



Ministry of Foreign Affairs

Cuba Sustainable Energy Forum

Commissioned by the Netherlands Enterprise Agency

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International.*

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Cuba Sustainable Energy Forum

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Management Summary

Cuba has developed an ambitious Renewable Energy program as one of the top priorities within the Cuban economic development policy. The aim of the Cuban government is to produce 24% of the national electricity consumption with renewable energy by 2030. Nowadays this is around 4.5%. The program has a focus on both the Production of Renewable Energy and Energy Efficiency.

RVO asked TNO to participate during the Cuba Sustainable Energy Forum in January of 2018, have meetings with key players and report on the results with a focus on how The Netherlands can assist Cuba with its ambitions on implementing their program on renewable energy and energy efficiency. This report has a focus on:

- Investments
- Sales
- Joint research and knowledge development

The development of a renewable energy program went parallel with different updates of the Cuban economic model, providing more opportunities for foreign investment in a large part of its economy. Regarding renewable energy, Cuba developed projects open for foreign investment for Wind-, PV and Bio-electricity. New technologies are being studied and partly open for foreign investment e.g. new applications of biogas, solid waste to energy, and Ocean Thermal Energy Conversion. The program is managed by the Ministry of Energy and Mines (MINEM) in close cooperation with the utility company, Union Electrica (UNE). To optimize energy consumption, Cuba also developed a program for Energy Efficiency. Cuba tries to reduce the usage of old technologies that consume a lot of electricity. E.g. Cuba replaces old electric stoves for stoves using induction. Similar programs are established to stimulate the usage of led-lighting within the residential and the public sector.

For the development of the Renewable Energy Program, Cuban authorities worked in close cooperation with Cuban universities and research centers. Within the universities and research centers, Cuba can count on a well-educated and motivated research staff. The Universities and research centers contribute to different aspects of the Cuban Renewable Energy Policy. Given this infrastructure of universities and research centers, Cuba is an interesting country for the development of cooperation projects for joint research and knowledge development.

To fund a cooperation project within Cuba, there are different options. The European Union together with the Cuban authorities developed a Support Program to Cuba's Energy Policy. The program consists of a budget of Euro 18 million. The program is expected to start in 2018 and will last 60 months. The program is suitable for universities and research institutes. The United Nations has a broad experience working on Renewable Energy issues within Cuba partly with the support of the Global Environment Fund (GEF). New projects are being prepared at the moment. Different countries have development agencies working within Cuba that can provide funding for cooperation projects.

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1 Introduction

1.1 Context of the Cuba Sustainable Energy forum

Cuba has developed an ambitious Renewable Energy program as one of the top priorities within the Cuban economic development policy. The program has a focus on both the Production of Renewable Energy and Energy Efficiency.

During the last 5 years Cuba has made different updates of their economic model. These updates provide a foundation for new foreign investments laws that support the development of the Cuban Economy. These updates of the Cuban economic model have not gone unnoticed outside of the Island. During the presidency of Obama the United States and Cuba entered into a stage of new diplomatic and economic relations.

The European Union and its member states also started processes of normalization of diplomatic relations and strengthening of economic ties. As one of the results, the Ministry of Energy and Mines of the Republic of Cuba and the European Union delegation in Cuba organized the '*Cuba Sustainable Energy Forum*' with the following objectives:

1. To discuss new energy and foreign investment policies
2. Present investment opportunities in the fields of renewable energy and energy efficiency
3. Exchange of knowledge on new technologies and experiences within the European Union on Renewable Energy
4. Presentation of EU financial instruments eligible for Cuba

1.2 Objectives of this report

RVO asked TNO to participate during the Cuba Sustainable Energy Forum, have meetings with key players and report on the results with a focus on how The Netherlands can assist Cuba with its ambition on implementing their program on renewable energy and energy efficiency. This report will focus on:

- Investments
- Sales
- Joint research and knowledge development

For that objectives, 1,2 and 4 of the Cuban Energy forum will be discussed.

Please note that this report is not intended as a comprehensive market analysis, but rather as a report on the Cuba Sustainable Energy Forum.

1.3 Outline

In order to gain some understanding of the 'Cuban' context the report will start in chapter 2 with a brief description on recent updates in the economic model of Cuba and international relations with the USA and the EU. Chapter 3 will consist of an introduction of the Cuban Renewable Energy Program. Chapters 4, 5 and 6 will describe opportunities for: investments (4), Sales (5) and Joint research and knowledge development (6). This report will conclude with an introduction of possibilities for funding and finance (chapter 7).

2 Cuba's economic reforms

2.1 Updating the economic model

In the last decade Cuba started to update its economic model based on socialist principals. Cuba wants to have more diversification within its economy, this both applies to reliance on international trade relations as to the diversification and modernisation of the Cuban productive sector. For that Cuba formulated new laws and regulations and started to develop projects open for foreign investment. These projects are updated on a year to year basis and presented within the Portfolio of Opportunities for Foreign Investment. New laws and a wide range of investment possibilities opens up opportunities. It is good to emphasize that these adjustments take place within the ideological framework of Cuba of a state planned economy. Because of this doing business in Cuba has different characteristics when compared to western economies.

General Foreign Investment Policy Principles	
1. To conceive of foreign investment as a source for the country's short, mid and long range economic development. Access to cutting edge technologies, securing managerial methods, diversifying and broadening export markets, replacing imports, access to foreign financing, creating new job sources and securing greater incomes on the basis of production linkage with the domestic economy are all objectives that should be proposed in order to attract foreign investment.	forestry and scrub (marabú) biomass, generation of water and biogas power.
2. To secure new managerial methods that contribute to achieving better market position, increase productivity and profitability, efficiency of complex investment processes and their assimilation by the rest of the economy.	7. To consider the participation of foreign capital in the complementation of national scientific and technological development projects, preserving intellectual property over the results obtained, especially brand names and patents created by the Cuban Party.
3. To immediately prioritize foreign investment directed towards replacing food imports.	8. To consider foreign investment in certain economic sectors and activities as an active and fundamental element for growth.
4. To encourage the development of comprehensive projects generating production linkage in the search for collective efficiency. These projects may be executed with one investor or with several having this mutual interest.	9. To consider agricultural and foods industry production as prioritized sectors along with tourism, including health tourism, the development of energy sources especially renewable energy, the exploration and exploitation of hydrocarbons and mining resources and construction or the improvement of industrial infrastructures.
5. Corresponding to the country's demographic dynamics, foreign investment must allow access to state-of-the-art technologies that increase productivity and permit the efficient use of the workforce.	10. To guide most of foreign investment towards export sectors. Moreover, to direct it towards eliminating bottle-necks in the production chain, encouraging modernization, infrastructure and changing the economical technological model as well as efficiently meeting the country's needs in the aim of replacing imports.
6. To contribute to changing the country's energy matrix by taking advantage of renewable energy sources, using solar and wind power and power from agro-industrial waste such as sugar cane,	11. To encourage foreign investment on the basis of a broad-based and diverse Portfolio of Projects. To focus promotion by stages and potential sectors/activities and to encourage diversification in the participation of business

Source: Cuba Portfolio of opportunities for foreign investment.

Foreign Investment Legal Regime

Law No. 118/2014: "Law of Foreign Investment"

Decree No. 325/2014: "Regulations of the Law of Foreign Investment" of the Council of Ministers

Resolution No. 46/2014 and No. 47/2014 of the Banco Central de Cuba

Resolution No. 128/2014 and No. 129/2014 of the Ministry of Foreign Commerce and Investment

Resolution No. 16/2014 of the Ministry of Labor and Social Security

Resolution No. 535/2014 of the Ministry of Finances and Prices

Resolution No 920/2014 of Ministry of the Economy and Planning.

Agreement No. 7567 of the Council of Ministers.

2.2 New investment laws

In 2014 the People's power assembly of the Republic of Cuba approved law number 118 that establishes the legal framework for foreign investments in the national territory of Cuba. The Act and its supplementary legislation establish a system of facilities, guarantees and legal security to investors with the purpose to attract and utilize foreign capital (source: Law 118).

The law allows different modalities for foreign investment:

- a. Joint Venture
- b. The International Economic Association Agreement*
- c. Totally Foreign Capital Company

** International economic association agreements include, among others, the risk contracts for the exploration of non-renewable natural resources, construction, agricultural production; hotel, production and services management and the contracts for the provision of professional services.*

With law 118, together with Degree 325/2014 and different resolutions Cuba established a comprehensive legal framework. For more information we refer to the Cuba Investment Guide and / or respective laws.

2.3 Cuba and the EU

The past two years there has been a significant progress in the diplomatic relations between the European Union and Cuba.

Between 1996 and 2016, the diplomatic relations between Cuba and the EU were limited by the so-called Common Position. In an effort to update EU-Cuba relations, the EU re-launched a dialogue at political level in 2008, complemented by development assistance. On December 12th, 2016, the repeal of the Common Position and the signature of the Political Dialogue and Cooperation Agreement (PDCA) between the EU and Cuba set the stage for a new impetus in EU-Cuba relations.

The PDCA creates an enabling framework for enhanced political dialogue, for improved bilateral cooperation, as well as for developing joint action in multilateral fora.

EU development assistance with Cuba is covered by the Development Cooperation Instrument (DCI). Development cooperation resumed in 2008, and in the first period until 2014, the European Commission committed around €90 million in the fields of food security, hurricane response and disaster preparedness, environment, climate change and energy, culture and heritage, support to economic and social modernization as well as management capacities.

A further €50 million has been allocated for the period 2014-2020 to support:

- 1) Sustainable agriculture and food security
- 2) Environment: support for a better use of key natural resources for sustainable development;
- 3) Support to sustainable economic and social modernization (*sources: Cuba stocktaking mission final report EU TAF¹, EU website factsheet EU-Cuba Relations*)

¹ Technical Assistance Facility

2.4 Cuba and the USA

During the terms in office of President Obama relations between the USA and Cuba improved significantly. The USA removed Cuba from the list of perceived terrorist states and relieved the effects of the USA Trade Embargo against Cuba. This opened up new trade possibilities for USA-companies and travel possibilities from USA citizens to Cuba. Nowadays there are daily regular flights from the USA to Cuba, Cruise Ships are allowed to enter Cuban ports and different business and cooperation agreements have been signed. President Trump has taken a new approach towards Cuba and restricted travelling from American citizens to Cuba. His administration will also be more firm on obeying the USA Trade Embargo. The approach of president Trump has caused a setback on USA and Cuban relations. Despite the approach of the Trump administration some American states and organizations are strengthening their ties with Cuba.

NATIONAL & WORLD AFFAIRS

A renewed Harvard-Cuba connection

DATE December 18, 2017

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University signs memorandum of understanding with Ministry of Higher Education

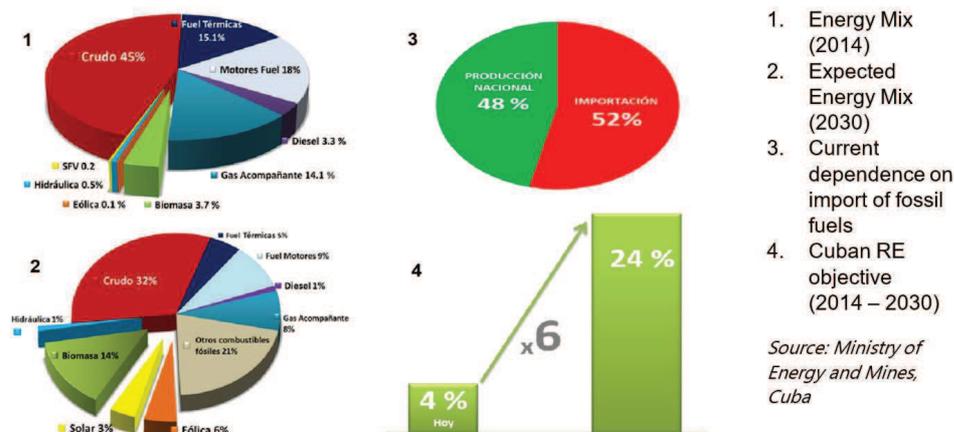
The academic partnership was signed by Mark C. Elliott, vice provost for international affairs at Harvard University, and Aurora Fernández, vice minister of higher education in Cuba.
Source: The Harvard Gazette

3 The Cuban Energy program

3.1 Current situation

Cuba has a high dependency on fossil fuels of which 52% is imported and 48% produced within the national territory. The high percentage of fossil fuel import comes with certain risks of both reliability of supply and affordability. Only 4.5% of the energy production comes from renewable resources.

The Cuban Energy mix and Objectives



Cuba started developing its approach towards renewable energy in December 2012. By presidential decree No. 3, a government commission was appointed to elaborate a renewable energy policy for the period 2014 – 2030. In June 2014 the policy was approved by the council of ministers and discussed in the National Assembly with the following policy objectives:

- To increase the amount of Renewable Energy providing energy to the National Electrical System (SEN) from 4% to 24%
- Achieve a higher efficiency in Electricity production to reduce cost and a more efficient electricity consumption
- Achieve environmental objectives, reduce pollution and increase the sustainability of the Cuban Economy

The approved policy resulted in the preparation and formulation of projects. Projects open for international investment are announced in the portfolio of opportunities (in this report, referred to as investment portfolio).

3.2 The Cuban Renewable Energy Program

The elaborated projects focus on Wind, Sun, Bio-Electricity within the sugarcane industry and Hydropower. The different projects are supposed to add 2339 MW on installed capacity with an investment potential of 4 billion USD.

Cuban Renewable Energy Program		
Source	Amount of developments	Amount of MW
Wind	13 parks	656 MW
Sun	Indefinite	700 MW
Bio-Electricity (sugarcane industry)	27 plants	872 MW
Hydropower	74 systems	56 MW

Source: Ministry of Energy and Mines, Cuba

The Cuban energy program is being updated on a continuous basis. Other technologies are also being explored, like solar thermal power; forest biomass; urban solid waste to energy; the production of biogas from organic industrial and crop residues; and Ocean Thermal Energy Conversion.

3.3 Organization²

Cuba is a centralized country structured by ministries, centralized Cuban state entities and state owned companies. In the Energy Sector the Ministry of Energy and Mines (MINEM) is the leading ministry on approving, controlling and managing state policies for energy. They work in close cooperation with the utility company Union Electrica (UNE). UNE has the responsibility for the distribution and sale of electric energy to the end-users, defines the power tariffs for the consumers and purchases electricity from independent producers.

Besides the Ministry of Energy and Mines, the Ministry of Agriculture (MINAG) plays an important role within the Cuban energy program. They are the leading Ministry for the Biomass program within the sugarcane industry and in general responsible for the treatment of residues within the agricultural, forestry and food sector. The program for Bio-Electricity within the sugarcane sector is executed by the agency AZCUBA.

ONURE is a body under MINEM. It is responsible for applying energy efficiency measures in Cuba and for developing the country's strategy regarding energy efficiency.

Universities and research centers play a very important role in defining R&D projects, improving scientific skills as well as working closely with local authorities for developing specific projects. The most important ones are the University of Havana (UH), University of Sancti Spiritus (UNISS), University of Pinar del Río (UPR), Polytechnic Institute "J.A. Eccheverría" (ISPJAE/CUJAE), Experimental Station Indio Hatüey (EEIH), Solar Energy Research Centre (CEIS), and the University "Las Villas" of Santa Clara (USC).

Between MINEM, MINAG, UNE and the Universities and research centers, TNO experienced strong institutional ties with an open culture of debating policies, research, solutions and results.

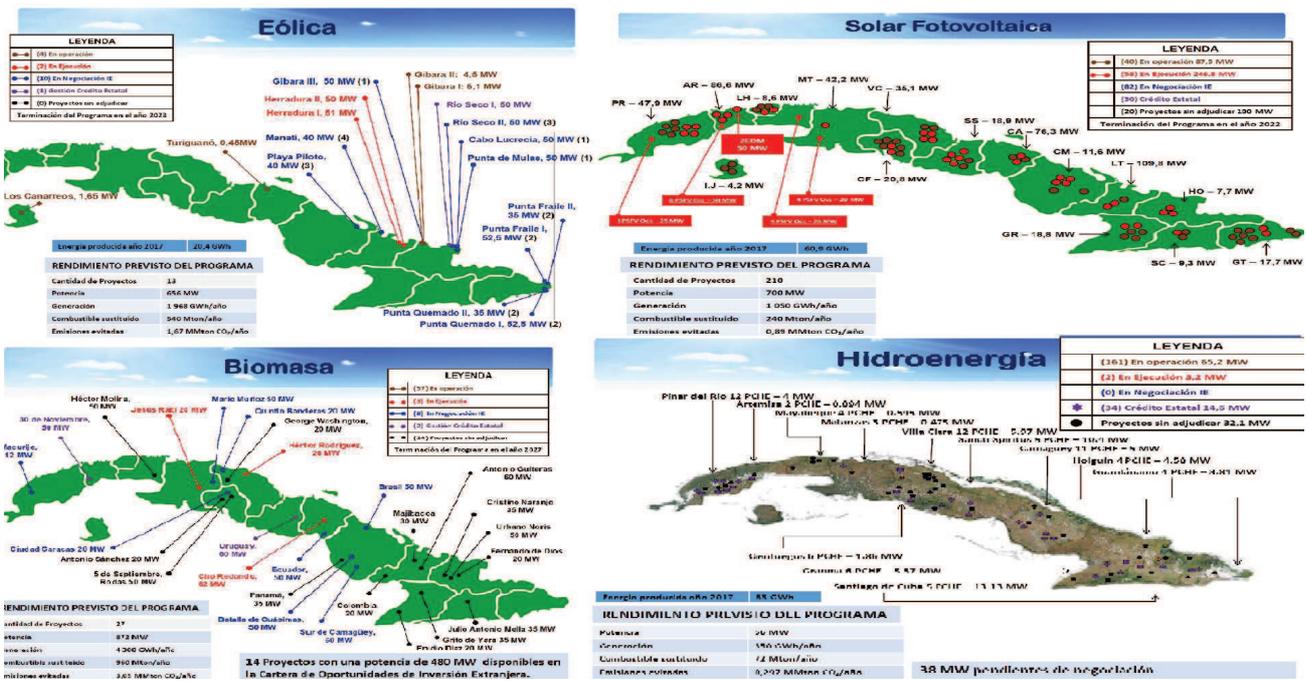
² This paragraph is partly based on paragraph 2.2 of the Cuba stocktaking mission final report EU TAF

4 Opportunities for Investment

4.1 Portfolio of opportunities for Foreign Investment

After approving a Renewable Energy Policy, Cuba studied projects for energy production that would deliver energy to the National Electricity System (SEN). Projects have been studied integrally from different point of views e.g.: capacity, output, grid connection, spatial zoning, security, environmental issues, geography etc. This preparation has been the input for the program as mentioned in paragraph 3.2 and is foreseen at the following locations.

The Cuban Renewable Energy Projects (see also annex 1)



Source: Ministry of Energy and Mines, Cuba

4.2 Wind projects

Large turbines

At the upper left corner you find the map for the studied wind projects. For investigating the prospects of wind energy Cuba installed 88 stations in 32 zones to measure wind conditions at an altitude of 50 meters and a network of 12 top-notch meteorological stations to measure up to altitudes of a 100 meter. Part of the research had been endorsed by Garrad Hassen & Partners International Consultants.

Opportunities:

At the moment all projects are in a stage of (preparation for) construction or exclusive negotiations. Recently the Dutch company InnoEolico got awarded two windfarms with a maximum capacity of 120 MW.

Wind mills

Within Cuba there is a demand for smaller wind mills in remote areas. E.g. windmills nearby small towns, within the agricultural sector and at the cays. The quality of connections in remote areas is not always adequate. The length of cables influences the connection negatively (high voltage drop and weakness against climate conditions). In addition, the construction cost are very high (around 15,000 USD per km). Therefore, connecting remote houses is not a suitable option. (*source: Cuba stocktaking mission final report EU TAF*). Combinations can be made with water treatment ((desalination and black water). Innovative solutions might be interesting as well for the built environment.

Opportunities:

The type of opportunities in this category are not as straight forward as projects already elaborated by Cuban authorities. The business models are different and to be investigated within the Cuban context. To enter in these kind of projects conversation can be started with the Ministry of Energy and Mines, UNE, the Ministry of Agriculture, the Ministry of Industry and the Ministry of Tourism. Also cooperation projects with universities and innovations centres might be interesting.

4.3 Photovoltaic Energy

Larger projects

The potential for solar radiation in Cuba is approximately 5KWh.M2 daily radiation. Cuba continuously investigates new smaller and larger sites. Sites are developed both with state investments as well as foreign investments. The focus of the program is on PV-projects that supply energy to the national electricity system (SEN). Within the program there is a priority for developments in the more remote tourist areas like the cays.

The produced electricity will be sold to UNE through a Power Purchase Agreement.

Cuba has one solar panel manufactory plant with an annual production capacity of approximately 14MWp. Cuba opened up the opportunity to set up production partnerships. Cuba also produces tables to install PV-panels.

Opportunities

In order to enter into negotiations about PV-projects, interest in such projects can be expressed to Union Electrica (UNE). The latest site published within the Investment Portfolio for the construction of 100 MW PV is a combined development with 50 MW of storage.

Smaller projects

Up till now the PV-program has a strong focus on larger projects to produce electricity for the National Electricity System (SEN). Cuba also explores the possibilities of smaller decentralized projects e.g. roof top with energy supply directly to the final user. Cuba already has experience with smaller residential projects at remote areas. New projects might or can be developed for e.g. roof top solar on: schools, hospitals, manufactory plants, warehouses and new hotel developments. Development paths will be different depending on the final energy consumer, the energy tariff structure and legal obligations. These smaller projects might also have a demand for storage of energy.

Smaller projects or energy solutions are also being studied for remote areas where energy supply through the grid comes with high cost or where there might be a temporal need for energy. E.g. construction areas.

Although the National Electricity System has made huge improvements in the last years, temporal power cuts due to weather conditions are still common. This results in a high demand of back-up systems that are mostly fuelled with diesel. For both environmental and cost arguments a transformation to backup systems using mainly PV seems feasible within the Cuban climate. These same kind of systems can be interesting in combination with decentralized systems for water treatment (desalination and black water).

Opportunities

The type of opportunities in this category are not as straight forward as projects already elaborated by Cuban authorities. The business models are different and to be investigated within the Cuban context.

To enter in these kind of projects conversation can be started with the Ministry of Energy and Mines, UNE, the Ministry of Agriculture, the Ministry of Industry and the Ministry of Tourism. Also cooperation projects with universities / innovations centres might be interesting.

4.4 Bio-Electricity

With a total estimated capacity of 872 MW Cuba has a great amount of possibilities to generate bio-electricity in combination with the modernization of the Cuba sugar plants. In the figure at the start of paragraph 4.1, 27 projects are mentioned. The green projects are still open for negotiations. All projects focus on recovering the capacity of the sugar mill in combination with the production of electricity. During the harvesting season the residues of the sugar cane will be used as raw materials for energy production. Outside the harvesting season there is a large supply of forestall residues like marabou that can be used. Electricity will be produced by means of steam.

Opportunities

There are still a large amount of projects in this category that can be negotiated. In the current Investment Portfolio 14 projects with a total amount of 480 MW are announced of being open for negotiations. The projects are negotiated with Zerus a state company that belongs to AZCUBA.

4.5 Hydropower

This program is developed with (international) credit. The total program amounts to a capacity of 56 MW and 74 projects widely spread throughout Cuba.

Opportunities

The hydropower projects might be interesting for companies that can provide certain materials / parts. If the projects will become larger or will be grouped to larger capacities this category will become interesting for foreign investments. The joint development of small projects has several cost savings effects. Larger project sizes will be more interesting for financiers (*source International Hydropower Association*).

4.6 Projects being elaborated

As mentioned in paragraph 3.2, Cuba is investigating new technologies in order to supply in its need for (renewable) energy. Solar thermal power; forest and forestry biomass; urban solid waste to energy; the production of biogas from organic industrial and crop residues; and ocean thermal energy conversion (OTEC). These studies are at different stages of elaboration.

4.6.1 Biogas

The most concrete within the newly studied projects are the facilities for the production of biogas. Up till now Cuba has identified the need of 531 industrial plants. Also the need for 8700 smaller biogas plants / digesters has been identified for the treatment of swine- and cow excreta and its conversion to energy.

BIOGAS:

Currently the country's development programs for pork, beef and poultry production include obtaining significant volumes of organic waste, as well as waste obtained from the foods industry factories and the sugar industry, figures on the rise with the development plans underway. Currently the potential for organic waste is for over 490 million m³, coming from animal products, the foods industry and solid urban waste.

It is a top priority for the country to eliminate the pollution of rivers and hydrographic basins, making use of this waste for energy purposes. The foods industry and pork production require this kind of technology because of the volumes of waste they produce and this is an opportunity to set up partnerships with foreign partners to achieve that objective.



Source: Investment Portfolio



Source: Ministry of Energy and Mines, Cuba

4.6.2 Ocean Thermal Energy Conversion (OTEC)

Cuba installed an OTEC installation at the bay of Matanzas in 1931. Unfortunately this installation did not have a long lifetime and the development of OTEC within Cuba stopped although the Cuban coastline has a large potential for energy production using the difference in temperature of profound and less profound ocean water. A total amount of 2100 MW has been identified. Although sites have been identified projects are not announced within the investment portfolio.

OTEC Potential in Cuba



Source: Ministry of Energy and Mines, Cuba

4.6.3 Solid waste

Within the investment portfolio 5 solid waste projects have been identified. These are integrated projects that take in all the stages of the process, from correct selection, collection, treatment and recycling to evaluating the energy potential for generating power, heat and producing organic fertilizers, etc. These projects are rather new and the models for participation should be further investigated.

4.7 Not identified projects, what to do?

Cuba started its renewable energy program with proven techniques and proven business models. Having identified the potential of such projects and having made huge steps in the preparation and contracting for these projects, Cuba seems open for new techniques and business models that contribute to the countries objectives. Since Cuba has a growing energy market and a relatively large capacity of conventional energy production that can be replaced, it is unlikely that there will be competition between renewable energy sources in the nearby future.

5 Sales Opportunities

5.1 Renewable Energy

The goals set by Cuba for the production of renewable energy will not only be achieved with large foreign investment projects. Smaller projects are being developed by Cuban organizations. In general there will be a market in Cuba for nearly all equipment that contributes to the production of renewable energy.

5.2 Energy Efficiency

Cuba tries to reduce the usage of old technologies that consume a lot of electricity. For instance Cuba replaces old electric stoves for stoves using induction. Similar programs are established to stimulate the usage of led-lighting within the residential and the public sector. For water heating Cuba promotes the installation of solar thermal collectors. Generally spoken sales opportunities exist for electric goods for domestic and public use that can reduce energy consumption significantly. Proven techniques that don't require (large) adjustment of existing infrastructure will probably have the best papers within the Cuban market. Integral solutions that require a system approach, for instance combination of cooling, energy production and insulation can be promoted for new buildings e.g. hotels or new industrial developments.

5.3 Peculiarities of the Cuban market

Cuba has a centralized planned economy. For this selling products to Cuba will nearly always be through one of the importers that are part of the state business system. The importers generally manage the importation of goods for certain parts of the economy, ministries etc. Demand for a product and decisions on sales often are divided between persons and organizations. Cuba has strict regulations for the importation of goods that need to be complied with.

6 Joint research and knowledge development

6.1 Organization

With approximately 11 million inhabitants Cuba is an island with a complete infrastructure of Universities and Research Centres and academic debate. Cuba has a well-educated and highly motivated academic community with experience in international projects.

In the table below a summary of the organizations that might be interesting for cooperation projects.

Universities and Research Centers		
Universities	Research Centres	Others
Havana (UH)	→ PV Laboratory / IMRE Faculty of Physics (UH). Perform both output studies of PV as material studies.	Cuba Solar (NGO, National network of professionals working on renewable energy)
Havana Technical University (CUJAE)	→ CETER (Study Centre for renewable energy (CUJAE) partly focused on wind.	PAAS-project (Project that supports a sustainable agricultural development)
University "Las Villas" of Santa Clara (USC)	→ This University is appointed by MINEM to hold the National Research Centre on Renewable Energy (USC). Perform studies on Bio Electricity (sugarcane), hydropower and energy from the sea.	Ecosol Energia (belongs to Copextal – have done projects in remote areas.
University of Matanzas	→ Experimental Station Indio Hatüey (EEIH) (UM). Dedicated to bio-energy projects within the rural environment.	Construction Innovation and Development Centre (CIDC). Belongs to the Ministry of Construction (MINCON)
University of Sancti Spiritus (UNISS) Develop the national program for Biogas.	Solar Energy Research Centre (Santiago de Cuba)	
University of Pinar del Río (UPR)	Cuba Energia (belongs to the Ministry of Science, Technology and Environment (CITMA)	
University de Oriente (UO) Focus on biomass and biofuel		
University of Cienfuegos Focus on Energy efficiency		

Some of the research centres are related to a University (4 of them). The research centres practice academic research, applied science and consultancy. Because of this they are interesting for Dutch Universities, for Dutch Research Centers and Consultancy firms related to Renewable Energy.

6.2 Possible cooperation projects

During the Energy Forum, but also during its presence in Cuba, TNO came across different projects for cooperation that can be interesting to connect Cuban Universities and Research centres with Dutch Universities, Research Centres and Consultancies.

Possible Cooperation Projects			
Project Title	Objective	Opportunity	Cuban partner
'Taking Innovation to Society'	Supporting the UH with establishing a strong R&D Centre that connects Academic research with the Cuban Industry and needs of Society in general	To establish ties between Cuban professionals and the 'Dutch' way of working together on innovation between Universities, R&D institutes and Government.	<ul style="list-style-type: none"> University of Havana
Solar for Power for Empowerment	Roof top testing of solar panels connected to a micro grid with storage.	Testing of different technologies within the Caribbean climate. Stand-alone testing and testing of interaction / optimization	<ul style="list-style-type: none"> University of Havana
Off grid systems for remote areas	To apply different techniques for energy production, storage and distribution within a real life setting on Cayo Levisa	Testing of different technologies within the Caribbean climate. Stand-alone testing and testing of interaction / optimization within a real life setting	<ul style="list-style-type: none"> Technical University of Havana (CUJAE)
Bio Energy Innovation Road mapping	To establish a joint research agenda for research on bio energy, broader life cycle analysis, evaluation models, feasibility, regulatory system etc.	Since a wide variety of themes can be part of the roadmap, this opens up possibilities for different Dutch Universities, R&D institutes and companies	<ul style="list-style-type: none"> Experimental Station Indio Hatüey (EEIH) (UM) Technical University of Havana Cuba Energia United Nations
National Centre for Renewable Energy	Support with the establishment of a National Renewable Energy Centre. Part of the project might be establishing research projects on energy production, storage and smart grid on the University Campus	To start working with a new research centre directly supported by the Ministry of Energy.	<ul style="list-style-type: none"> University "Las Villas" of Santa Clara (USC) Ministry of Energy and Mines
Zero Energy Housing	To establish zero energy houses within an Cuban residential area	The Dutch government has run a 4 years applied research program together with the building industry on building zero energy houses. The results have been internationally noticed and can be very interesting to adjust to warm climates.	<ul style="list-style-type: none"> Construction Innovation and Development Centre (CIDC) University of Havana
Sustainable Energy Solutions within the agricultural sector	To apply different technical solutions for farm cooperatives to foresee in their own energy needs. This in combination with optimization of current systems for irrigation, treatment of residues and the establishment of small production plants (mini industrias)	Working within this project gives a broad access to the Cuban agricultural sector, Dutch knowledge on renewable energy and sustainable agriculture can be combined.	<ul style="list-style-type: none"> PAAS-project (Project that supports a sustainable agricultural development) Ministry of Agriculture

6.3 The challenge of cooperation projects

It is very interesting to start a cooperation project, e.g. joint research, testing of systems or knowledge development in Cuba. Starting up these kind of projects is not always considered as easy.

For Cuban Universities it is very difficult to dedicate funding to cover cost of international projects. They mostly depend on subsidies for these kind of projects or a foreign partner bearing most of the cost. This includes flight tickets, accommodation, cost for visa etc., when Cuban professionals come to visit a foreign university. Although improving, communication is not always easy due to the limited capacity of the internet while making phone calls to Cuba is quite expensive. Generally Cubans will not be able to make phone calls abroad and therefor are not capable of responding to missed calls.

These circumstances might give foreign partners the idea of a lack of interest on the Cuban side concerning the cooperation while this mostly won't be the case. In general Cuban professionals are very motivated and dedicated to their work. Within research projects, Cuba can offer a lot of space for testing and a motivated and skilled staff. Cuban staff will be less expensive then working with European staff.

To start cooperation projects within Cuba, third party funding is almost a necessity. Before projects can be started funding is necessary to cover the phase of project identification and the development of a joint project plan.

7 International Funding

7.1 EU Support Program on Renewable Energy

The European Union together with the Cuban authorities developed a Support Program to Cuba's Energy Policy. The program consists of a budget of Euro 18 million and has the following objectives:

Objective 1: Support the effective implementation of the *"Policy for the perspective of Renewable Sources and the Efficient Use of Energy"* and its Regulatory Framework.

Objective 2: Facilitate foreign investment in the sector of Renewable Energy and Energy Efficiency as well as the access to international cooperation funds

Objective 3: Support the implementation of the Programme for Energy Management and Conservation, including Energy Efficiency.

Objective 4: Support local development enhancing the access of rural communities to renewable energy, while encouraging efficient energy consumption.

The program is expected to start in 2018 and will last 60 months. The program is suitable for universities and research institutes. Part of the budget will be managed by the UN and EU member state agencies.

7.2 LAIF Cuba

A budget of Euro 3 million has been reserved for the preparation of pre-feasibility studies for projects of the Cuban government. The program is executed by the French development Agency (FAD). International consultants to provide technical assistance are selected through tender processes.

7.3 European Investment Bank (EIB)

The European Investment Bank provides finance for large and long term projects. The EIB also provides loans for projects within the Latin American region. A total of 105 projects in the Latin American region have been supported by the EIB.

Within the Latin American region the EIB formulated three priorities. Energy projects in Cuba might be eligible within the objective *'Mitigation of and Adaption to Climate Change'* and within the external lending mandate. The EIB holds a first come first serve policy (source:Angel Diez Fraile, EIB).

7.4 United Nations

The United Nations, with an office in Havana, has a dedicated team to support Cuba on its renewable energy ambition and adaption to climate change. The UN works with funding of different institutes or countries. The UN will execute part of the EU-program, objective 4. There is a lot of experience with the GEF (Global

Environment Fund) in different projects. In 2018 a new round of GEF-funding will start. Projects are being prepared at the moment.

7.5 Development agencies

Different EU member states and non-EU member states have development agencies that work within Cuba e.g.: Switzerland, France, Spain, Canada, China and Mexico. One of the bigger ones is COSUDE the development agency from Switzerland. The development agencies can provide funding for cooperation projects that contribute to their program objectives.

8 Review on the Cuban Sustainable Energy Forum

TNO valued The Cuban Sustainable Energy Forum as a very interesting event to get a comprehensive picture of how the Cuban renewable energy program works and how it is organized. The Cuban Renewable Energy Program is well developed and elaborated. Whereas up till now the focus has been on well proven technologies, this focus will now be broadened and also incorporate new (innovative) technologies.

Although important steps have already been taken concerning investments in renewable energy projects, new opportunities for investments already exist or are being developed. For that the Cuban renewable energy program remains interesting for foreign technology providers and investors. During the forum there has the possibility to meet the key-players in the Cuban investment program.

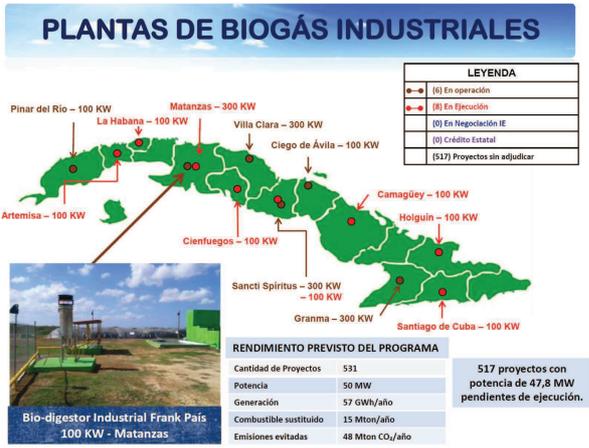
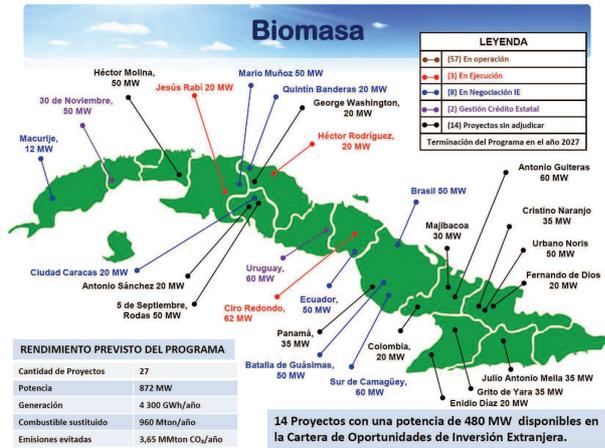
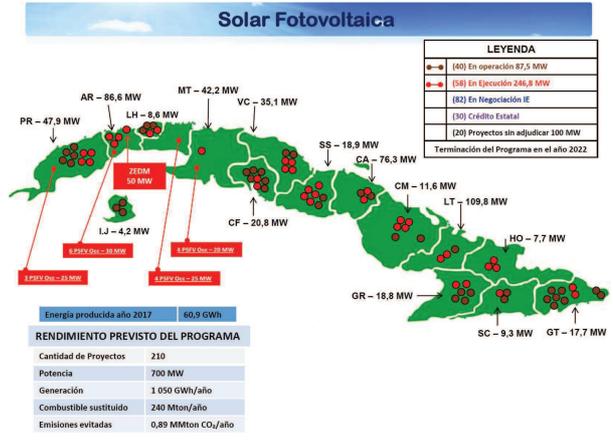
Although less profoundly discussed during the forum the Cuban program on Energy Efficiency is of a high importance for the development of the Cuban Economy. With national programs to change old and high energy consuming technologies for new and less energy consuming technologies there is a demand for products that can be implemented fast and without high cost of adjusting existing infrastructure.

New opportunities arise where energy production and energy reduction are integrated in the development of buildings or (remote) areas / districts. As other countries that are changing their energy supply to renewable energy, Cuba is also facing the challenges of grid flexibility and looking for suitable solutions. The current state of the Cuban electricity network has been presented by the utility company.

With a good analysis of the own network, but in general good analysis of the existing energy consumption, existing and new technologies and energy growth Cuba provides a very interesting infrastructure of professionals for practicing joint research and technology development.

Overall TNO valued the Cuban Sustainable Energy Forum as an important and valuable step in the development of the Cuban ambitions on Renewable Energy, providing a good insight in opportunities for investors, technology providers and research and knowledge organizations.

Annex 1 The Cuban Renewable Energy Program



Source: Ministry of Energy and Mines, Cuba

Annex 2 Additional information

<http://www.cubatrademagazine.com/cubas-plan-produce-quarter-energy-renewables/>

<http://www.cubatrademagazine.com/hive-energy-foreign-owned-solar-park-cuba/>

<http://media.firabcn.es/content/fira-cuba/documents/Portfolio%20of%20opportunities%20for%20foreign%20investment%202017-2018.pdf>

http://www.granma.cu/file/sp/cartera-de-oportunidades-de-inversion-extranjera-23/datos/documentos/Cuba_guia-del-inversionista_ENG.pdf



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