient and advanced vehicle technologies: Vehicles that are more energy-efficient than the conventional ones are often more expensive. On the microscale, investments in energy-efficient vehicle technologies may be problematic as commercial banks, through which the majority of new vehicles are purchased, do not usually examine the lifecycle costs. The availability of fiscal incentives, such as tariff reductions and VAT exemptions, would help to level the price difference between traditional and energy efficient vehicle technologies.

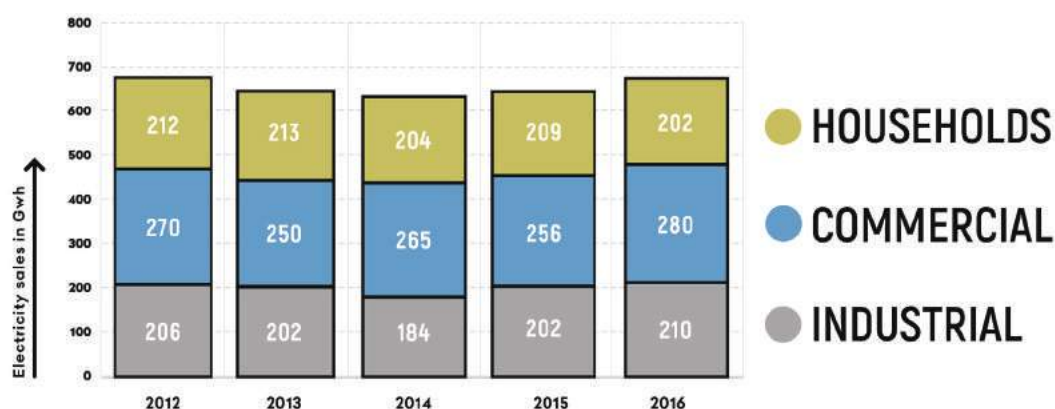
Split incentives: In the public transport and freight services, management and operational features can provide significant energy efficiency gains. Factors such as gross vehicle weight, driving practices and vehicle maintenance are important to fuel use efficiency and are frequently determined by the vehicle operator or fleet manager (who may be a different party than the owner). As a consequence, the significance of fuel savings may not be relevant for the daily operation.

²⁹ Economic Commission for Latin America and the Caribbean's (ECLAC) and German Cooperation, *An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Curaçao*, 2013.

8 Energy efficiency

Table A.9 presents the electricity demand between 2012 and 2016. In 2016, 814 GWh of electricity was generated of which roughly 490 GWh were consumed by the industrial and commercial sectors (excluding the importing and exporting industry) and 202 GWh by the residential sector respectively.

Table A.9
Electricity
demand in
Curaçao (data
provided by
Aqualectra)³⁰.



Overall electricity generation efficiency ranges between 30 and 40 percent and improvement is expected. Transmission and distribution losses have been estimated at above 12 percent, which is in line with the regional average. Again, there are annual (technical) improvements to the network reducing these losses.

However, until today little attention has been given to demand-side energy efficiency. The residential sector, in particular, accounts for approximately 40 percent of electricity end use. There seems to be a significant potential to increase the energy efficiency of lighting, cooling, water heating and other appliances; energy consumption reductions between 15 and 25 % are considered feasible. This would translate into a possible 10 percent decrease in overall electricity consumption for the island and a saving of at least 110,000 boe (barrels of oil equivalents) per year³¹. This provides the motivation for the Government to address energy efficiency in the National Energy Policy.

Although no recent data are available on electricity consumption for air conditioning, the share of electricity use for cooling could well range to more than 50 % for the business and (standard) industry sectors and probably also for households. Air conditioning would then consume approximately 130 GWh in hotels, restaurants, distribution and retail centers. The electricity consumption for air conditioning could be reduced by at least 10 % by optimization of air conditioning utilization (e.g. applying improved temperature settings, performing appropriate maintenance to ensure optimized operation, reducing cool air losses by insulation and optimizing ventilation).

Furthermore, hotels, restaurants and other buildings that are suitably located could use SWAC (Sea Water Air Conditioning) or OWAC (Ocean Water Assisted Cooling) leading to a 70 to 90 % reduction of electricity consumption for air conditioning. It seems a sound estimate that introducing SWAC and OWAC in combination with efficiency measures could result in a 25 % overall decrease of electricity demand for cooling in these sectors (which corresponds with 65 GWh, representing 10 % of the overall electricity demand).

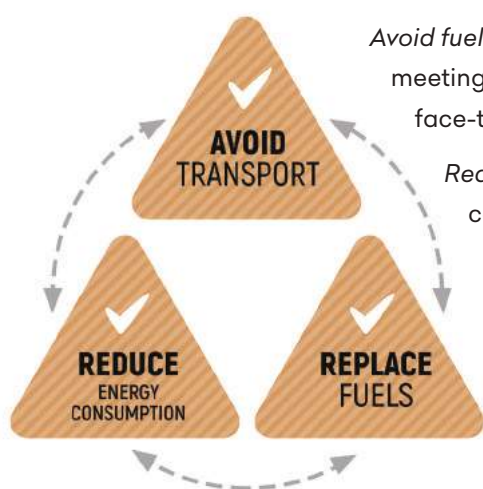
³⁰ Total electricity production was higher than the indicated 660 GWh in 2014. Aqualectra uses approximately 50 GWh itself and has to take into account 13 % of so-called NRE (non-revenue electricity) losses in the distribution systems and so-called administrative losses account for approximately 110 GWh.

³¹ This assumes 40 percent efficiency in the conversion of fuels into electricity.

On Curaçao there is limited knowledge and experience with respect to the implementation of energy efficiency measures. Essentially, three types of barriers may be identified: economic, institutional and behavioral barriers, which need to be addressed. However, the lack of sufficient data on energy consumption complicates matters. Nonetheless, qualitative assessments suggest that there is considerable scope for decreasing the energy consumption in several sectors:

Electricity consumption in buildings and industry: Buildings account for over a large share of total energy use. There are several opportunities for reducing energy consumption in buildings, many of which having short payback periods and immediate environmental advantages. Energy audits are important tools for helping to determine energy consumption patterns and suggesting the measures to achieve energy savings. Hot water can e.g. be produced by applying solar thermal technologies. The use of efficient lighting, efficient motors and drives, and the installation of energy management systems are other options to be considered.

Transport: Low-carbon transport solutions are built on the following three pillars:



Avoid fuel use, where possible, through the usage of broadband services for meetings and access to public services. Currently, much travel in Curaçao is for face-to-face meetings and the transaction of business.

Reduce fuel use e.g. by shifting to mass transportation systems for commuters and to non-motorized transport modes in the city. Moreover, improvements in efficient fuel use could be achieved by making the vehicle fleet more energy efficient.

Replace conventional fuel use as much as is possible by a 'mix' of vehicles running on renewable fuels (such as biodiesel in public transport buses) and electric and hybrid electric vehicles which are charged by electricity produced from renewable energies.

In general, these pillars require not only smarter transport planning but also policies that promote the development of a market for vehicles and the required energy infrastructure.

Water conservation: Potable water conservation has a direct relationship with energy conservation due to the fact that potable water is produced via a reverse osmosis process on Curaçao. Water conservation should therefore be part of our energy conservation efforts.

In the ECLAC study, among others, the following regulatory and fiscal barriers have been identified with respect to achieving energy efficiency³²:

Imperfect information: Research has shown that consumers are inadequately informed (and therefore not knowledgeable) about energy market performance, energy technology characteristics and their own energy use. This leads to a lack of adequate information about potential energy efficient technologies which inhibits investments in energy efficiency measures. There is nonetheless a significant scope for market driven energy efficient technologies, especially at the level of households, given the savings which could be achieved.

³² Economic Commission for Latin America and the Caribbean's (ECLAC) and German Cooperation, *An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Curaçao*, 2013.

Split incentives: A split incentive occurs when the potential adopter of an investment is not the party benefiting from the savings. If so, only providing information about cost effective energy efficiency measures may not be sufficient. This situation is quite common in residential and commercial landlord-tenant arrangements or business owner-manager relations. In multi-division organizations, including the Government, the lack of metering each entity may also be classified as a split incentive. Regulations, such as building ordinances that govern strata developments, are required for dealing with split incentive barriers.

Absence of minimum energy performance requirements: The absence of minimum energy performance requirements for industrial, commercial and public buildings, as well as end use appliances also provides a barrier toward energy efficiency. The implementation of an energy building code and appropriate regulations and standards for the energy use of appliances and equipment will push energy efficiency in building designs, end-use technologies and services.

Credit-restriction measures from the Central Bank of Curaçao and Saint Maarten: As a means of containing the availability of surplus liquidity within Curaçao, the Central Bank of Curaçao and Saint Maarten has from time to time 'exercised control' over commercial bank lending to individuals. This is an antagonistic measure that serves to remove much of the capital that is required for financing small commercial and domestic energy efficiency applications from the credit market.

9 The N.V. Buskabaai and the Asphalt Lake

The Asphalt Lake stems from the Second World War when the allied forces relied on the fuel supply by the Shell refinery in Curaçao. The long residue products, accompanying the light fuels required for aviation, were dumped in what is now called the Asphalt Lake in an area called Buskabaai. In 2005 the volume of hydrocarbons in the lake were estimated to be roughly 500,000 m³.

When the Government of Curaçao purchased the refinery from Shell in 1985, the N.V. Buskabaai was created to manage the Asphalt Lake. The shares of N.V. Buskabaai are owned by the Island Territory of Curaçao.

The N.V. Buskabaai plays an important role in the energy sector as the asphalt is presently recycled and transformed into oils which are partly exported and partly used on the island. N.V. Buskabaai has already removed and sold half of the estimated total volume in the asphalt lake and will continue to do so for at least the coming five years. Moreover, N.V. Buskabaai is presently developing oil recycling options resulting in added value to the island's economy and environment. The Government supports these efforts.

10 Conclusions

The recent drop in world oil prices, from more than US\$ 100 per barrel in the first half of 2014, to less than US\$ 55 in 2017 has reduced the urgency of measures and investments in the energy sector. Nevertheless a new surge in the oil prices could occur in the coming years. It is therefore a very opportune moment to develop and implement a robust energy strategy.

Since Curaçao's first Electricity Policy of 2011 significant progress in renewable energy implementation has been realized. However in the field of energy efficiency and in the transport sector almost no developments have taken place.

The current situation in the field of energy in Curaçao can be conveniently summarized in the following SWOT analysis.



STRENGTHS

Good experience with the implementation and application of wind and solar energy.

Well-functioning electricity generation system and distribution network (although further improvements are possible).

Energy sector stakeholders are willing to adopt renewable energy systems.



WEAKNESSES

Absence of a monitoring and reporting system for electricity generation and consumption and on fuel distribution and consumption.

Lack of expertise on energy issues within the Government organization

Absence of regulatory measures for stimulating renewable energy and energy efficiency.

Insufficient awareness among the general public and other energy end users on energy consumption and efficiency opportunities.

Limited willingness to invest in energy technologies by the private sector (except for wind power).



OPPORTUNITIES

Favorable climate for renewable energies, especially for wind, solar energy, and ocean thermal energy.

Opportunity to invest in a waste to energy facility.

Currently low oil prices provide a favorable time window for starting an energy transition.

Renewable technologies and energy conservation reduce the country's foreign currency expenditures for fuel imports.

Curaçao may develop into a leader in clean energy technologies in the region.

Expansion of the N.V. Buskabaai activities.



THREATS

Curaçao is still highly dependent on conventional fuels for its energy supply.

Long lead times to develop and implement new renewable energy systems because of lengthy administrative procedures.

Lack of Government funds to implement organizational, regulatory and fiscal measures.

Low local private financing support structures.

**SWOT analysis of
the Curaçao energy
system.**



Oil price developments will affect Curaçao's economy directly through higher electricity tariffs for all end users and through a larger share of foreign currency requirements for the imports of fuels. An energy transition towards the widely available sustainable energy resources in Curaçao is a logical choice. Important sources of renewable energy are wind power, solar energy, ocean thermal energy and biomass including municipal waste. Curaçao has sufficient potential for implementation of sustainable energy to become fully self-sufficient in the coming decades.

From the assessment of the current energy situation in Curaçao, the following conclusions can be drawn:

- Curaçao has made significant progress in the implementation of renewable energy, especially wind energy, in the energy system. By the end of 2017 renewable energy accounts for roughly 28 %.
- The present contribution of renewable energy in Curaçao stems almost solely from wind energy, as this source is commercially attractive given Curaçao's favorable wind conditions. Recent measures initiated a rapid development of solar energy, but this has slowed down considerably after adaptation of the rates for feeding excess supply to the grid since 1 January 2015.
- The Government budget currently leaves no room for stimulation measures. The Curaçao Government could investigate whether there are nonetheless opportunities aimed at 'greening' the economy: increased taxation or applying other fiscal measures to make polluting and non-sustainable energy use more expensive while using this additional budget to reduce costs for the adoption of sustainable energy technologies.
- Curaçao has no energy data collection system in place, which complicates the analysis of energy consumption and production.
- The Ministry of Economic Development responsible for energy policy has presently no energy department ('Energy Office') with qualified staff for policy development and progress monitoring in this field.
- Curoil and Aqualectra are both state-owned companies providing integrated energy services for all consumers on Curaçao. Supervision is done by the BT&P as independent regulator. Further institutional improvements may however be necessary as Curaçao proceeds with implementing more renewable energy.
- The regulatory system in the field of electricity has developed during the recent years. BT&P has clear regulatory tasks and advises the Minister of Economic Development on the tariffs for all energy utility companies. Aqualectra has been assigned the main responsibilities for the production and distribution of electricity, still leaving opportunities for the commercial sector to enter into contracts with Aqualectra for the production and supply of (renewable) electricity.
- There is no regulatory and/or fiscal framework available to stimulate renewable energy or energy efficiency technologies in the transport and in the building sector, except for the policy on small-scale solar energy installations.

