

PROJECTPLAN

SYSTEEMINTEGRATIESTUDIE 2017

Publiek eindverslag over de uitvoering van de activiteiten en de resultaten daarvan



Project title: Aruba Reversed Osmosis Wind

Abbreviation: ARROW

Reference number: TESI117012

Study type:

A feasibility study with demonstration prior to an investment project.

Locations where the project was executed:

DOT BV Office: Raam 180, 2611WP Delft, the Netherlands

DOT BV Laboratory: Schieweg 15D, 2627AN Delft, the Netherlands

Delft University of Technology: Faculty of Civil Engineering and Geosciences, Department of Water Management, Stevinweg 1, 2628CN Delft, the Netherlands

Water- En Energiebedrijf Aruba NV: Balashi 76, Aruba, Dutch Caribbean

1. PUBLIC SUMMARY

Background

The Delft Offshore Wind Turbine Concept (DOT) offers a solution to reduce the costs of offshore wind installations by means of hydraulic power transmission. In the DOT concept a seawater pump, located in the wind turbine's nacelle, is directly driven by rotor blades and pumps pressurised seawater towards a centralised platform where hydraulic power is converted into electricity. Besides the production of electricity DOT is investigating other market potentials to exploit on commercial scale, including fresh water production and sea water air conditioning systems.

Aruba, an autonomous island of the Kingdom of the Netherlands in the southern Caribbean, does not possess any natural freshwater resources, and produces all of its fresh water through Reverse Osmosis (RO) of sea water. Aruba has initiated a Clean Energy Strategy to increase the island's use of renewable energy and decrease its dependency on (imported) fossil fuels. This means WEB Aruba NV (*Water- en Energiebedrijf*) is looking for options to replace their fuel driven electro motors, currently driving the RO units, with a more renewable setup.

Project's Objective

DOT BV aims to contribute to the sustainable development of Aruba, by introducing and investigating an integrated setup for the production of both drinking water and electricity. The setup is based on a direct extraction of sea water which is pressurized by one or multiple on- or offshore wind turbines and directly inserted into a RO facility in combination with the already identified storage possibilities at the Butucu mountain, see Figure 1.

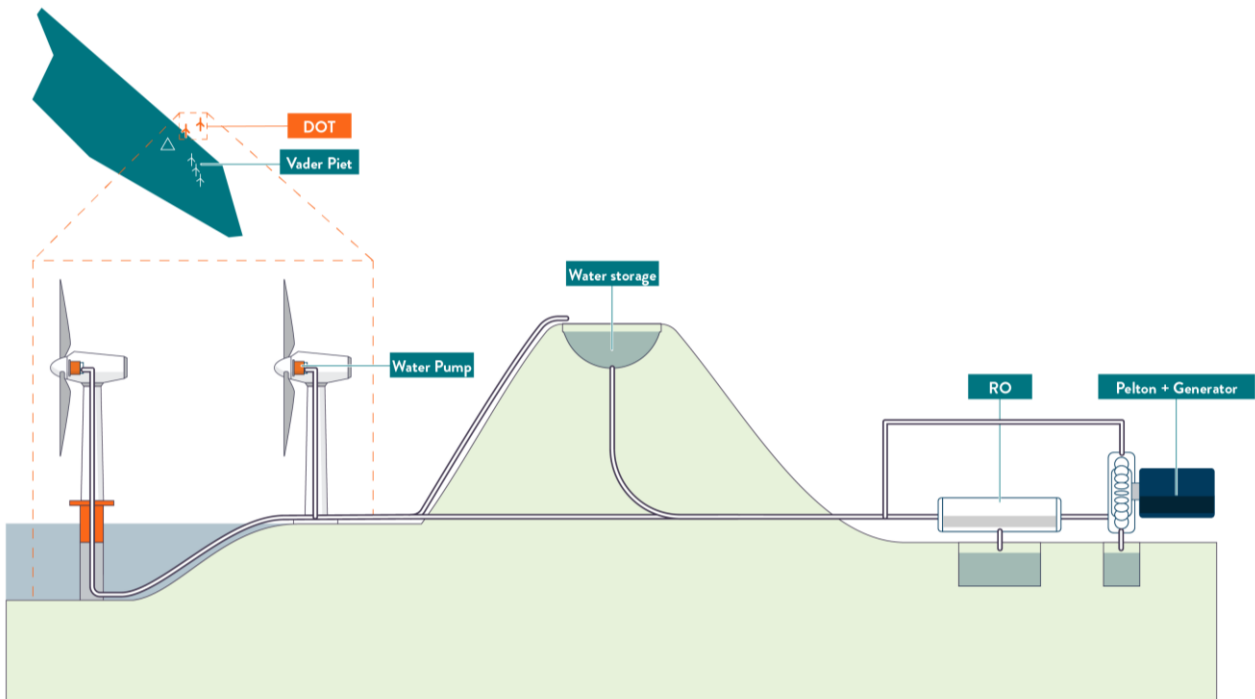


FIGURE 1: SCHEMATIC SET-UP OF THE ARUBA DOT DESALINATION SYSTEM

The delivered electricity production is an addition to the existing Vader Piet Windfarm with the big advantage being the flexibility in choice of either using the additional renewable energy to produce drinking water or electricity.

The objective of this system integration study is to investigate the (market) potential of the proposed set-up and to create a sound basis of design as well as a first concept design for a pilot project.

Executed Activities

The ARROW project included the following phases:

- 1) **Technical feasibility study**
 - a) **Desk study:** exploring the possibilities in systems, facilities and inputs for the hybrid setup on Aruba.
 - b) **Basic concept design study:** estimating the number and type of wind turbines, RO unit and electricity production unit.
 - c) **Field study:** optimizing the location, system and collaborative setup, by analysing data of wind hours, demands, etc.
 - d) **Concept design study:** concluding the findings in a form of an evaluation and recommendations for the construction and demonstration of the setup and the setup of a revenue model
- 2) **Pilot study:** Testing the demonstration concept in a small-scale test set-up
- 3) **Business case:** Investigating the possibility the formation of a consortium investing in the hybrid DOT RO construction.

Results

The executed technical feasibility study resulted into two possible set-ups:

- 1) Directly powering the already used high pressure water pump in WEB's SWRO process
- 2) Stand-alone set-up combining a DOT wind turbine with an individual SWRO unit

Of these two options the stand-alone set-up was selected as being the most promising, not only for this specific location on Aruba but also for future commercialisation.

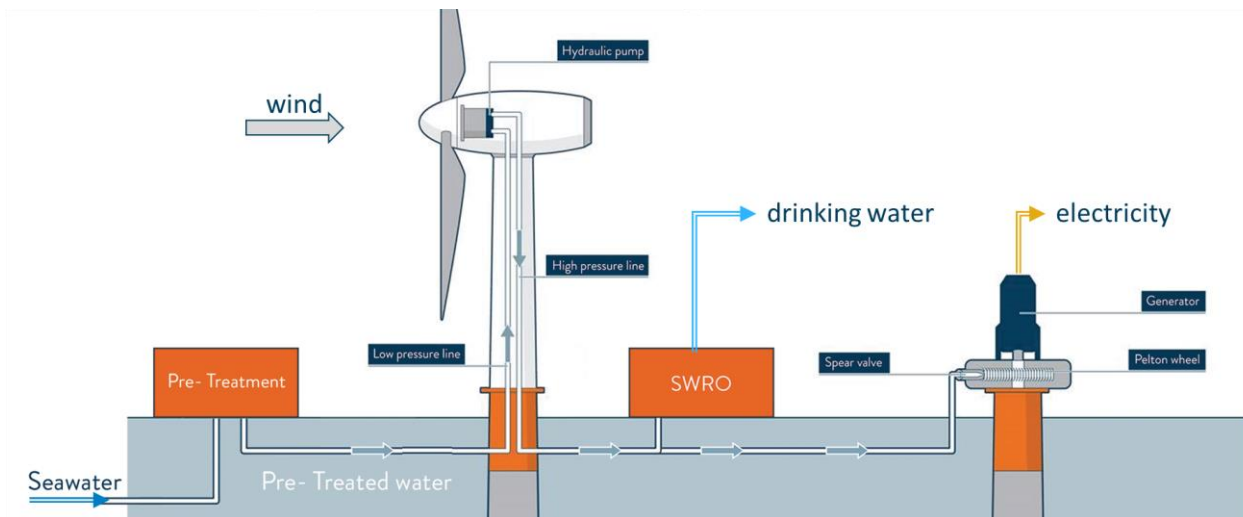


FIGURE 2: DOT WIND POWERED DESALINATION AND ELECTRICITY PRODUCTION CONCEPT

As part of the pilot study a small-scale set-up was designed, built and tested to mimic and investigate this stand-alone set-up and also the business case was developed based on this configuration.

Follow Up

As follow up to this system integration study, together with WEB a funding application was handed in with RVO as part of the DEI funding scheme (application reference: DEI118012). Unfortunately, this project was not granted subsidy but a second attempt (application reference: DEI119003) was granted by RVO and has the aim of designing, building and testing a 500kW set-up at the Maasvlakte 2 in Rotterdam. Once this pilot is successful, we expect to ship it towards Aruba or a similar location for a pre-commercial demo.