

# IRENA / MTIE

## IRENA – PROJECT NAVIGATOR WORKSHOP

# CABEOLICA

First Large Scale Wind Energy PPP  
in Sub-Saharan Africa

**PRAIA – CABO VERDE**

SEPTEMBER 10, 11 & 12, 2014

Accionistas



Financiadores



# WIND FARMS EXTENSION

## HISTORY:

CABO VERDE: HIGHLY DEPENDENT FROM OIL IMPORT TO GENERATE ELECTRICITY

SMALL PILOT PROJECTS OF RE

STEP 1: WIND FARM OF SANTIAGO 3 X 300 KW

S. VICENTE 3 X 300 KW

SAL 2 X 300 KW

STEP 2: EXTENSION OF WIND FARMS

STOPPED DUE TO END OF COOPERATION WITH DK

ALMOST 10 YEARS SURCHING FOR STRATEGIC PARTNER AND INVESTORS TO ENLARGE WIND ENERGY  
INSTALLED CAPACITY

GOVERNMENT DECISION TO DEVELOP THE PROJECT BY ENGAGING AN EXPERINCED AND TRUSTFUL  
DEVELOPPER - INFRACO



## Strategic Objectives:

- Reduction of oil based electricity generation dependency;
- Attraction of private investment;
- Relieving State of single financing the country's energy sector.

## Political Commitment:

- Establishment of a strong **PPP** in 2008-09, between a Developer - InfraCo Lda; State of Cabo Verde (GoCV) and Electra (Utility), that had the purpose of implementing an economically feasible alternative for the rapidly growing energy sector.





## Investors and Lenders:

### ○ Investors:

**AFC** - Africa Finance Corporation; **FinFund** - Finnish Fund for Industrial Development and **InfraCo - Ltd.**

### ○ Lenders:

○ European Investment Bank (EIB) and African Development Bank (ADB).

○ Investment based on a Project Finance scheme: 30% equity and 70% debt provided, in a total project amount of **+/- 60 M Euros**

○ Company held a turn key **EPC** contract with Vestas for the supply and installation of 30 V-52 turbines.

○ Construction initiated at the end of 2010; was completed by end of 2011 in ST & SV and beginning 2012 in Sal and BV.

○ The company has constructed and currently operates four wind farms, with a total installed capacity of **25.5 MW**

- Santiago – 9.35 MW; São Vicente – 5.95 MW
- Sal - 7.65 MW; Boa Vista – 2.55 MW





## Instruments:

- Power Purchase Agreement (**PPA**) signed with the Off-taker  
Tariffs:
  - PPA: - establishes base energy price and monthly base energy;
    - discount energy price, tiers 1 and 2
  - Take or Pay: – conditioned practiced frequently in PPAs worldwide;
    - was integrated in the PPA to guarantee necessary external investments and debt.
  - To date the tariffs are lower than conventional production cost.
- Government Support Agreement (**SA**)
  - Government support was essential for participation of external investors and dept providers.
- Service and Availability Agreement (**SAA**)
  - The supplier and installer signed a maintenance and availability guarantees for medium/long term.





## Main (Obstacles) Challenges:

- Development phase: time necessary to finalize all preliminary studies; agreements; land concessions; permit and licenses; and contractual and legal documentation.
- Conceptual design: a dynamic power analysis of four completely different power grids, each with its own complexity, had to be conducted to assess the limitations and evaluate wind energy integration.
- Implementation phase: transportation of 30 turbines to different islands with logistic limitations and equipment and personnel for in land specialized works.
- Operating phase: sudden transition from almost 100% diesel to a diesel-wind grid connected system posed challenges related to grid stability, dispatching of power generated by different sources and personnel capacitation.





## OPERATION - Achievements:

- As of June 2014 the wind farms had generated a total of 200 472 MWh.
  
- This translates to roughly 24% of the total supply in Cape Verde.
  - On São Vicente and Sal islands, the average 30%.
  - In São Vicente, the daily wind energy penetration rate has frequently exceeded 50%.
  - If all available output had been used, the wind farms would have contributed with 30% of the country's total electricity supply.
  
- Significantly increased availability of power.





### Main constraints:

- Curtailment of the wind farms, specially in Sal;
- High number of Wind Farms shut downs in the first two years;
- Grid events, mainly due to shorts circuits;
- Power plants issues, mainly on the dispatching.

### Mitigate constraints:

- SCADA control system: operators training
- Remote rearm of WF
- ION grid analyzer: analysis of the events on the grids



# Operation Performance

(Commercial Operation Date (COD) until end of June 2014)



	Installed Capacity	Total Production	Energy Available	Avg. Wind Speed	Capacity Factor *	Availability	Penetration Rate
	(MW)	(MWh)	(MWh)	(m/s)	(%)	(%)	(%)
Santiago	9,35	91.349	98.758	8,3	40%	99,27%	17%
S. Vicente	5,95	57.563	82.652	9,5	40%	97,97%	32%
Sal	7,65	38.291	82.651	8,5	21%	98,42%	30%
Boa Vista	2,55	13.269	21.449	8,3	27%	99,14%	26%
<b>Total/Avg</b>	<b>25,50</b>	<b>200.472</b>	<b>285.510</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>24%</b>

\* Capacity factor considering curtailment

## Total Production

- Santiago 45%
- São Vicente 29%
- Sal 19%
- Boa Vista 7%

## Utilization Energy Available

- Santiago 92%
- São Vicente 70%
- Sal 46%
- Boa Vista 62%

## WF Shut downs reduction

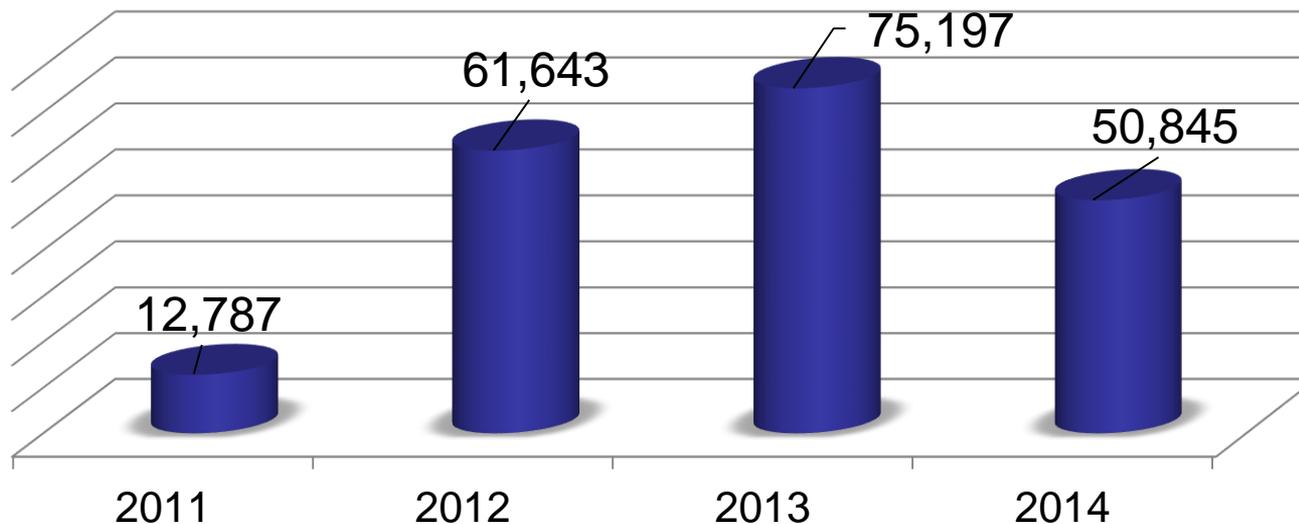
- Santiago: 71%
- S. Vicente: 45%
- Sal: 45%
- Boa Vista: 40%

# Operation Performance

(Since Operation Date until June 2014)



## Energy Produced Evolution (MWh)



## Situation in Sal island (COD until June 2014)

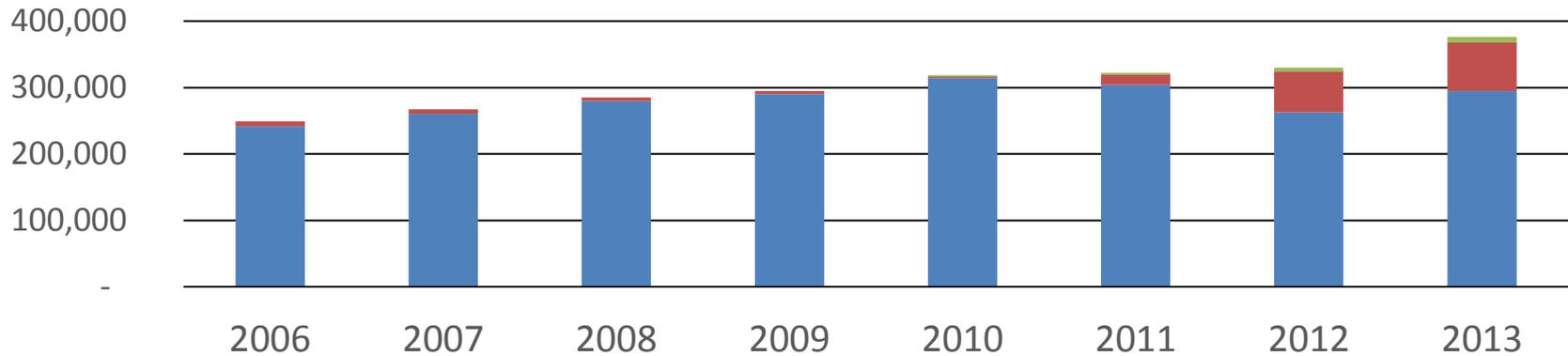


- Installed Capacity - Wind/Solar - 38%
- Good potencial with annual avg. wind speed of 8,5m/s
- High penetration rate - 30%
- High curtailments:
  - Energy Available utilized - 46%
  - Low Capacity Factor - 20%
- Annual load demand growing poorly



## Production Evolution (MWh)

■ Diesel ■ Wind ■ Solar





## General Benefits:

- Offset diesel imports by over 25,000 Tonnes.
- Savings for the utility company/country
- Almost the entire population of the island benefits from clean RE
- Road to sustainability
- Curbed over 70,000 tonnes of GHG emissions to date, thus aiding in achieving its international environmental obligations.
- Cabeolica is staffed entirely by Cape Verdeans thus ensuring retention of know-how.





## Replicability:

- Cabeólica as the first large scale wind energy PPP in sub-Saharan Africa has an important leadership role in encouraging other countries to launching of successful renewable energy PPPs.
- The PPP formula can work in countries with sufficient political will and serious and transparent environment between the public and private partners.
- The key ingredients for the success of the Cabeólica PPP are:
  - Participation of solid, transparent and high profile public and private partners;
  - Government support;
  - The incentive of a long term off take agreement to ensure predictable and transparent cost planning and predictable and transparent cash flow projections.
  - Stable and reliable energy supply and continuous optimization of the commercial relationship with the Off-Taker





## Steps Forward:

- GCV has set an ambitious target for 2020 (50% to 100% RE).
- Currently the local grid stability and spinning reserve requirements limit RE penetration to around 40 - 50%.
- The increase in uptake of renewable energy in general in Cape Verde will require maximization of stable production and minimization of losses through:
  - technical, commercial and organisational improvements;
  - continuous development of the grid control systems;
  - development of RE storages;
  - training and continuing capacity building of personnel.



**CONCLUSION:  
Wind - competitive  
energy source**



- Wind / Solar technologies available in the market are reliable and cost-effective.

Needs: Gain scale through effective demand; Have knowledge of demand

- Bankable and viable projects;
- Good tendering process;
- Accelerate procedures;
- Optimize production;
- Reduce losses.

Investment opportunities for good RE projects exist

**THANK  
YOU**

