

Renewable Energy in Curaçao



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1. Introduction: Sustainable energy production in the SIDS (1)

- **Electricity production in SIDS**

- Electricity production in SIDS is strongly dependent on imported fossil fuels.

- **The main disadvantages of fossil fuels**

- Contribute to Global Warming.
- A finite amount of fossil fuels is available.





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1. Introduction: Sustainable energy production in the SIDs (2)

- **Barriers that impede the implementation of RESs in SIDS, such as:**
 - Most RESs are weather dependent and display daily variations.
 - Intermittent RESs require additional financial investments due to the need for back-up.
 - Limited financial resources.
 - Lack of awareness of RES alternatives.
 - Lack of technical knowledge on RESs.
 - Insufficient human capacity.
 - RESs require large parcels of lands.
 - Unwillingness by consumers and suppliers to invest in RESs.
 - Lack of policies.

2. Past: Wind energy in Curaçao (1)

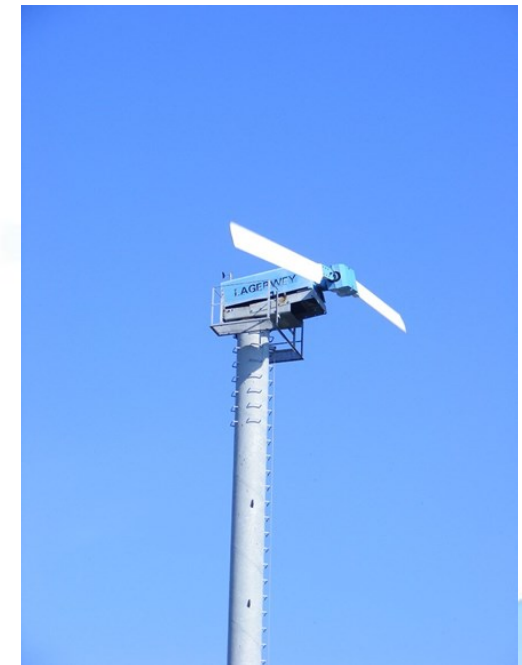
1975: FAPE

- Measurements and research: local and international;
- Wind map for Curaçao;
- Stimulation for the application of wind energy and the wind turbines;
- Energy savings research.

1984: A Lagerweij 30 kW wind turbine
University of the Netherlands Antilles.

1985: A Newecs 300 kW wind turbine
Tera Cora (KODELA).

1985: A Polenco 100 kW wind turbine
The Dutch Royal Navy.



2. Past: Wind energy in Curaçao (2)

1987: The idea to build a 10 MW wind farm in Curaçao.

1992: 3 MW wind farm at Tera Kora.

1999: 9 MW wind farm at playa Kanoa.

2012: 15 MW at Tera Kora.

2012: 15 MW at Playa Kanoa.

2017: 31.5 MW at Tera Kora.



2. Past: Solar energy in Curaçao (1)

- Since 80's: several solar energy projects in Curaçao.
- Examples:
 - After several years of measuring, the UNA has determined the tilt angle for solar panels on Curaçao.
 - A 1 k Wp grid-connected solar panel system on the Kodela site.
 - A 20 kWp grid-connected solar panel system on KAE site.



2. Past: Solar energy in Curaçao (2)

- In 1984, Radio Hoyer, E SOLO DI PUEBLO made history by becoming the world's first commercial FM radio station to run on 100% solar energy.
- Radio station & solar power system is located on Tafel berg.
- The building was built on the passive design principles.
- Almost all appliances that were used were energy-efficient appliances.



2. Past: Solar energy in Curaçao (3)

- The original configuration of the solar power system:
 - 128 Monocrystalline solar panels, type ARCO M53, 43 Wp, 12 V;
 - Total capacity: 5.5 kWp;
 - Output DC voltage: 24 V;
 - Batteries: 3,600 Ah;
 - Regulators;
 - A backup diesel generator set: 3 kW, 220 V, 50 Hz.
- The Radio Hoyer studio is located about 15 km from the radio station.
- The entire system could be monitored and controlled from the studio.



3. Present: The current state of electricity infrastructure in Curaçao

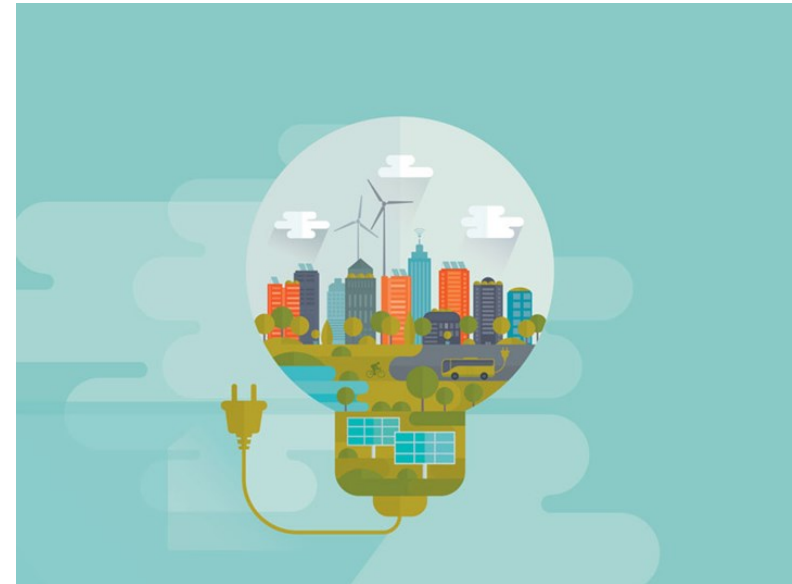
Electricity production:

- Total installed electricity production capacity (238.3 MW).
- Non renewable energy sources (176.8 MW).
- Wind farms (46.5 MW).
- Solar panel installations (18 MW).
- No energy storage systems.
- Non renewable energy sources as back-up.
- Electricity production by the renewables: about 35%.



3. Present: Reduce the energy demand (1)

- Energy use and behavior in the household sector, the commercial sector, and the industrial sector in Curaçao.
 - 384 households.
 - 333 offices.
 - 22 hotels.
 - Nine supermarkets.
 - Measurement of standby losses in 20 households.
 - 626 buildings were investigated.



3. Present: Reduce the energy demand (2)

Appliances that use the most energy in Curaçao:

- Air conditioners.
- Lighting.
- Refrigeration.



3. Present: Development of solar energy (1)

- **Late 2011:** renewable energy sources connected to grid.
- **2012 – 2016:** increased from 0 to about 14.322 MW.
- **2014:** a peak of 6 MW.
- **2017 – 2021:** from 10.800 MW to 18.452 MW.
- **2012 – 2016:** increase with about 2.2 MW per year.
- **2019 – 2021:** increase with about 1.5 MW per year.



3. Present: Development of solar energy (2)

- Installed solar panels

- By the end of 2016:
 - Residential sector: about 3,5 MWp;
 - Business sector: about 7,5 MWp.

- By the end of 2021:
 - Residential sector: about 3,9 MWp;
 - Business sector: about 14,5 MWp.

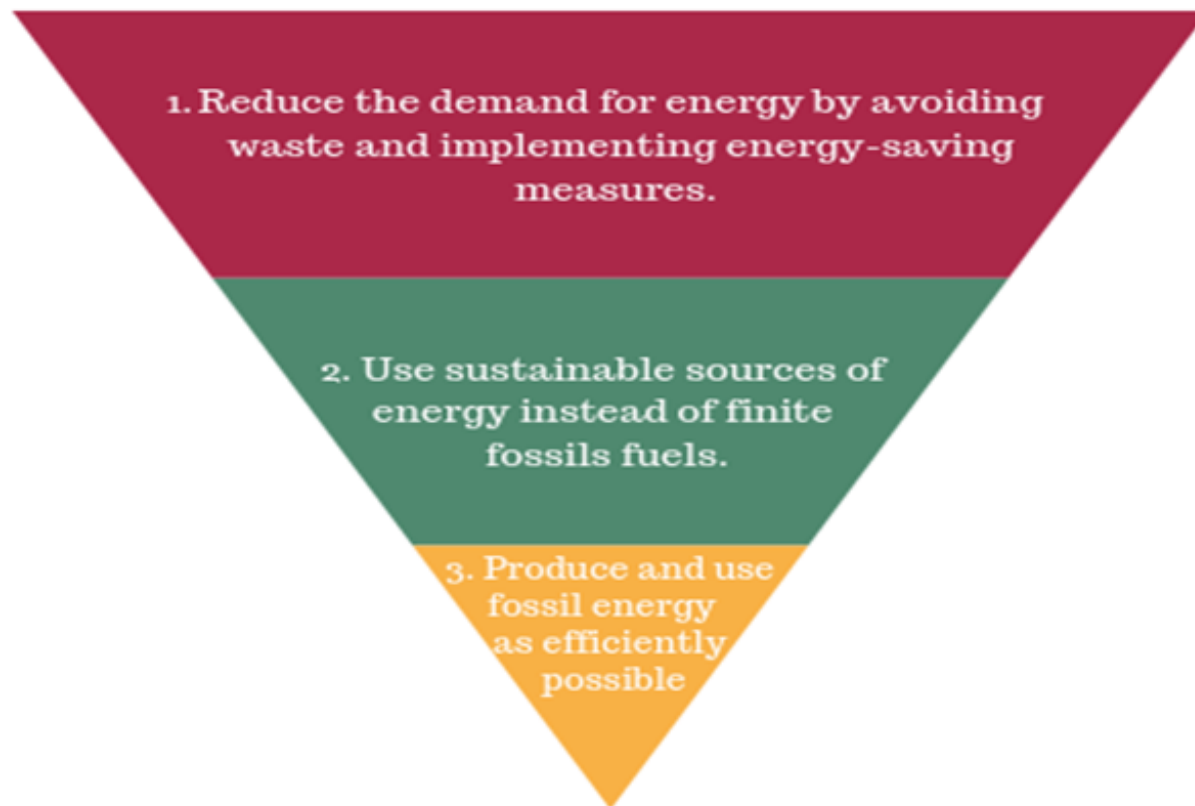


3. Present: Development of solar energy (3)

Photovoltaic power system fees

	Sector					
	Residential	Commercial	Industry standard	Industry export	Industry import	Hospital
Period	Feed-in tariff [USD]					
Before 2015	*Balanced	0.234	0.234	0.234	0.234	0.234
Jan - Dec 2015	0.180	0.180	0.180	0.180	0.180	0.180
Since Jan 2016	0.136	0.136	0.136	0.136	0.136	0.136
	Fixed monthly fee [USD/kW]					
Jan 2015 - Dec 2017	9	18	18	9	18	9
Since Jan 2018	4.5	9	9	4.5	9	4.5

4. Future: Trias Energetica model





4. Future: Reduce the energy demand

- Techniques for improving the energy efficiency of the most-commonly used appliances such as:
 - Improve the energy efficiency of lighting systems.
 - Reduce standby power losses.
 - Use energy efficient appliances.
 - Use sustainable air conditioners.
 - Increasing consumer awareness of energy saving behavior.
 - Use smart LED street lighting.
 - An active role of the government.





4. Future: Renewable energy

- Environmental and economic benefits of using renewable energy include:
 - Producing energy that does not emit greenhouse gases from fossil fuels.
 - Diversifying energy supplies and minimizing dependence on imported fuels.
 - Economic development and job creation in manufacturing, installation and more.





4. Future: Use fossil energy as efficiently possible

- Optimize the baseload.
- Improve the efficiency of the generator sets.
- Reduce energy losses in the transmission, distribution, and low-voltage infrastructure.
- Apply tri-generation for district cooling.

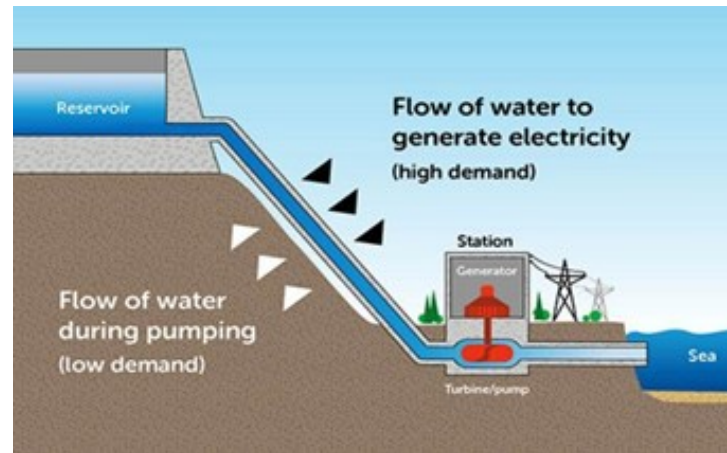


4. Future: Let's be innovative

Energy vault
storage system



OWAC by Omega
Engineer



Pumped storage
hydro water





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4. Future: Make better use of our knowledge and expertise

- Different companies perform different activities outside Curaçao in the field of sustainable energy and environmental aspects, such as:
- Omega Engineering Inc.
- Aqualectra
- Nucapital
- Dynaf
- Eco vision
- University of Curaçao.



4. Future: Recommendations

- Let's make better use of our knowledge and expertise!
- Let's overcome barriers and create more opportunities!
- Let's invest in human resources!
- Let's be innovative!
- Let's work together to put Curaçao on the map as a sustainable energy island!





**Thank you
for your attention.**

