Running 100% on sustainable energy
Why didn't YOU install solar energy yet?
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Working with Solar Energy Bonaire
This presentation

Based on questions during discussions:

- Explanation of some basic terms
- Explanation of various solar systems
- Example of economic installation
kW = Power

Power indicates the consumption of a device
Power rates the production capability

Airco 12000 BTU/hr
Power consumption = 1 kW

Generator 20kVA
Maximum power rating = 16 kW
kWh = Energy

Energy is the amount of power used over a period of time

Energy used in 8 hours:
1 kW x 8 hours = 8 kWh

Airco 12000 BTU/hr
Power consumption = 1 kW
kWh = Energy

Energy is the amount of power produced over a period of time

Generator producing 14 kW

Energy produced in 4 hours:
14 kW x 4 hours = 56 kWh
Energy is what you pay for
Solar power rating (kWp)

- kWp is the maximum amount of kW produced by solar panels
- number of kWp determines number of solar panels
- kWp is what you buy
- 1 kWp produces 4.5 kWh of energy daily (in Bonaire)
In 2016 BES electricity law has changed

- Connecting sustainable energy sources to the grid became allowed
- Everyone had high expectations
- And according to WEB 4 contracts for connection have been signed until now
“Bondigro was the second company who successfully completed the procedure”

Van onze correspondent

KRALENDIJK - Zonnepanelen worden nog vrij weinig gebruikt op Bonaire. De coöperatieve supermarkt Bondigro vindt het idee passen bij zijn uitgangspunt om producten voor lage prijzen aan te bieden aan de consument. Vorige week tekende Bondigro een interconnectie-overeenkomst met nutsbedrijf WEB voor de aansluiting van een zonnepaneleninstallatie. Bondigro wil daarmee de kosten laag houden, maar vindt de natuurlijke energiebron ook goed bij Bonaire passen.

WEB beoordeelt de aanvragen voor de installatie van zonnepanelen voordat die op het elektriciteitsnet kunnen worden aangesloten. Na goedkeuring van de tekeningen en technische gegevens wordt na de installatie opnieuw bekeken of alles volgens de veiligheids- en andere voorwaarden is aangesloten. Ook de Directie Toezicht en Handhaving moet de installatie goedkeuren. Pas dan mag de gebruiker de zonnepanelen gebruiken en ontvangt de terugleververgoeding voor de aan het net geleverde energie. Bondigro heeft als tweede bedrijf op Bonaire dit proces met succes doorlopen.
In 2016 BES electricity law has changed

- Connecting sustainable energy sources to the grid became allowed
- Everyone had high expectations
- And according to WEB 4 contracts for connection have been signed until now

WHY?
Discouraging policies

- Feed back rate is $0.01/kWh for business users
- $0.05/kWh for home users
- *Complete* electrical installation has to be approved again
- Fixed fee yet to be determined
- Obligation to pay the fixed fee for 5 years
- In general: FUD: Fear, Uncertainty, Doubt
Sending money back to outer space
But solar radiation is *free*

- As the old Dutch saying goes "Voor niets gaat de zon op"
- The sun is more reliable than even taxes and death
- Radiation not being used is converted to heat or radiated back into outer space
- That does not make sense
At least you should try to keep *something* for yourself
Actual power consumption is reduced by exactly the amount of solar power produced.
Grid-tied solar system

- Simple
- Economic (~1700 / kWp)
- Scalable (start small, expand as desired)
- WEB consumption is decreased exactly by the amount of solar production
- Power is summed
- No grid, no power, no UPS function
- Energy at different moments is **not** summed
Stand-alone solar system

- Generator
- Charging 1.5 kW
- Solar 3.5 kW
- Consumption 2 kW
Stand-alone solar system

- Solar 3.5 kW
- Grid
- Charging 1.5 kW
- Consumption 2 kW
Stand-alone solar system

- Not-so-simple
- More expensive than Grid-tied
- Not easily scalable
- Back-up generator is mandatory
- Or a switch to the grid
- Batteries, batteries, batteries
- Fully independent of the grid
Batteries

- Night consumption usually is 50% higher than estimated
- Battery life is 50% less than estimated
Hybrid “energy saving” system

Solar 3.5 kW

Charging 1.5 kW

Consumption 2 kW
Grid interaction is minimized

Solar 3.5 kW

Charging 1.5 kW

Consumption 2 kW
Night consumption from batteries

Consumption 2 kW

Discharge 2 kW

Consumption 2 kW
Seamless switch to grid when batteries are empty

Consumption 2 kW
Hybrid solar system

- System of the future
- Grid interaction is minimized
- Solar energy is stored for night-time use
- Acts as a UPS during blackout
- Scalable both for power and batteries
- More expensive than Grid-tied
- Batteries, batteries, batteries
Hybrid solar system

- System of the future
- Grid interaction is minimized
- Solar energy is stored for night-time use
- Acts as a UPS during blackout
- Scalable both for power and batteries
- More expensive than Grid-tied
- Batteries, batteries, batteries
- **NOT AVAILABLE IN THE MARKET**
Back to the grid-tied solar system

Actual power consumption is reduced by exactly the amount of solar power produced.
Surplus power is feed back for free

Solar 3.5 kW

WEB 1.5 kW

Consumption 2 kW

$ 0.01 / kWh
And at night purchased for premium price

Solar 3.5 kW

Consumption 2 kW

WEB 2 kW

$ 0.31 / kWh
“Old” mechanical meters counted backwards

$ 0.31 / kWh

Solar 3.5 kW

Grid 1.5 kW

Consumption 2 kW
And at night consumption for the same price

$0.31 / kWh

Solar 3.5 kW

Grid 2 kW

Consumption 2 kW
Energy summation ("saldering")

- Energy is summed regardless of occurrence
- Actually the meter turns backward
- Feed back into the grid for the same price as consumption
- Very favourable to homes with shifted production and consumption times
Energy summation ("saldering")

- In NL-EU allowed until at least 2023
- A fixed fee (vastrech) is common
- Grid operational costs must be covered
- So WEB also introduces a fixed fee
- But keeps the difference between feed back and purchase
- That does not sound fair 😞
Example: Home use

Due to time shift in production and consumption installation is not economic
Typical home power balance

Solar installation 3 kWp

2 airconditioners

Lights, Television, Computers

Refrigerator, coffee maker, Television

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Typical home energy balance

Solar production 13.5 kWh

2 airconditioners

Energy reduction 3 kWh

Cost of solar installation: $5100
Payback time: 26.8 years

Sold to WEB: 10.5 kWh: $0.52

Purchased from WEB: 20 kWh: $6.20
Example: Office use

- Production and consumption coincide
- Installation is economic as long as Solar peak production is below consumption
Typical (small) office power balance

Solar installation 3 kWp

Peak power: 3.5 kW

Lights

2 airconditioners, 3 computers

3 kW

2 kW

1 kW

00:00 06:00 12:00 18:00 24:00
Typical (small) office power balance

Solar production 13.5 kWh

Energy reduction: 13.5 kWh: $ 4.19

Cost of solar installation: $5100
Payback time: 3.3 years

Purchased from WEB: 26 kWh: $8.25
Those who payed attention noticed...

Solar production 13.5 kWh

Purchased from WEB: 26 kWh: $8.25

The areas of purchased and produced energy do do do match the figures.
Solar production is wildly varying. So the green area is not solid. The figures still match, of course.
Energy production without feedback

- Every kWp installed of solar panels produces 1650 kWh / yr
- This 1650 kWh is not purchased from WEB
- $1650 \times 0.31 = $512 is not paid to WEB
- Cost of 1 kWp ~ $1700
- After 3 years and 4 months energy is free
Energy production without feedback

- No matter how small the solar installation is
- Every installed panel reduces energy consumption
- Just avoid feeding back to the grid
- *After 3 years and 4 months energy is free*
When will you start using free solar power?