



ECOWAS Regional Workshop on WIND ENERGY



NOVEMBER 2013



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GESTO PRESENTATION

GESTO EXPERIENCE

CAPE VERDE EXPERIENCE

GESTO WIND EXPERIENCE



GESTO PRESENTATION

GESTO EXPERIENCE

CAPE VERDE EXPERIENCE

GESTO WIND EXPERIENCE

GESTO IS SPECIALIZED IN ENERGY CONSULTING AND RENEWABLE PROJECT DEVELOPMENT (I/II)



ENERGY CONSULTING



PROJECT DEVELOPMENT

ENERGY POLICY AND PLANNING

Gesto is specialized in energy planning and renewable energies action plans:

- Electrical system analysis (demand, installed power units, generators characteristics, electrical grid)
- Demand forecast
- Grid network studies and projects
- System operation cost analysis
- Energy efficiency measures
- Infrastructure investment planning
- Renewable energies scenarios and grid impact
- Legal framework development and support
- Definition of incentives to Renewable Energies
- Legal support to state agencies concerning the preparation of public tenders for energy projects

SUPPORT TO RENEWABLE ENERGY PROJECT DEVELOPMENT

- Renewable resources assessment (hydro, wind, solar, biomass/MSW, waves/tides, geothermal)
- Resource mapping
- Renewable project identification and energy potential evaluation
- Site assessment
- Licensing (construction/Municipal; electrical Installations, environmental, electrical grid, telecommunications, etc)
- EPC contracts management, projects development supervision and coordination, quality and safety conditions control
- Operational dispatch design and implementation support:
 - Management and stability solutions
 - Renewables projects grid integration solutions - studies and project

HYDRO, WIND & SOLAR

Identification, technical-economical assessment and development of projects:

- *Small hydro*
- *Pumped storage*
- *Solar PV*
- *Solar & Diesel integration*
- *Wind farms*

GEOHERMAL / GEOLOGY

Identification, technical-economical assessment and development of geothermal projects:

- *Medium enthalpy*
 - *High enthalpy*
- Other geological resources and opportunities

OTHER

Energy services projects

In cooperation with investment funds

GESTO IS SPECIALIZED IN ENERGY CONSULTING AND RENEWABLE PROJECT DEVELOPMENT (II/II)



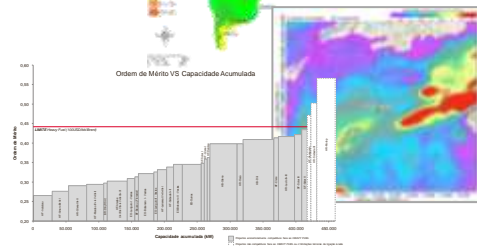
MARTIFER
Renewables
Microgeneration
(Solar projects)

“Consulting for sustainable energy”

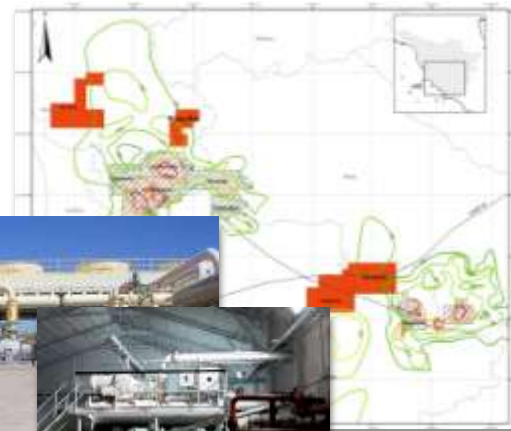
“Geothermal exploitation in Italy”



- Renewables evaluation
- Project identification, development & management
- Master Planning
- Legal support & Financing



Portugal
Spain
East Timor
Cape Verde
Mozambique
Namibia
Angola
...



HidroAvelar



500MW Hydro Pump Storage project under development (initial stage)

ENERGY CONSULTING

RENEWABLE PROJECT DEVELOPMENT

GESTO IS A SPIN-OFF OF MARTIFER GROUP



- ANGOLA
- AUSTRALIA
- BELGIUM
- BRAZIL
- BULGARIA
- CANADA
- CAPE VERDE
- CHILE
- CZECH REPUBLIC
- FRANCE
- GERMANY
- GREECE
- INDIA
- IRELAND
- ITALY
- MEXICO
- MOROCCO
- MOZAMBIQUE
- PERU
- POLAND
- PORTUGAL
- ROMANIA
- SAUDI ARABIA
- SLOVAKIA
- SOUTH AFRICA
- SPAIN
- UNITED KINGDOM
- USA



Gesto is a spin-off from Martifer group focused on Renewables...

- Resource study and analysis (Resource Atlas)
- Project identification (location, power, etc)
- Energy planning and policies
- Licensing and project management
- Project development
- Grid study, optimization and renewable projects integration



... with projects developed in Europe, Asia and Africa...

Cape Verde Energy Master Plan



Mozambique Renewable Energy Atlas



Gesto developed the biggest Solar PV Power Plant in Africa in Santiago Island

Santiago PV Power Plant

- Power: 5 MWp
- Number of PV modules: 21.696
- Occupation area: 12 hectares
- Annual electricity generation: 8.120 MWh
- CO2 emissions avoid: 8.700 tons/year

Sal PV Power Plant

- Power: 2,5 MWp
- Number of PV modules: 11.6016
- Occupation area: 5,5 hectares
- Annual electricity generation: 4.112 MWh
- CO2 emissions avoid: 4.300 tons/year

MARTIFER AND GESTO HAVE A STRONG BACKGROUND AND EXPERIENCE IN THE DEVELOPMENT OF RE PROJECTS...



PROJECTS IN OPERATION

		CAPACITY (MW)
WIND	PORTUGAL	12.6
		6.3
	GERMANY	27.6
		25.5
	BRAZIL	14.7
	POLAND	10.0
SOLAR		1.8
		0.4
	SPAIN	0.6
		0.84
		1.79
		1.8
TOTAL		103.93

LATE STAGE DEVELOPMENT PROJECTS

		CAPACITY (MW)
WIND	PORTUGAL	Ventiveste 400
		Randado 80
	USA	Oilton 94
		Bukowsko 16
	POLAND	Rymanów 26
	ROMANIA	Babadaq 42
HYDRO		Ribeiradio 72
	PORTUGAL	Carvão – Ribeira (*) 470
GEO		Baccinello (*) 6
	ITALY	Mazzolla (*) 3
TOTAL		1218

(*) License in process
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GESTO PRESENTATION

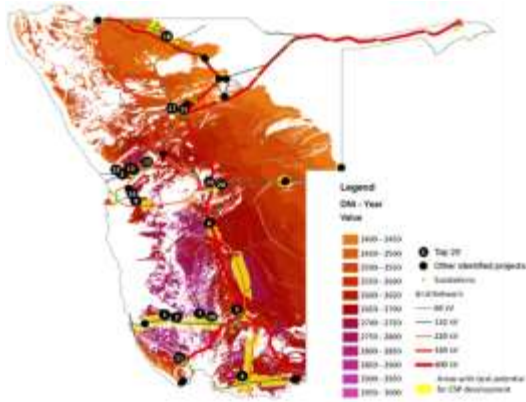
GESTO EXPERIENCE

CAPE VERDE EXPERIENCE

GESTO WIND EXPERIENCE

GESTO HAS KNOW-HOW AND EXPERIENCE IN THE DEVELOPMENT OF RENEWABLE ENERGY POLICY AND MASTER PLANS

Renewable resource assessment and Electric System characterization



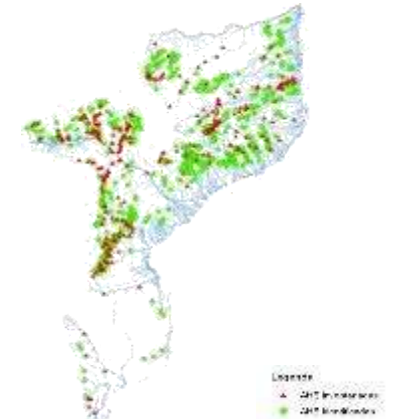
Source: Namibia project – Solar CSP

Social economic studies and Demand forecasting



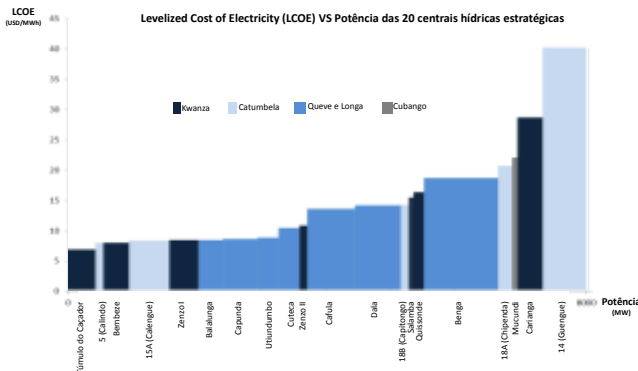
Source: Cape Verde project

Renewable projects identification and technical feasibility studies



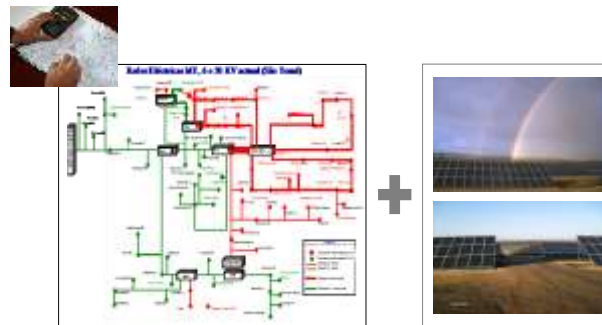
Source: Mozambique Renewable Atlas – hydro example

Economic, environmental, and social impact evaluation (project prioritization)



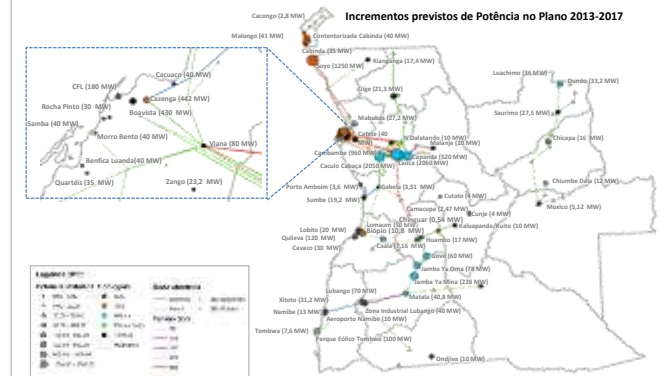
Source: Angola Energy 2025 project

Renewable energy integration scenarios and grid integration solutions



Source: S. Tomé study of solar PV power plant integration

Renewable Energy Master Plan, infrastructure investment planning and legislation review

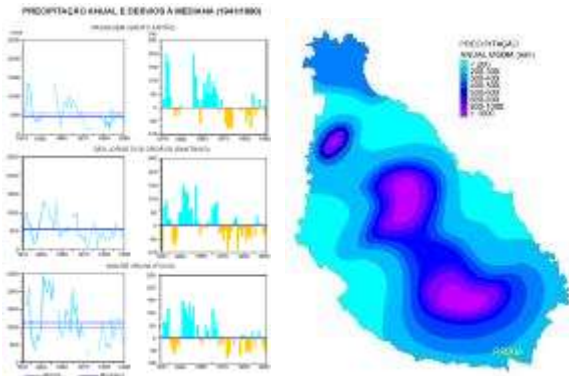


Source: Angola Energy 2025 project

GESTO SUPPORTS ALL PHASES OF RENEWABLE ENERGY PROJECT DEVELOPMENT

Resource study and analysis (Resource Atlas)

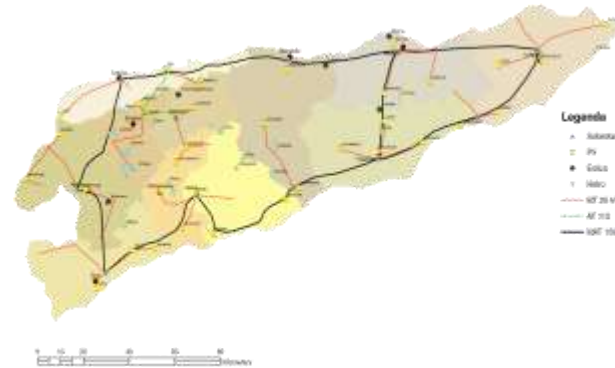
1st



Source: Cape Verde project, Santiago island – hydro resource evaluation

Project identification (location, power, etc)

2nd



Source: East-Timor project

Renewable incentive policies

3rd



Source: Cape Verde project

Licensing and project management

4th



Project development

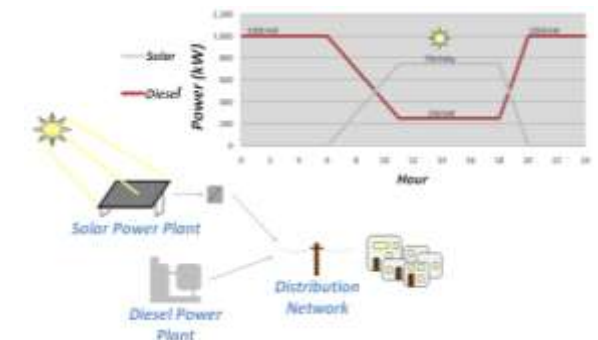
5th



Source: Solar power plant (2,5 MW), Sal island – Cape Verde

Grid study, optimization and renewable projects integration

6th

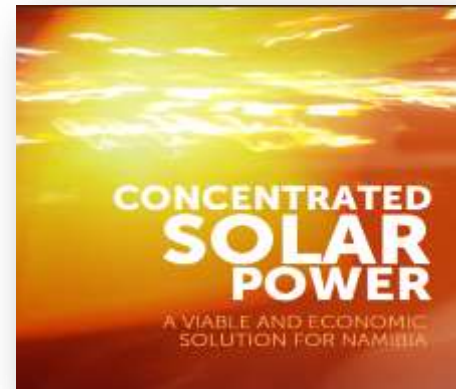


Source: GeSto study, hybrid-systems (Diesel + Solar)

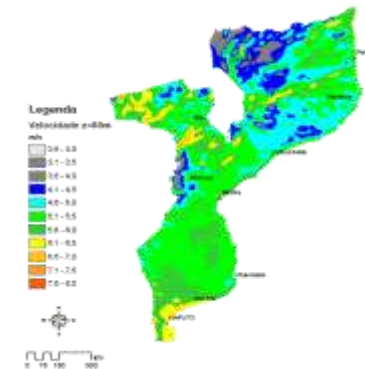
Cape Verde Energy Master Plan 2010-20



Solar CSP pre-feasibility study for Namibia



Renewable energy Atlas of Mozambique



Angola Energy Master Plan 2025



East Timor Renewable electrification plan



Project development in SADC



Wind



Solar



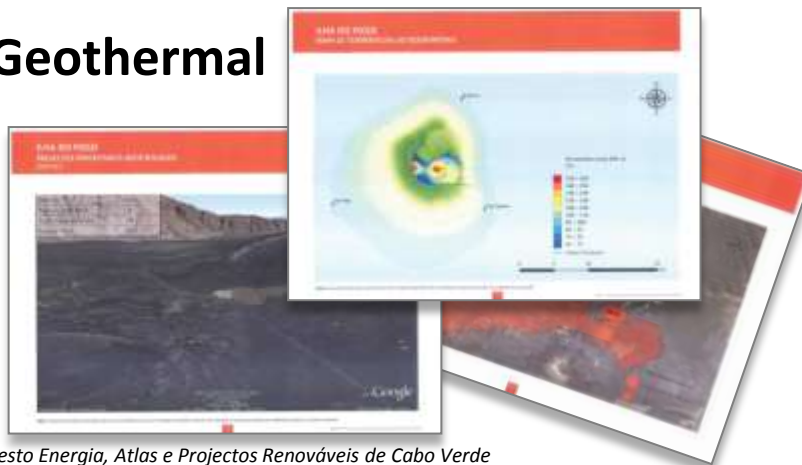
Hydro



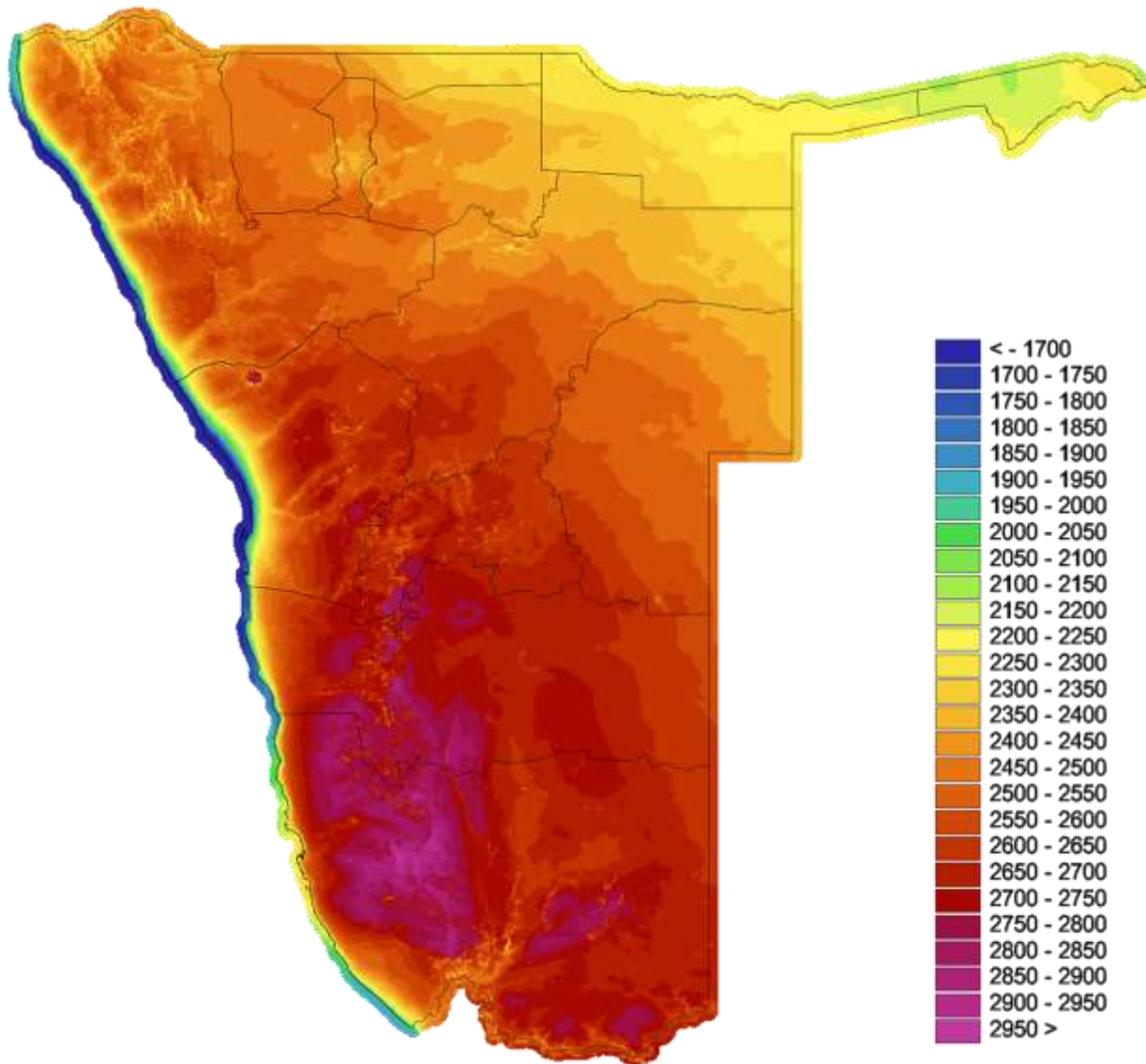
Waves



Geothermal

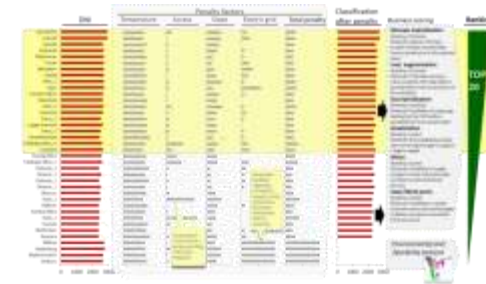


GESTO DEVELOPED THE “PRE-FEASIBILITY STUDY FOR THE DEVELOPMENT OF A CSP POWER PLANT IN NAMIBIA”, UNDER WHICH THE SOLAR ATLAS OF NAMIBIA WAS DEVELOPED

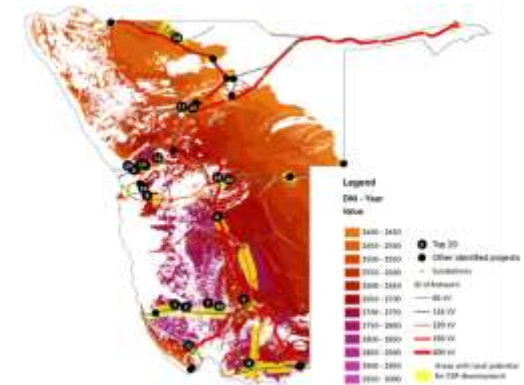


Solar Atlas of Namibia by Gesto

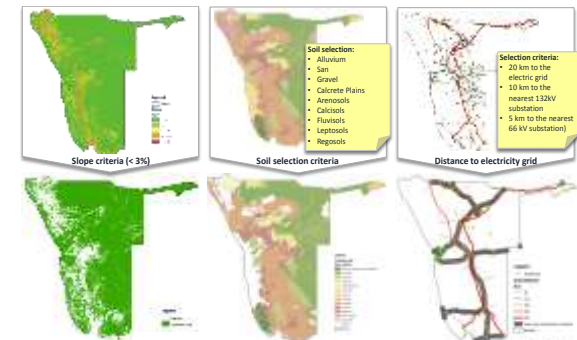
Example of multi criteria analysis



Example of selected solar sites for visit

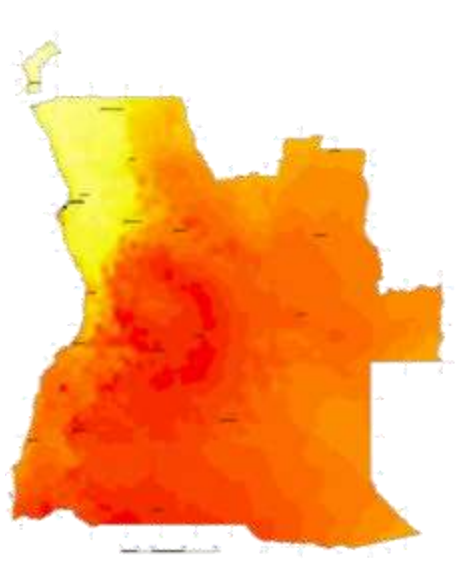
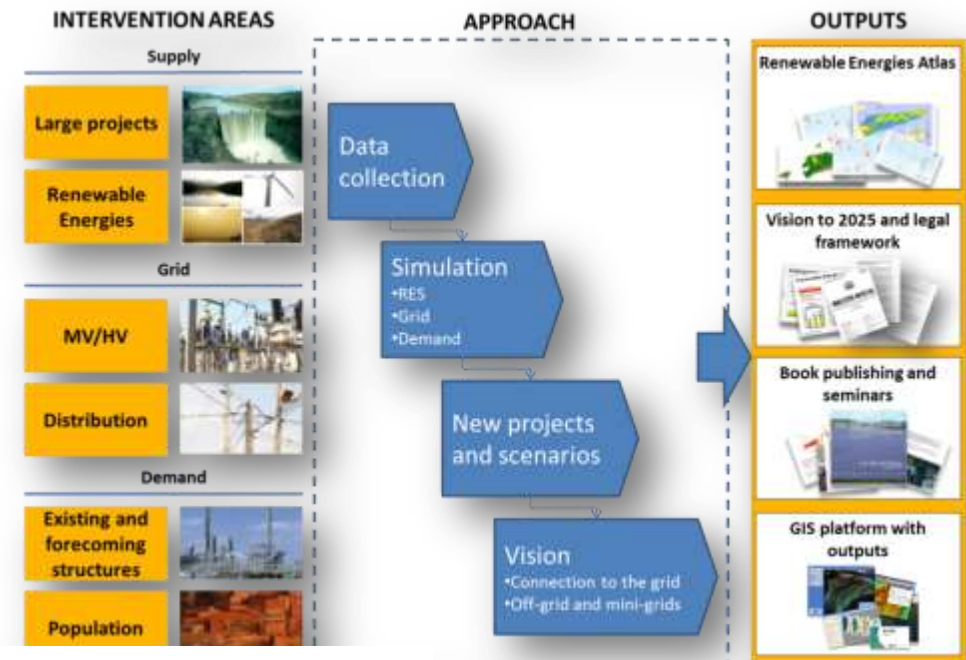


Example of outputs

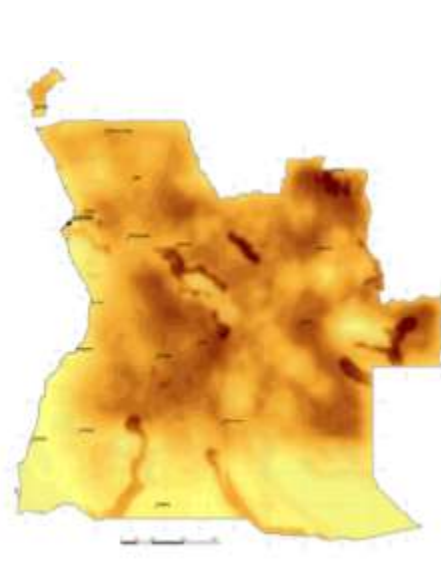


Development of the strategic master plan for the energy sector until 2025:

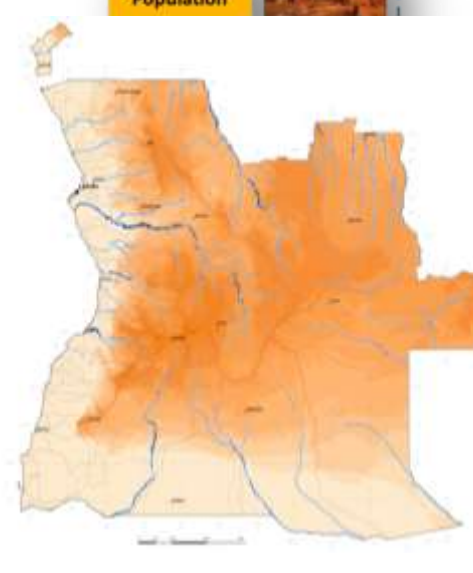
- Renewable resources assessment (hydro, wind, solar, biomass/MSW)
- Renewable resource mapping
- Study of renewable energy scenarios
- Macro-economical impact analysis
- Investment plan (grid and power plants)
- Definition of a Master Plan until 2025



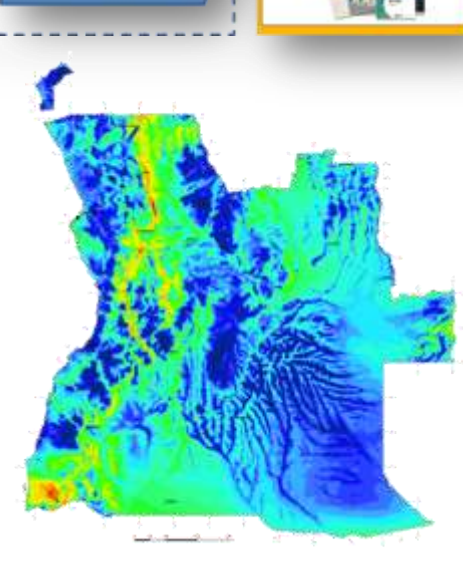
Solar resource Atlas



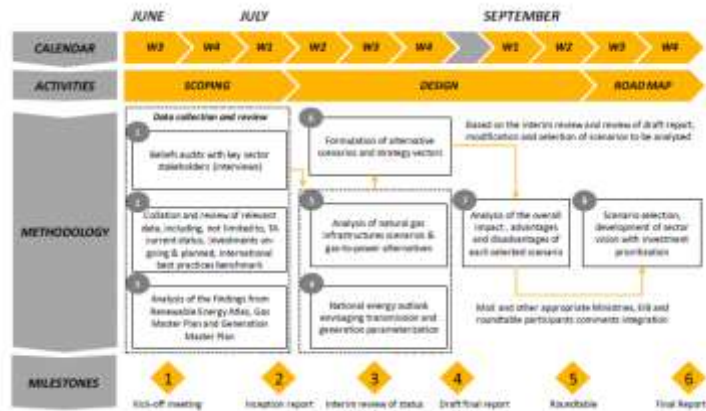
Biomass resource Atlas



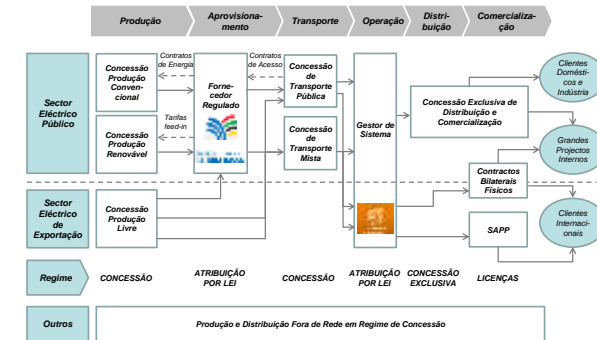
Hydro resource Atlas



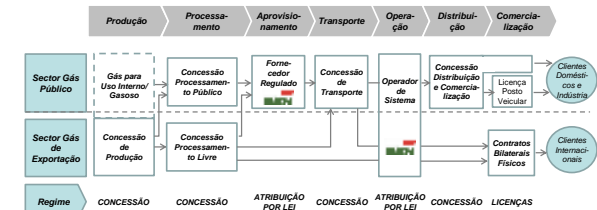
Wind resource Atlas



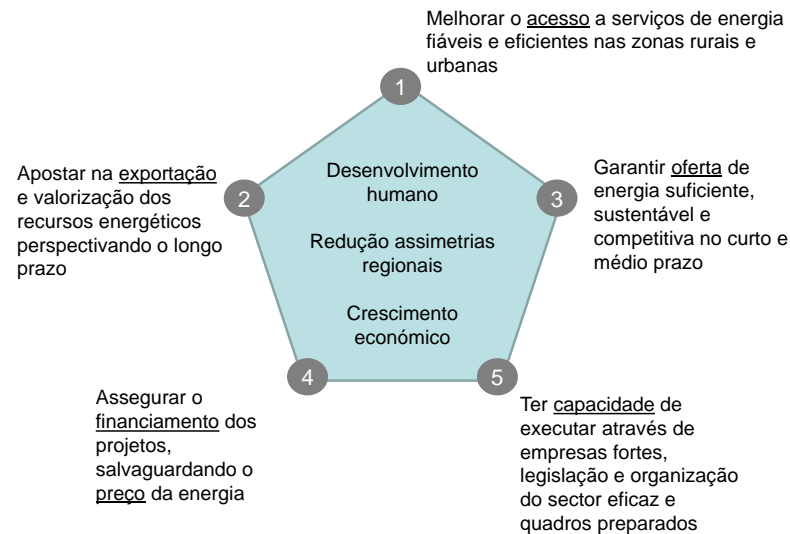
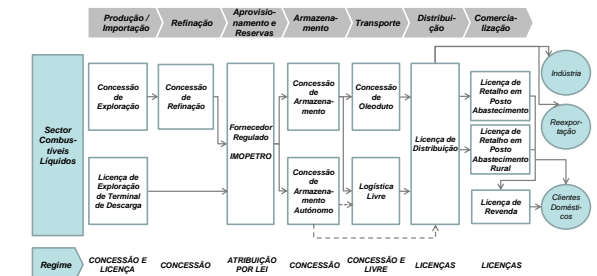
5.1. PROPOSTA DE ORGANIZAÇÃO – SECTOR ELÉTRICO



5.1. PROPOSTA DE ORGANIZAÇÃO – SECTOR GÁS NATURAL



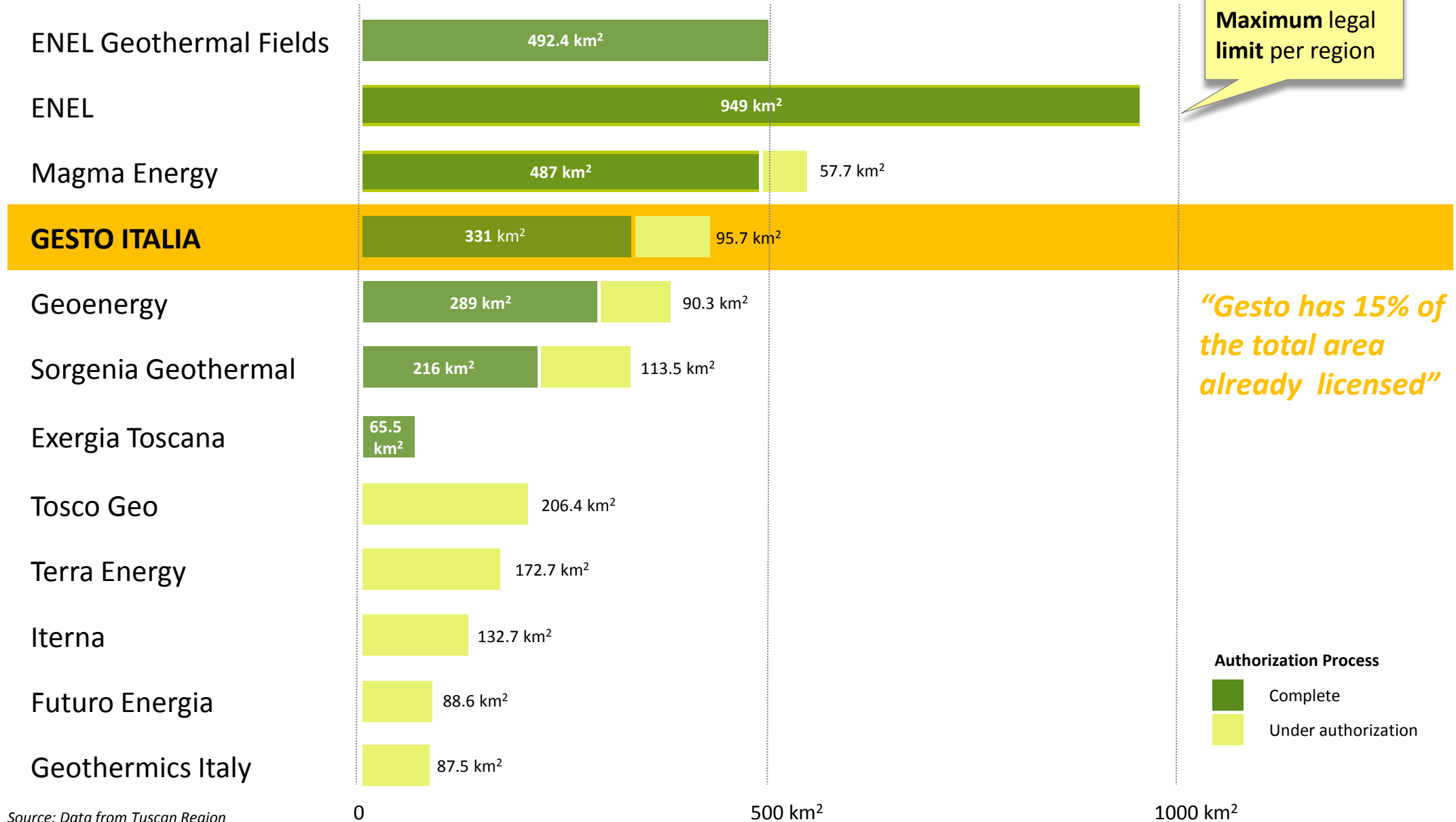
5.1. PROPOSTA DE ORGANIZAÇÃO – SECTOR COMBUSTÍVEIS LÍQUIDOS



GESTO IS ONE OF THE TOP THREE PLAYERS IN GEOTHERMAL IN ITALY...



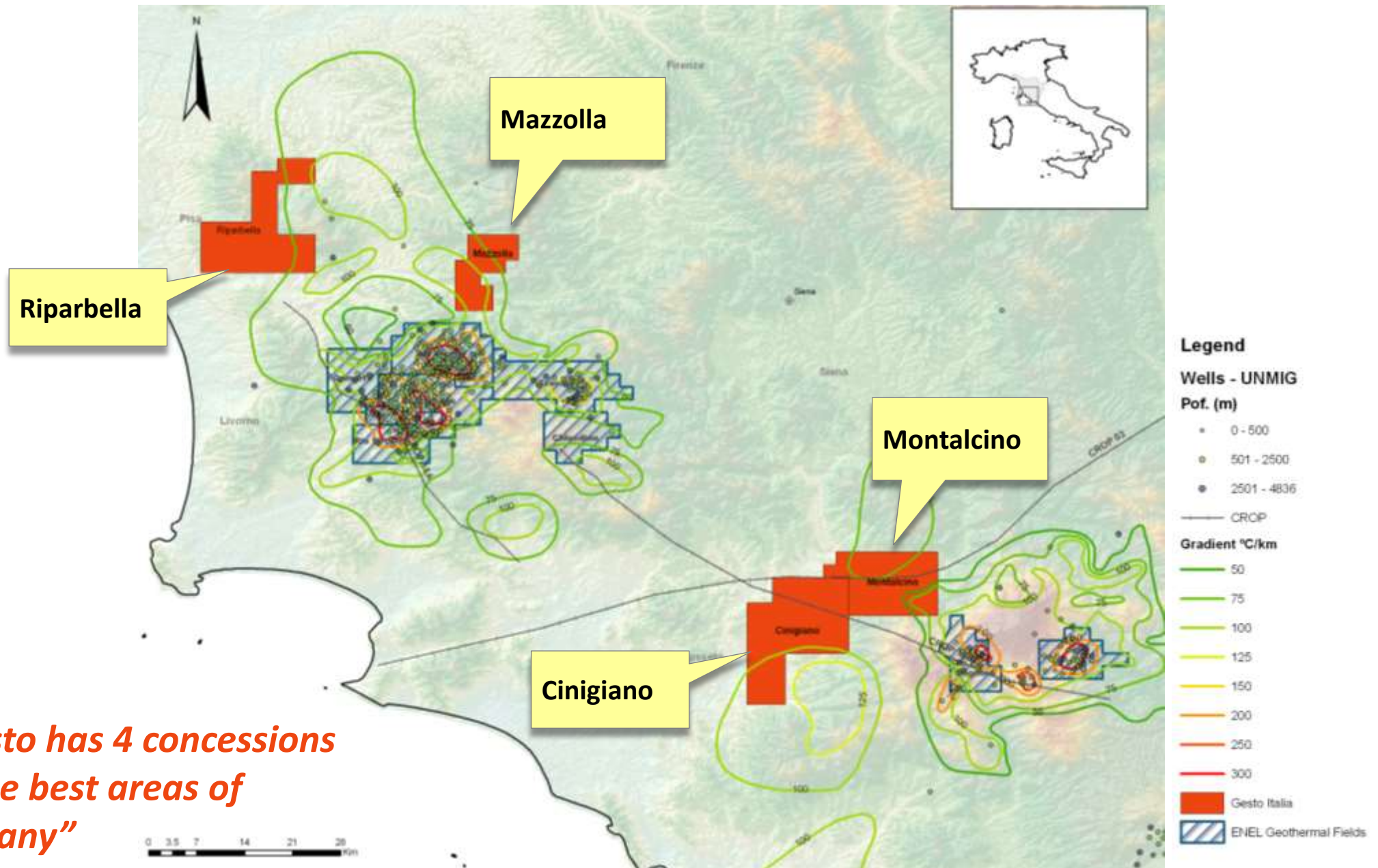
Main Players in Geothermal Market in Tuscany



Source: Data from Tuscan Region

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... HOLDING 4 RESEARCH PERMITS IN TUSCANY REGION



“Gesto has 4 concessions in the best areas of Tuscany”

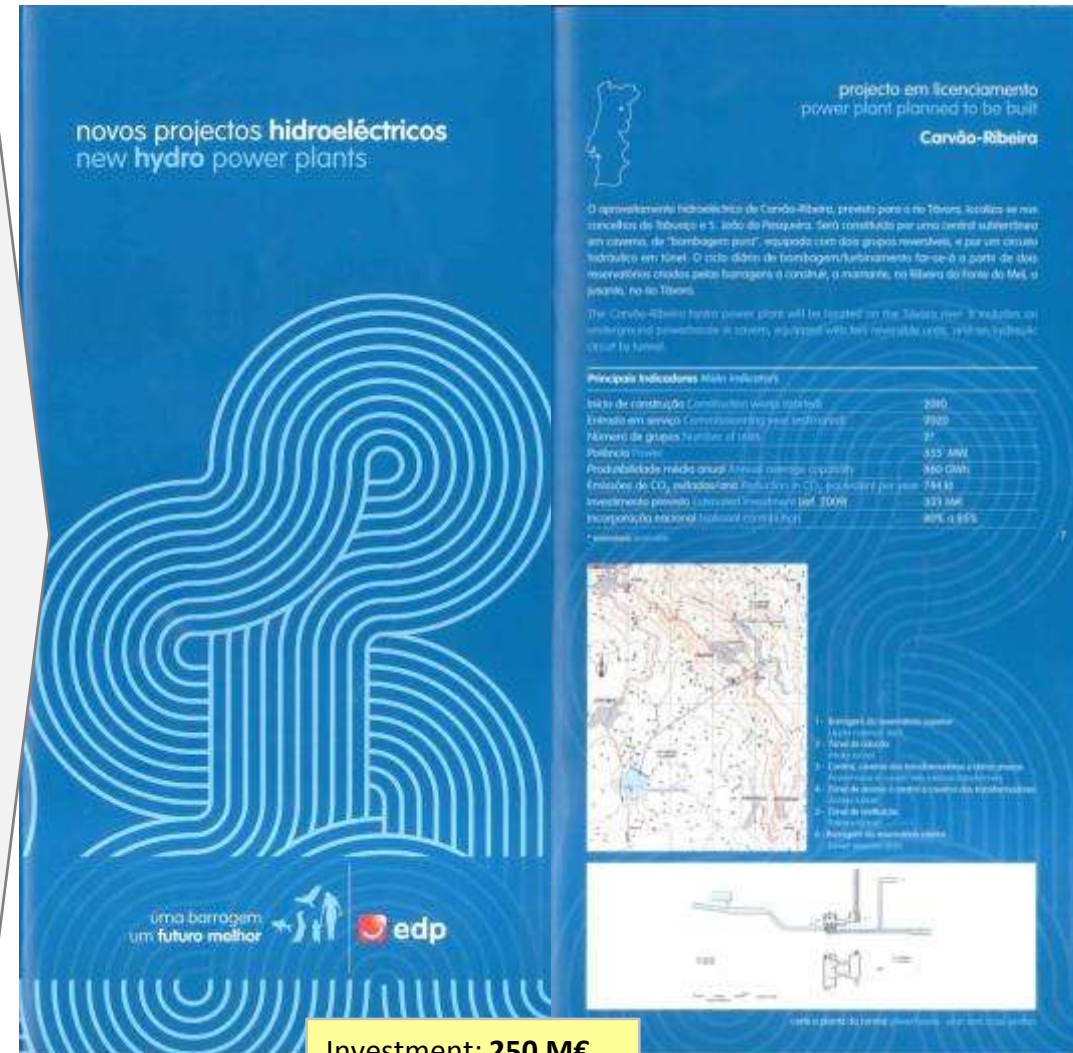
GESTO WAS THE FIRST COMPANY TO DEVELOP A PUMPED-STORAGE PROJECT IN PORTUGAL

The Carvão-Ribeira PSP will be located on the Távora river. It includes an underground powerhouse in cavern, equipped with two reversible units, and an hydraulic circuit by tunnel.

On February 2010 the public tender was open. The highest bidder was EDP with 10,5 M€. The permit was conceded to EDP on May 2010.



Having won the public tender (highest offer), EDP already included this project on their New Hydro Power Plants plan info (September 2010):



novos projectos hidroelétricos
new hydro power plants

projecto em licenciamento
power plant planned to be built
Carvão-Ribeira

O aproveitamento hidroelétrico de Carvão-Ribeira, previsto para o rio Távora, localiza-se nas freguesias de Ribeira e S. João de Passageira. Será constituído por uma central subterrânea em caverna, de "bombeagem pura", equipada com dois grupos reversíveis, e por um circuito hidráulico em túnel. O ciclo diário de bombeamento/funcionamento for-se-á a partir de dois reservatórios criados pelas barragens a construir, a montante, na freguesia do Foz do Mel, a jusante, no rio Távora.

The Carvão-Ribeira hydro power plant will be located on the Távora river. It includes an underground powerhouse in cavern, equipped with two reversible units, and an hydraulic circuit by tunnel.

Principais Indicações mais Indicators	
Índice de construção Construction works ratio	65%
Estimado em serviço Commissioning year indicator	2020
Número de grupos/bombas of sets	2
Potência Power	557 MW
Produtibilidade média anual Annual average capacity	160 GWh
Emissões de CO ₂ mil toneladas/ano (emissões em CO ₂ por unidade por ano)	744 t/a
Investimento previsto (valor atualizado) (em 2009)	333 M€
Incorporação nacional (valor atualizado) (em 2009)	80% a 85%

1. Barragem de aproveitamento superior
2. Túnel de tomada
3. Túnel de retorno das bombas/barragem a jusante
4. Túnel de derivação a montante e retorno das bombas/barragem a jusante
5. Túnel de restituição
6. Barragem de aproveitamento inferior

Uma barragem um futuro melhor

edp

Investment: **250 M€**
Highest bid: **10,5 M€**



The Energy Sector Management Assistance Program (ESMAP) is a global knowledge and technical assistance program administered by the World Bank. Its mission is to assist low- and middle-income countries to increase know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth.

Portuguesa Gesto ganha projecto do Banco Mundial

O contrato-programa é de quatro anos e implica o levantamento do potencial hidroelétrico em dez países.

Ana Maria Gonçalves
ana.goncalves@diariodopovo.pt

A Gesto Energy, a empresa de consultoria portuguesa para engenharia de energia, venceu o concurso para a realização do levantamento do potencial hidroelétrico em dez países. O contrato-programa é de quatro anos e implica o levantamento do potencial hidroelétrico em dez países.

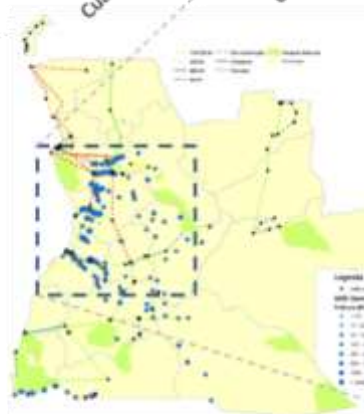
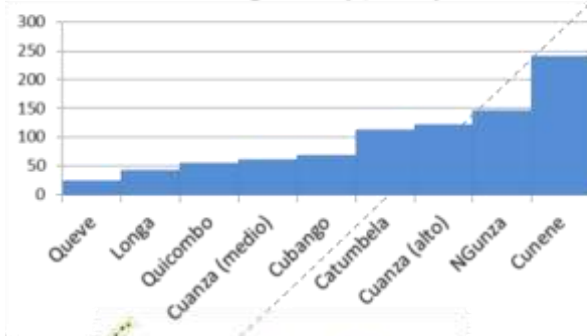


Ricardo Soares
Presidente da Gesto Energy

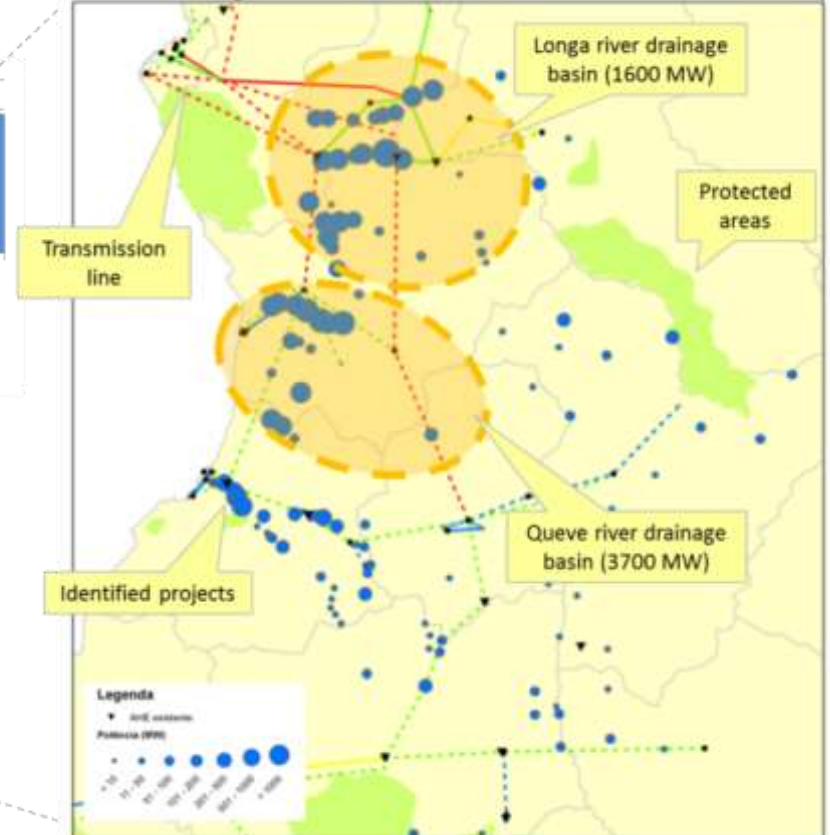
A Gesto Energy, a empresa de consultoria portuguesa para engenharia de energia, venceu o concurso para a realização do levantamento do potencial hidroelétrico em dez países. O contrato-programa é de quatro anos e implica o levantamento do potencial hidroelétrico em dez países.

Apresentamos os dados levantados por Gesto Energy em 2011 e 2012, os resultados da nossa participação no concurso de engenharia em Portugal, segundo dados do Instituto Nacional de Energia. Com esta informação, os resultados que se podem obter são os seguintes:

Estimated Levelized Cost of Electricity (LCOE) per drainage basin (€/MWh)



The two drainage basins with lowest overall Levelized Cost of Electricity



Excerpt of article in main Portuguese Daily Economy Newspaper

Methodology example (Angola)



GESTO PRESENTATION

GESTO EXPERIENCE

CAPE VERDE EXPERIENCE

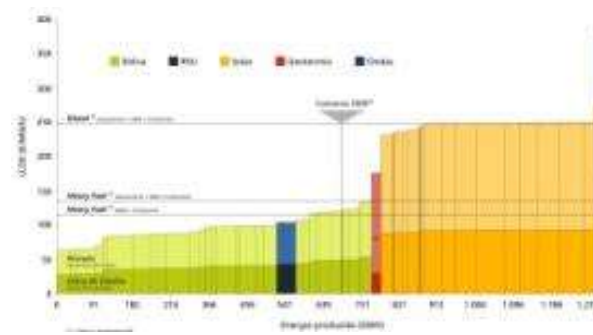
GESTO WIND EXPERIENCE

Energy Strategy Publication



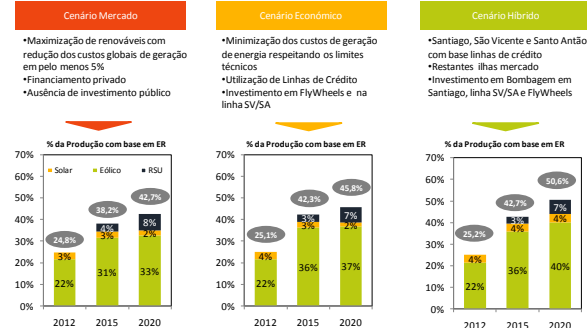
Source: Gesto Energia, Livro "Cabo Verde 50% Renovável"
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Cost of energy per project



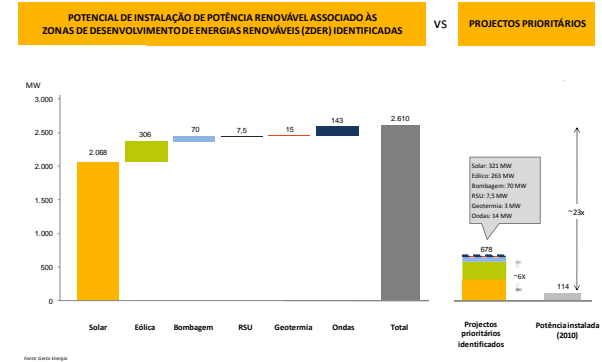
Energy mix scenarios

Cenários alternativos propostos:

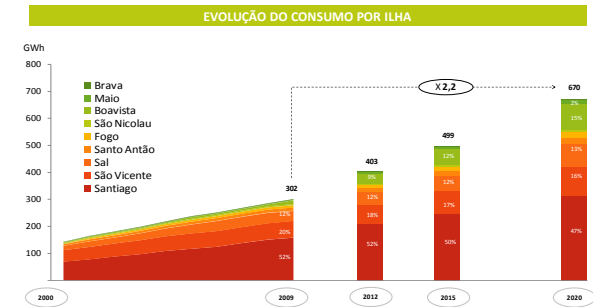


Fonte: Análise Gesto Energia - Cenários alternativos

Renewable energy potential



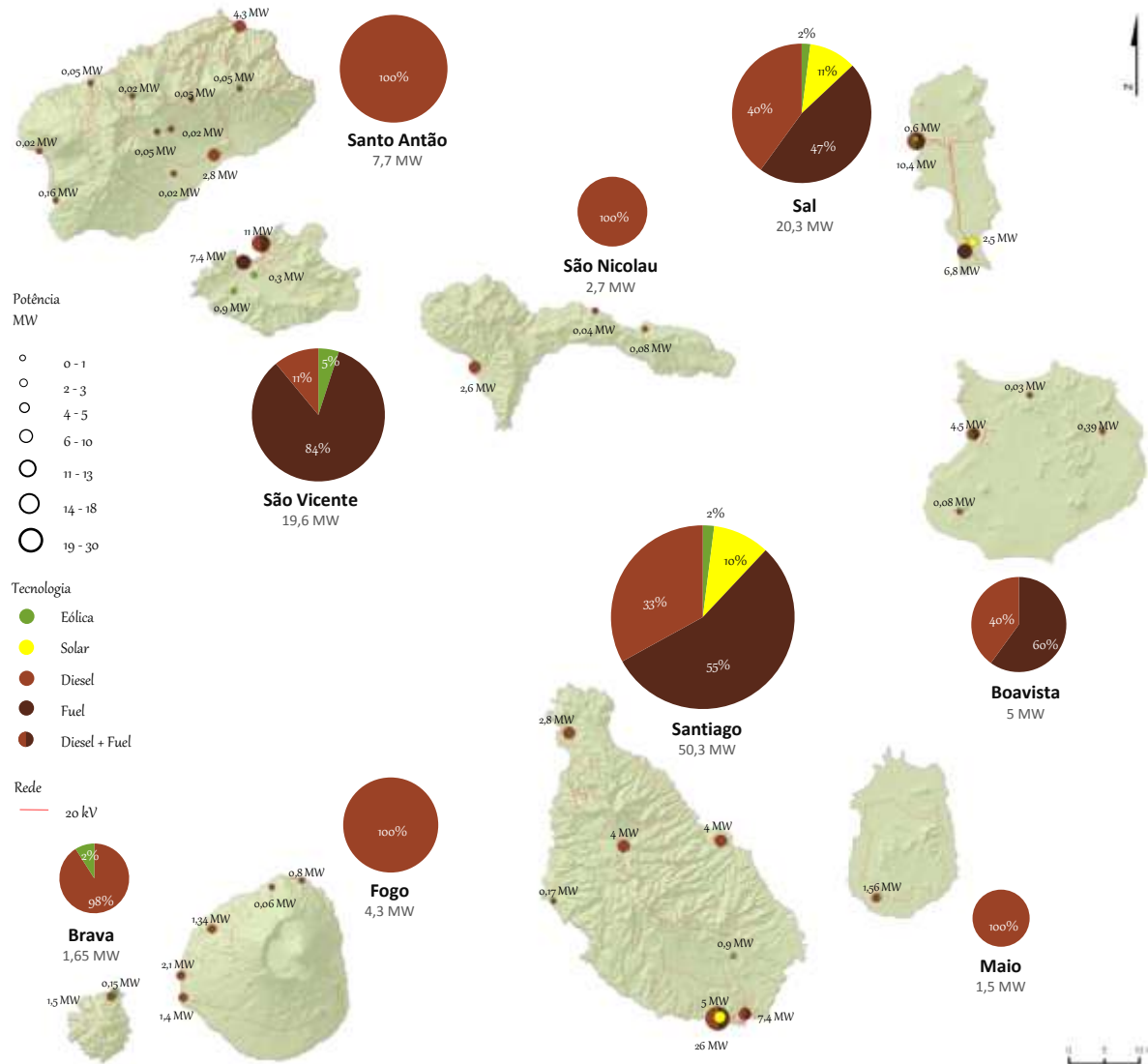
Demand forecasts



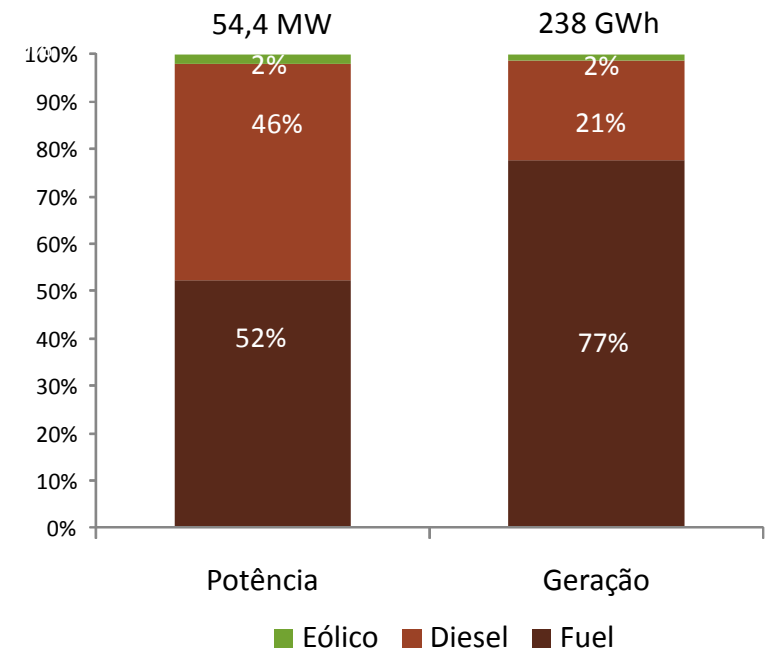
CAPE VERDE ENERGY MASTER PLAN 2010-2020

CURRENT GENERATION ASSESSMENT

INSTALLED POWER PER TECHNOLOGY (2010)



MORE THAN 77% OF ENERGY COMES FROM HEAVY FUEL POWER PLANTS BASED (2009)

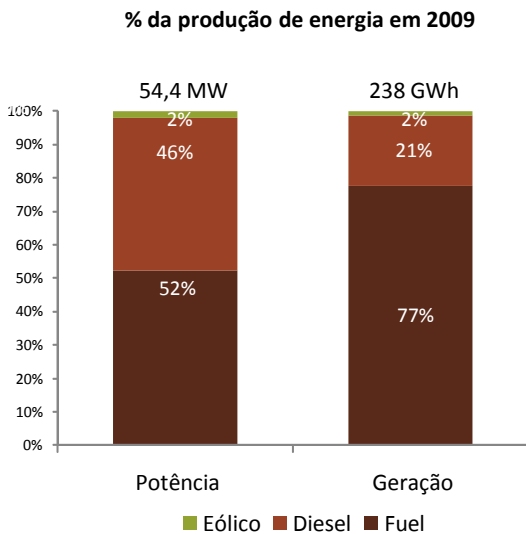


CAPE VERDE ENERGY MASTER PLAN 2010-2020

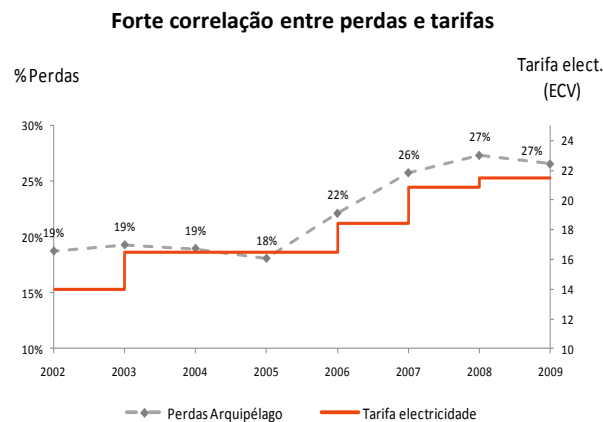
HEAVY FUEL DEPENDENCY IS POINTED AS ONE OF THE MOST RELEVANT REASONS FOR THE ENERGY SECTOR PROBLEMS



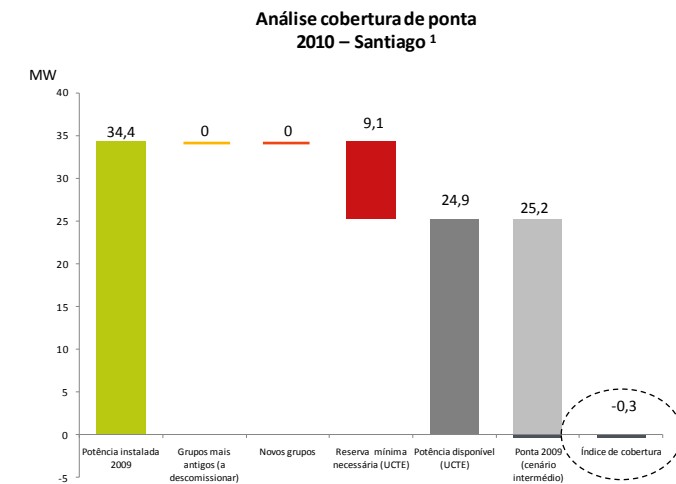
Oil price increase influence the cost of productions on 99% of the electricity generation



Increase on the energy tariffs impacts on the non-technical losses (due to fraud and thief)



Financing difficulties results on an upgrade generation investment deficit



Oil cost increase

Income reduction

Operation costs increase

ENERGY PRICES INCREASE / LOSS OF COMPETITIVENESS

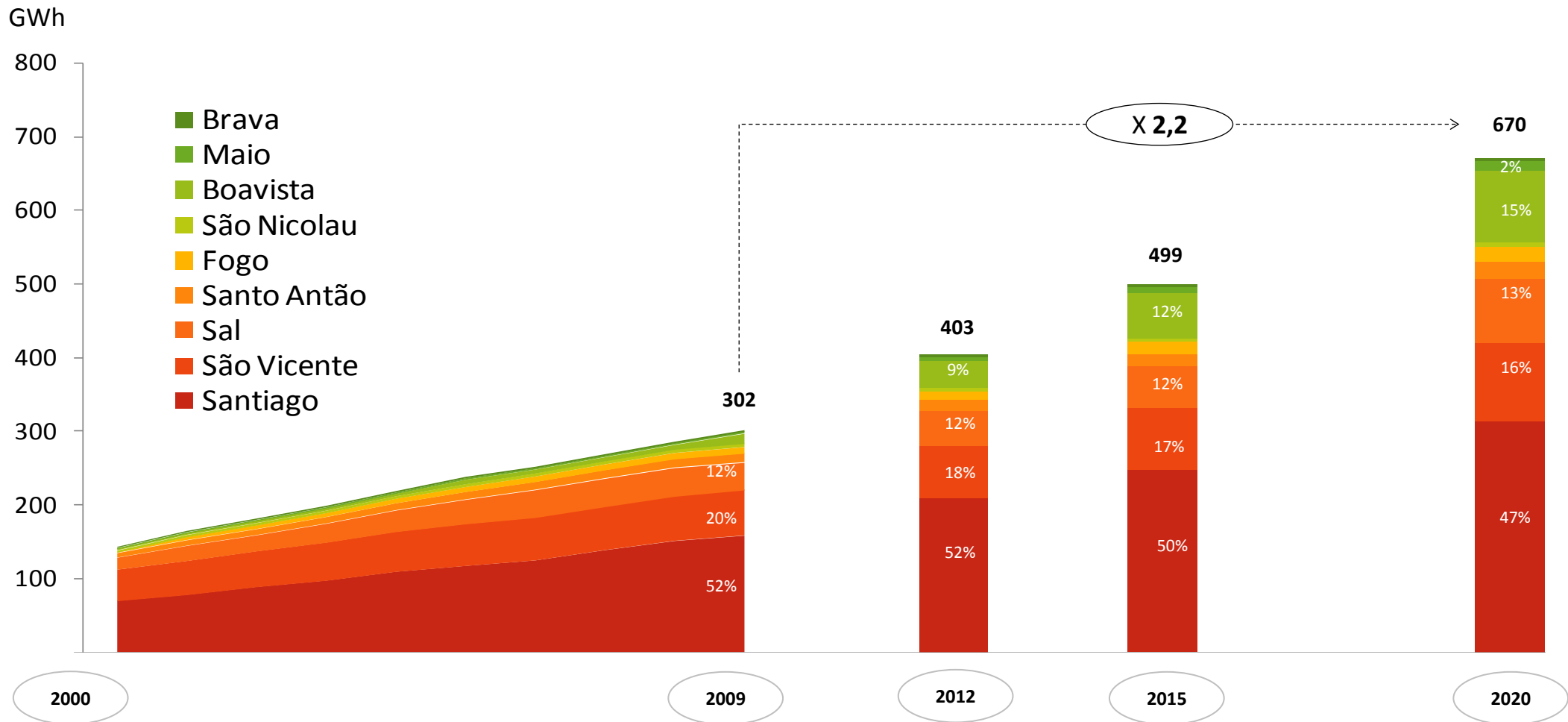
¹ – Sistema Praia

CAPE VERDE ENERGY MASTER PLAN 2010-2020

DEMAND FORECAST STUDIES FOR EACH ISLAND AND SECTOR



DEMAND FORECAST PER ISLAND



Fonte: ELECTRA; Análise Gesto Energia

Na ilha do Sal não se considerou o consumo das unidades hoteleiras alimentadas pela APP (sistema isolado)

CAPE VERDE ENERGY MASTER PLAN 2010-2020

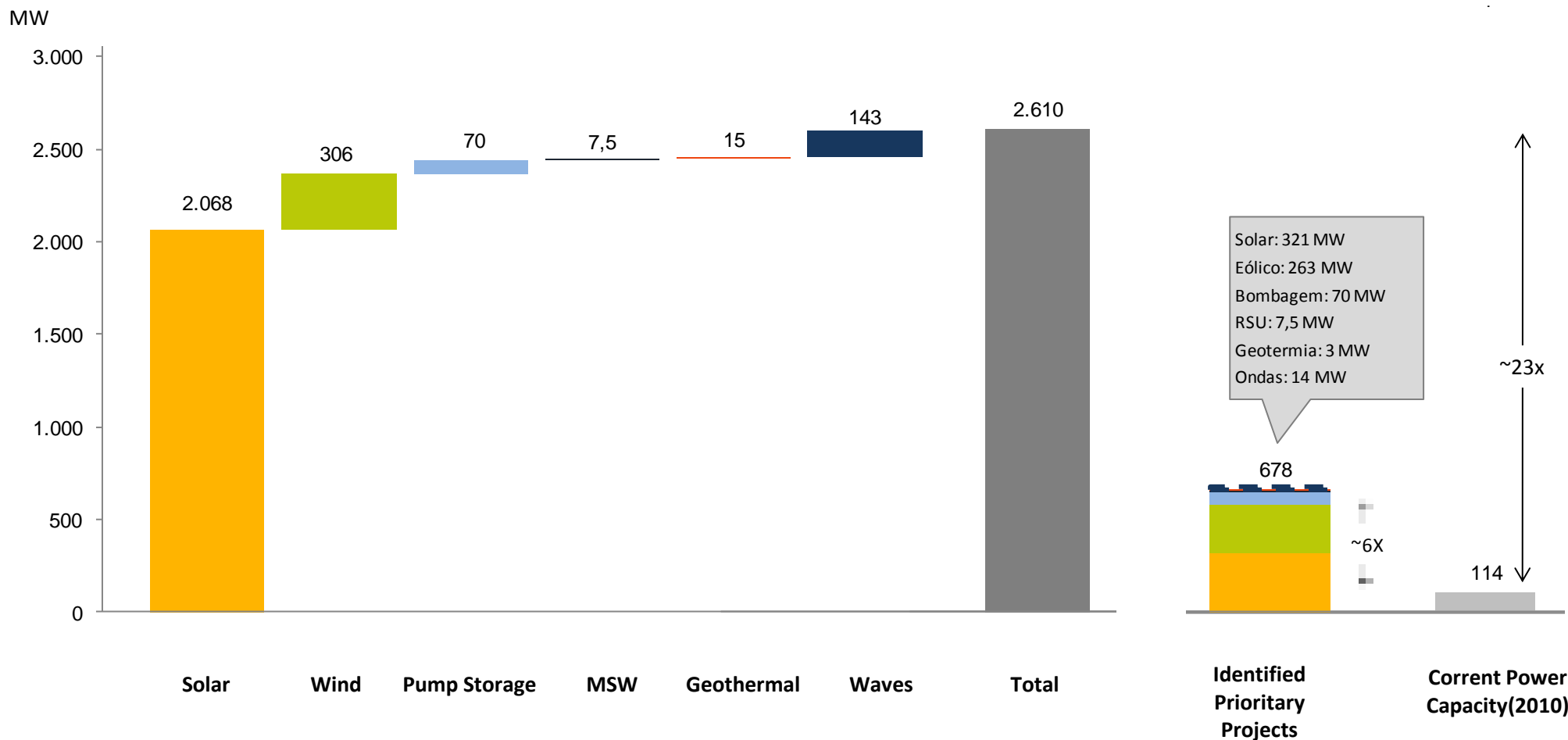
MORE THAN 2.600MW OF RENEWABLE PROJECTS IDENTIFIED AND 678MW SELECTED AND STUDIED



POTENCIAL OF THE IDENTIFIED ON THE RENEWABLE ENERGY DEVELOPMENT ZONES (ZDER)

VS

PRIORITARY PROJECTS

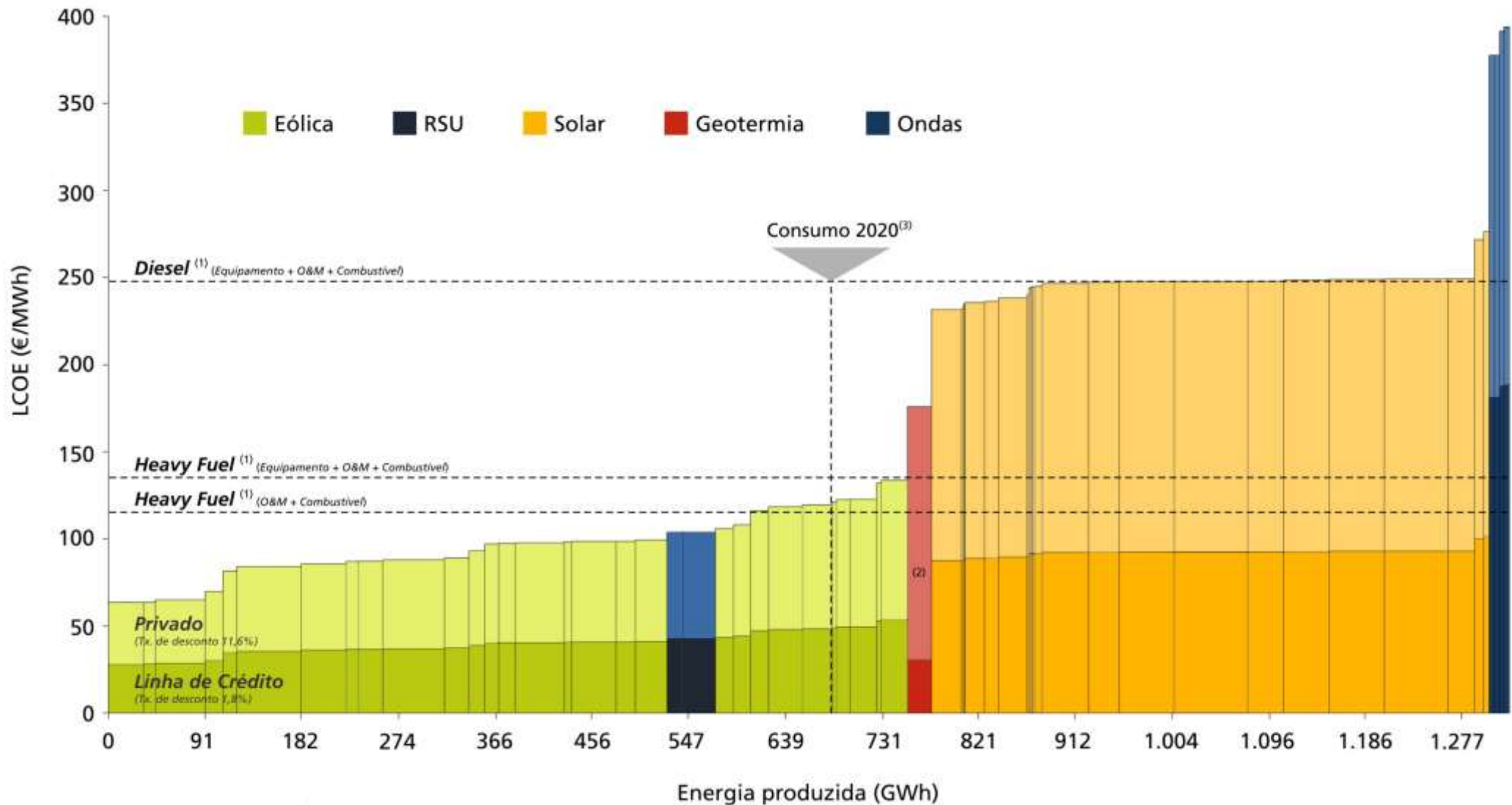


Fonte: Gesto Energia

Na presente análise estão considerados os projectos que se encontram em curso

CAPE VERDE ENERGY MASTER PLAN 2010-2020

LEVELIZED COST OF ELECTRICITY ANALYSIS AND PROJECT RANKING

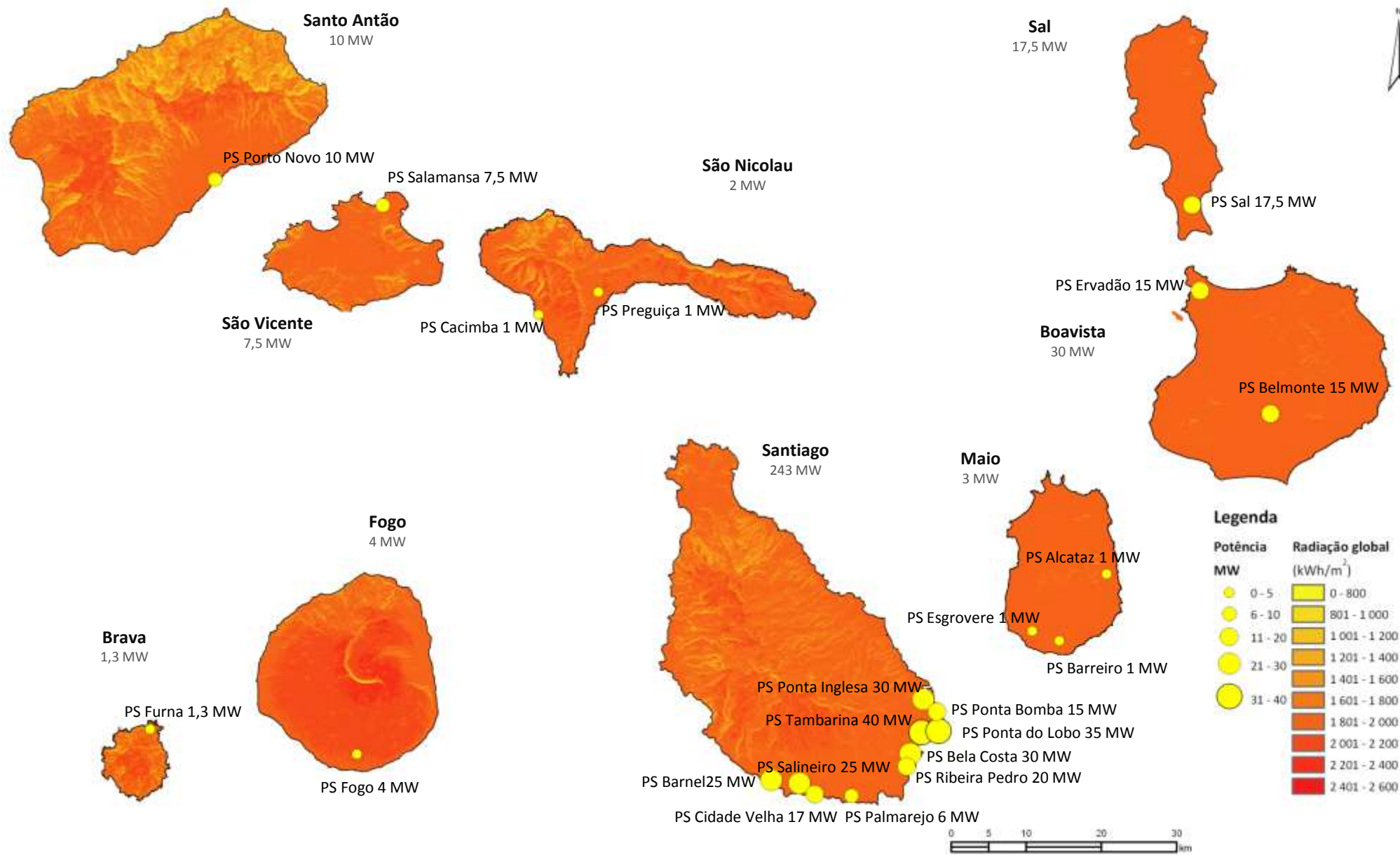


- (1) Utility: Tx. de desconto 6,8%
- (2) Geotermia: Tx. de desconto 19,6%
- (3) 9 ilhas estudo – cenário intermédio

Fonte: ELECTRA; Análise Gesto Energia

CAPE VERDE ENERGY MASTER PLAN 2010-2020

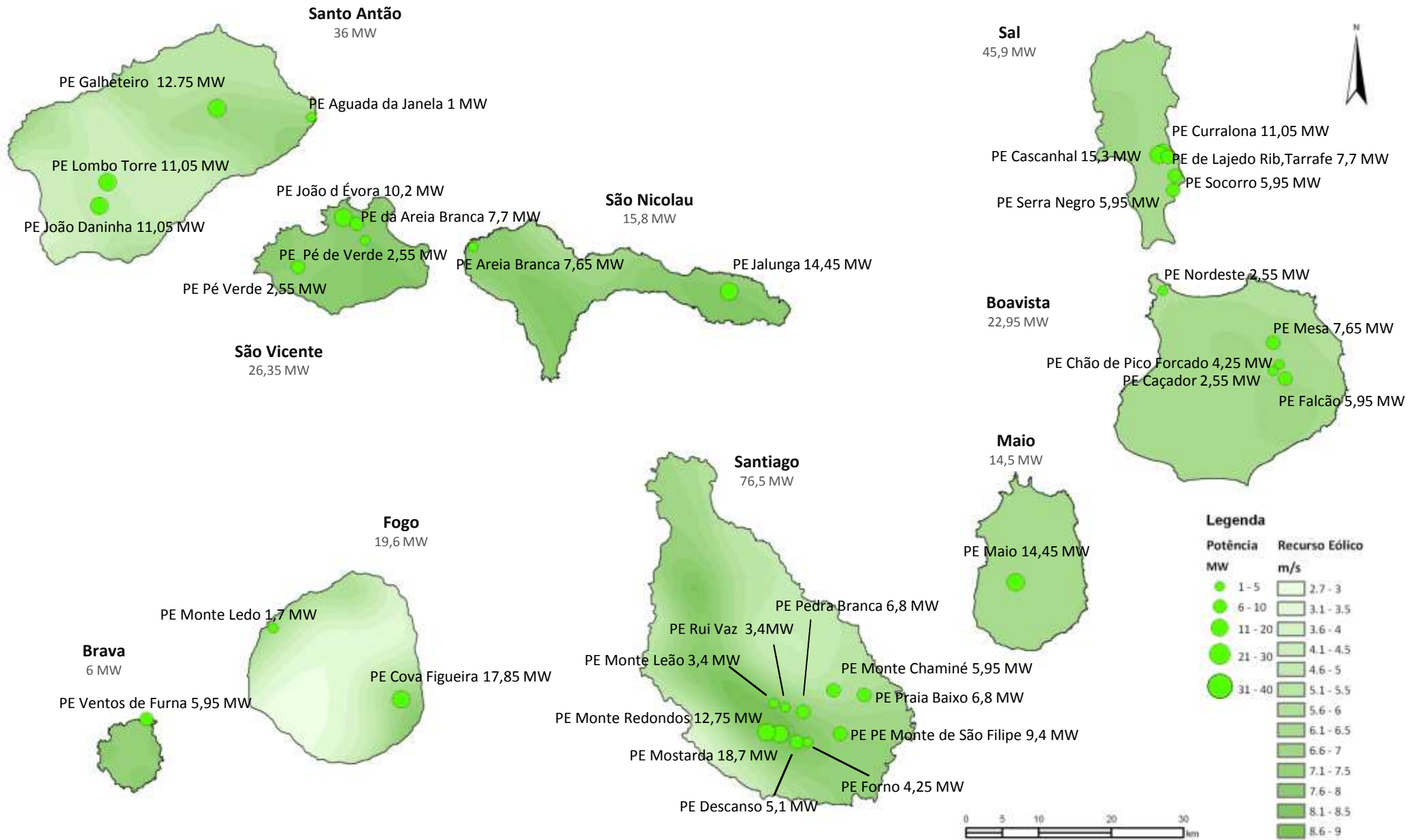
SOLAR RESOURCE MAPPING + 22 PRIORITY PROJECTS (321MW)



Na presente análise estão considerados os projectos que se encontram em curso

CAPE VERDE ENERGY MASTER PLAN 2010-2020

SOLAR RESOURCE MAPPING + 34 PRIORITY PROJECTS (263MW)



Fonte: RisØ

Na presente análise estão considerados os projectos que se encontram em curso

CAPE VERDE ENERGY MASTER PLAN 2010-2020

WIND FARM PROJECTS (EXAMPLES)

Santiago, Parque eólico de Monte Leão
Potência: 3,4 MW Energia: 13,6 GWh



Santiago, Parque eólico de Rui Vaz
Potência: 3,4 MW Energia: 12,2 GWh



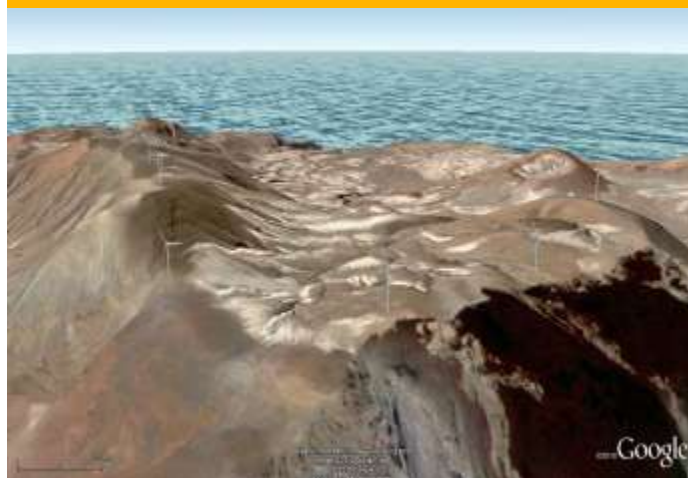
São Vicente, Parque eólico de João D'Évora
Potência: 10,2 MW Energia: 46,5 GWh



Sal, Parque eólico de Serra Negra
Potência: 6,0 MW Energia: 18,0 GWh



Santo Antão, Parque eólico Lombo da Torre
Potência: 11,1 MW Energia: 27,6 GWh



Fogo, Parque eólico de cova Figueira
Potência: 17,9 MW Energia: 58,1 GWh



CAPE VERDE ENERGY MASTER PLAN 2010-2020

PUMP STORAGE PROJECTS – SANTIAGO ISLAND

Obras principais: 2 barragens, circuito hidráulico, central hidroelétrica, ligação à rede eléctrica nacional, acessos



AHE MATO SANCHO (água doce)
 Potência instalada: 20 MW (2 x 10 MW reversíveis)
 Estimativa de custo: 43,4 M€ ⇒ 2,17 M€/MW



AHE RIBEIRA DOS PICOS (água doce)
 Potência instalada: 20 MW (2 x 10 MW reversíveis)
 Estimativa de custo: 41,8 M€ ⇒ 2,09 M€/MW



AHE CHÃ GONÇALVES (água doce)
 Potência instalada: 20 MW (2 x 10 MW reversíveis)
 Estimativa de custo: 42,6 M€ ⇒ 2,13 M€/MW



- Legenda**
- Isolinha de escoamento
 - - - - - Circuito hidráulico
 - Albufeira
 - - - - - Bacia hidrográfica

GEOTHERMAL

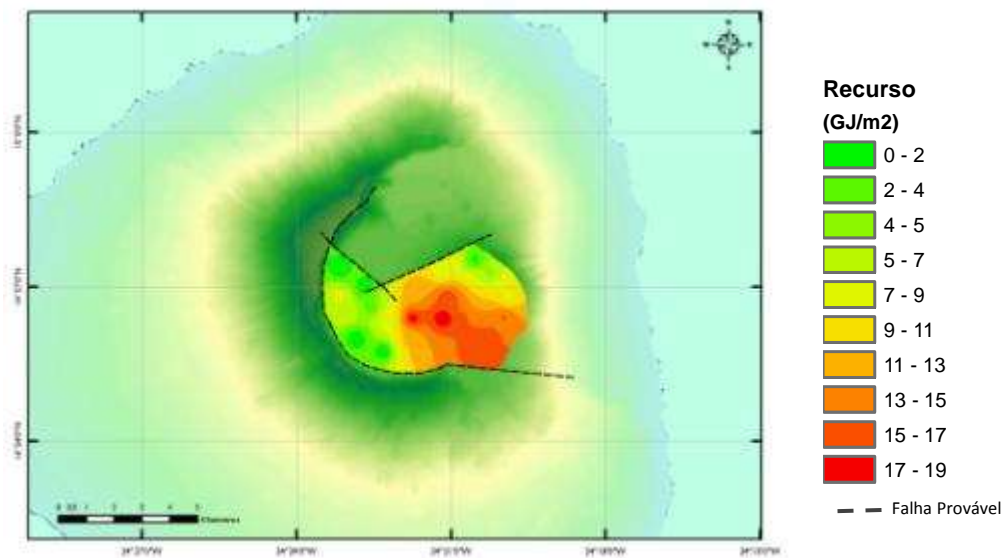
High temperatures system low probability in the studied islands (Fogo e Santo Antão):

- Geochemical data from the collected water samples with no trace of geothermic phenomena
- Geophysical data with low prospective for the identification of a geothermal high temperature reservoir

The only site that presents an area with low resistivity is at Chã das Caldeiras at Fogo Island

- The probability of an existing geothermal reservoir is low

Localization and estimated resource of the potential reservoir at Fogo Island:

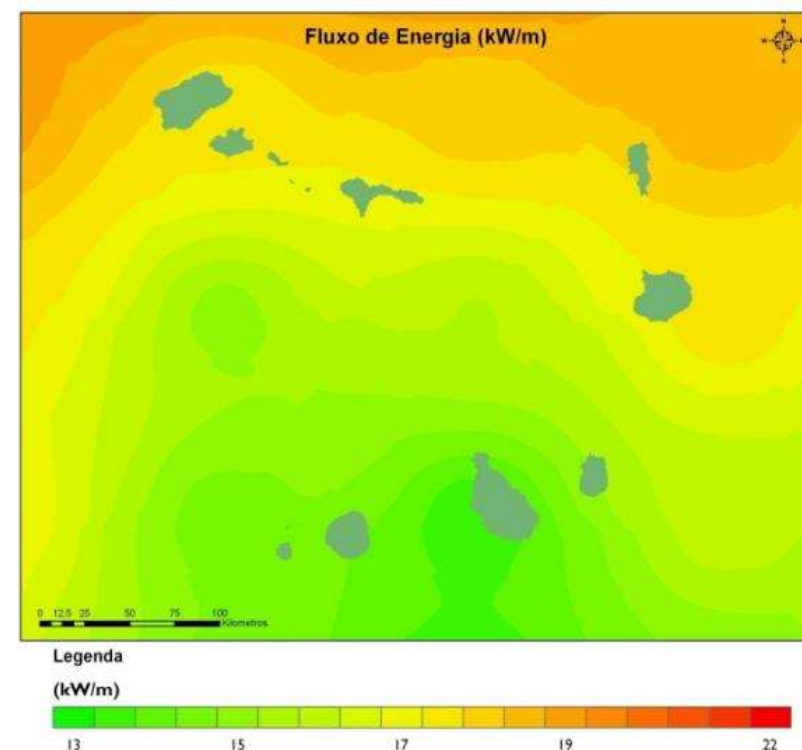


WAVES

Waves energy with limited resource, very concentrated in four months of the year (January, February, March and December)

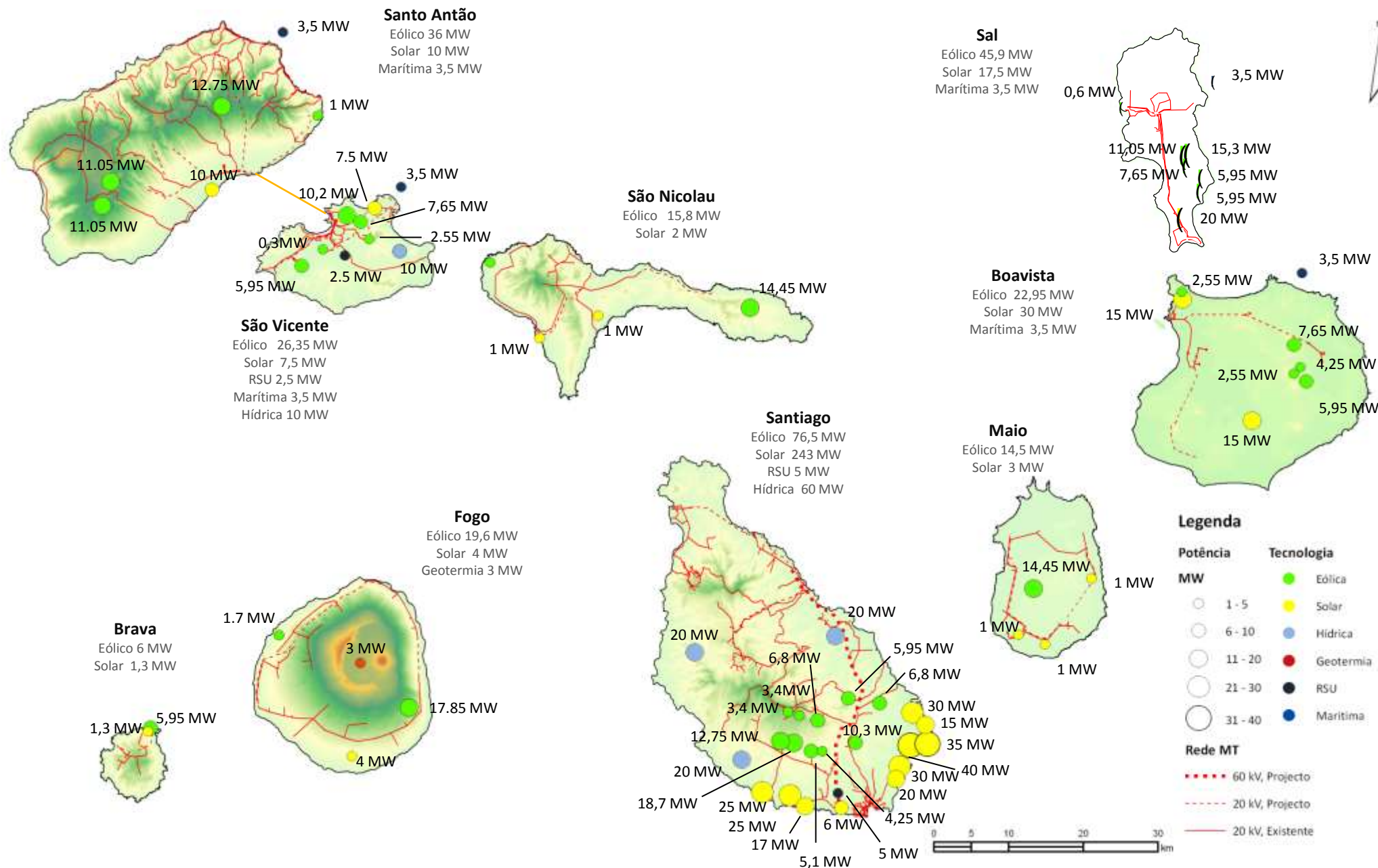
- Low potencial 20 kW/m (ex. In Portugal typical values are around 40 kW/m)
- Biggest potencial concentrated in the northern islands of the archipelago

Waves technology still in R&D stage > Projects with high costs of production and with a high level of uncertainty/risk



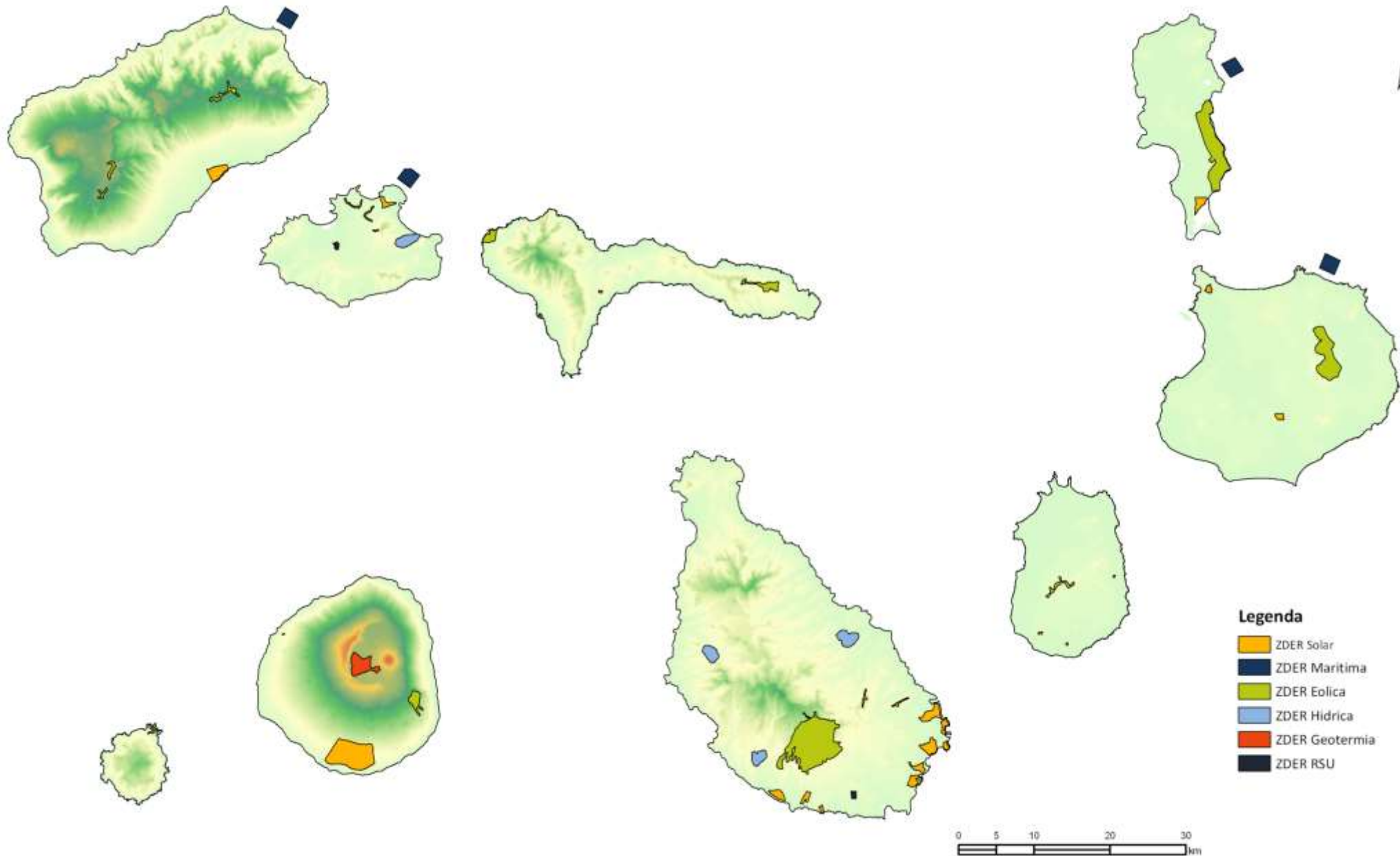
CAPE VERDE ENERGY MASTER PLAN 2010-2020

IDENTIFIED, VISITED, STUDIED AND STUDIED PROJECTS...



CAPE VERDE ENERGY MASTER PLAN 2010-2020

ESTABLISHMENT OF ZDER'S (RENEWABLE ENERGY DEVELOPMENT ZONES)...



Nota: A proposta de ZDERs condicionada à consulta das entidades competentes

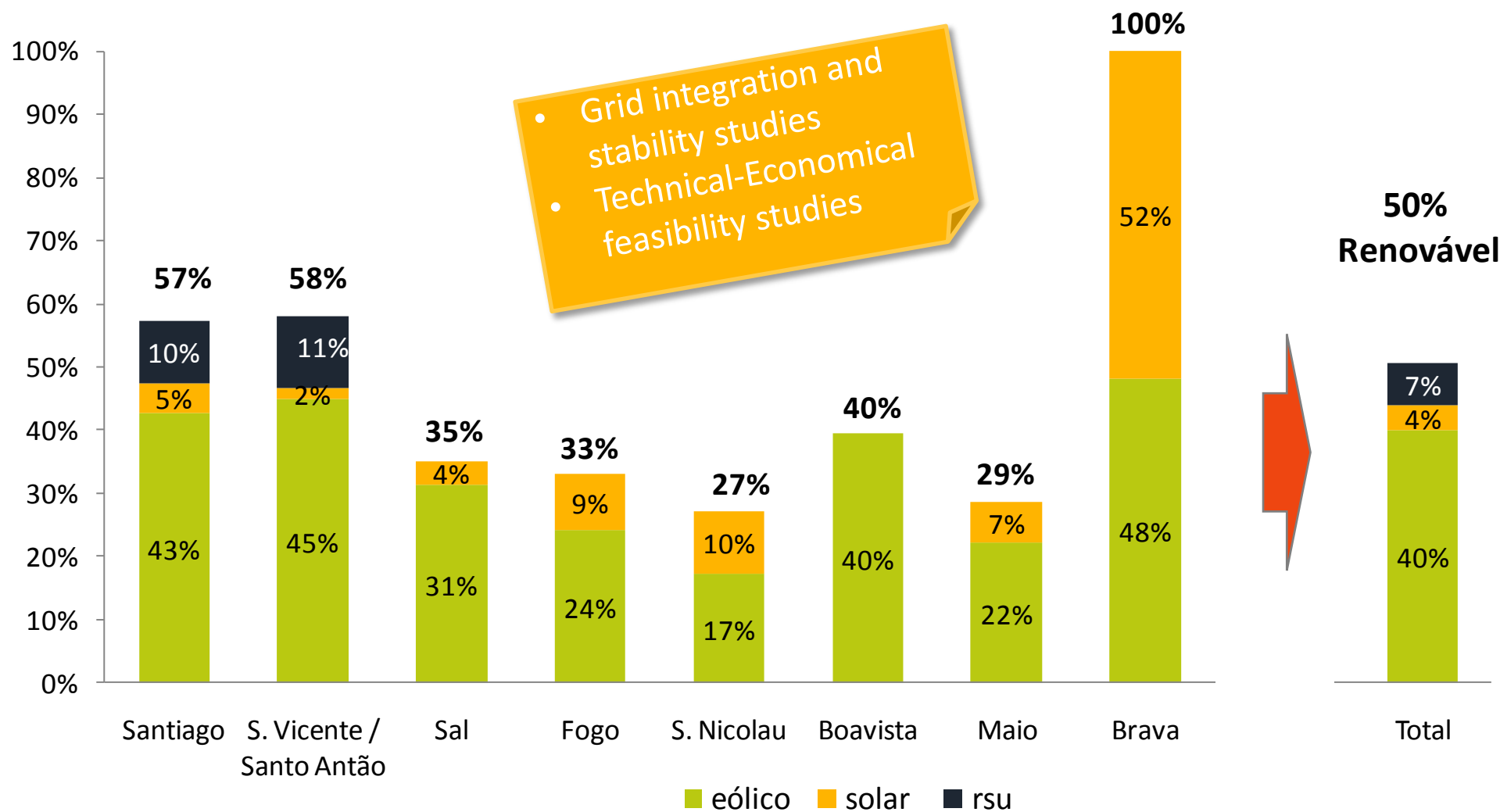
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CAPE VERDE ENERGY MASTER PLAN 2010-2020

VISION: CAPE VERDE 50% RENEWABLE ENERGY AT 2020

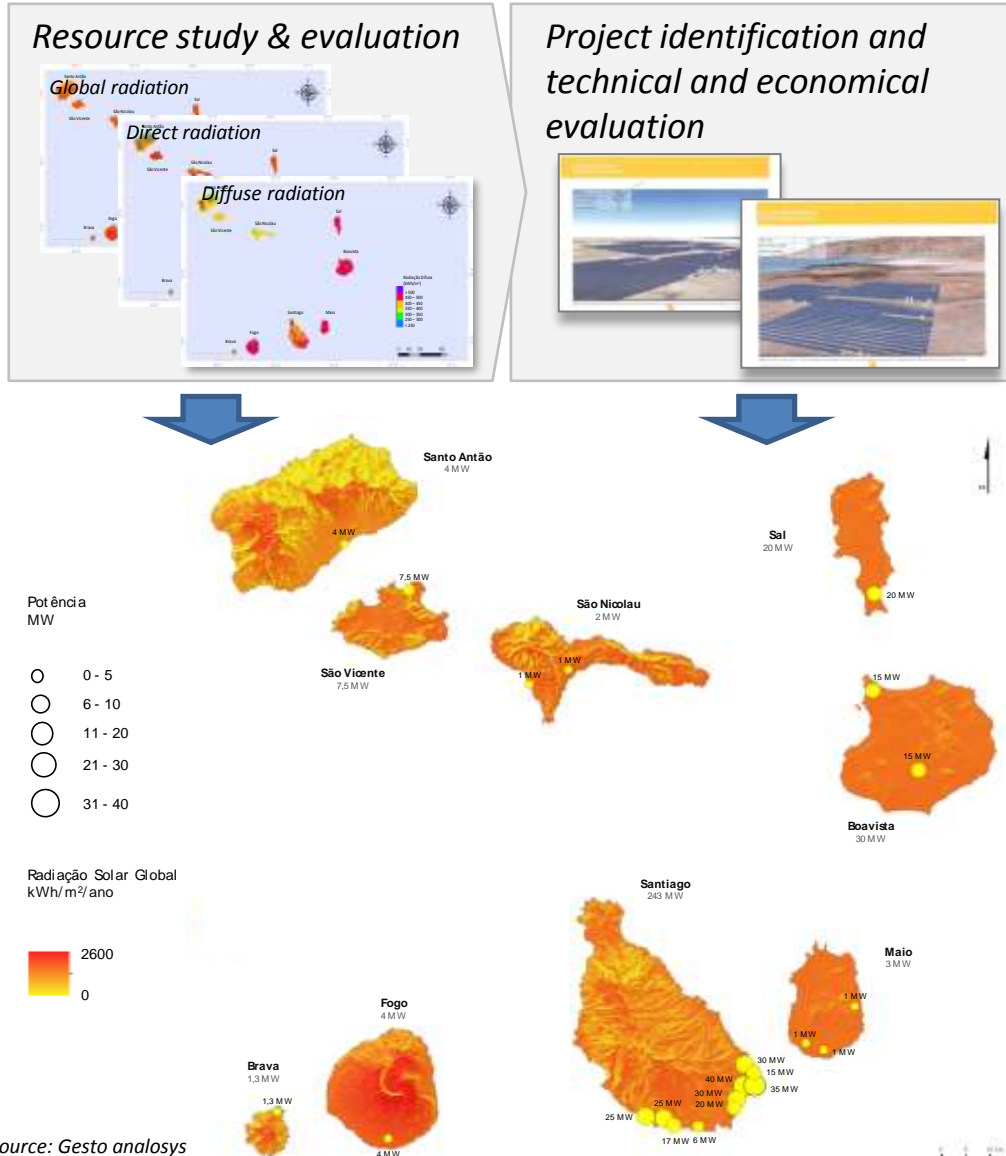


RENEWABLE ENERGY GRID INTEGRATION @ 2020




GESTO SUPPORTED THE DEVELOPMENT OF THE FIRST LARGE SCALE CAPE VERDE PHOTOVOLTAIC POWER PLANTS SANTIAGO (5MWP) AND SAL (2,5MWP)

SOLAR RESOURCE STUDY AND EVALUATION AND PROJECT ANALYSIS AND PRIORITIZATION



SUPPORTED THE DEVELOPMENT OF THE LARGEST PV PLANT IN AFRICA (5MW in SANTIAGO)




City of Praia is the Capital of Cape Verde. The Santiago island has 250.000 habitants

Fuel power plant:

- 26 MW
- 220 g/kWh

Integration system



Solar power plant:

- Power: 5 MW
- Energy: 8.120 MWh/year

Area:

- 12 hectares

Construction:

- 10 months

Energy/year:

- 8.120 MWh

Prevent emission of

- 8.250 ton CO₂/year

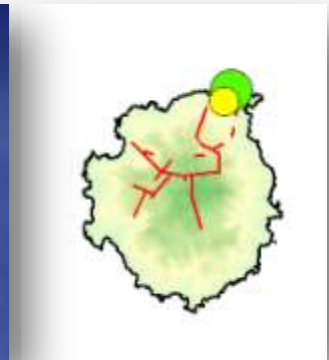
“BRAVA ISLAND 100% RENEWABLE” PROJECT



- Wind Resource study
- Solar Resource study
- Island energy demand characterization and load profile study

12 month campaigns

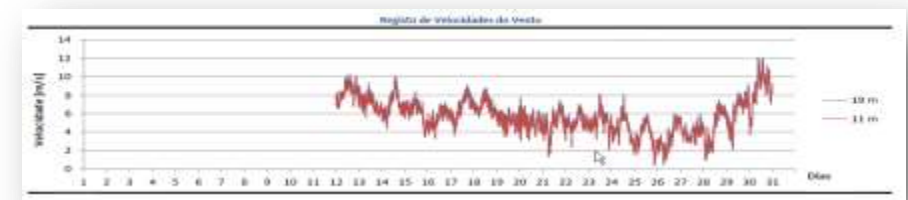
- Dimensioning and specification of a small wind farm and solar PV power plant
- Definition and specification of an energy storage solution



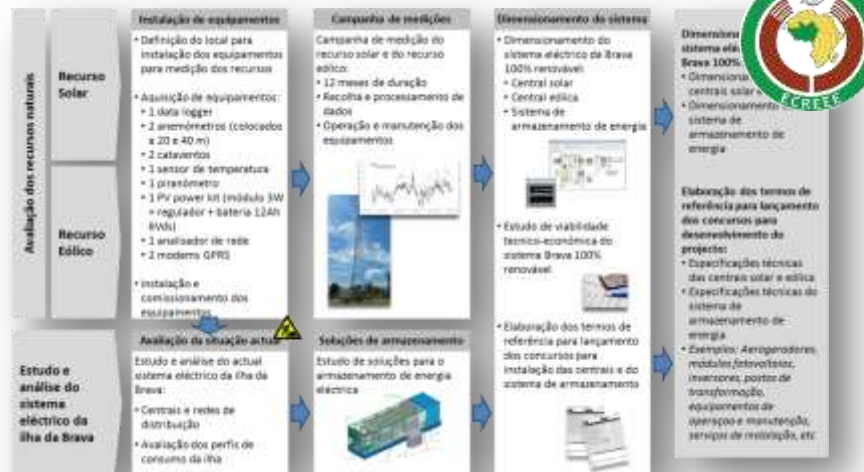
Meteorological mast instrumentation works



First wind data collected...



Project methodology



FUTURE SANTIAGO AND SÃO VICENTE WIND FARMS

TECHNICAL-ECONOMICAL FEASIBILITY STUDY AND MICROSITING

- Wind Resource study

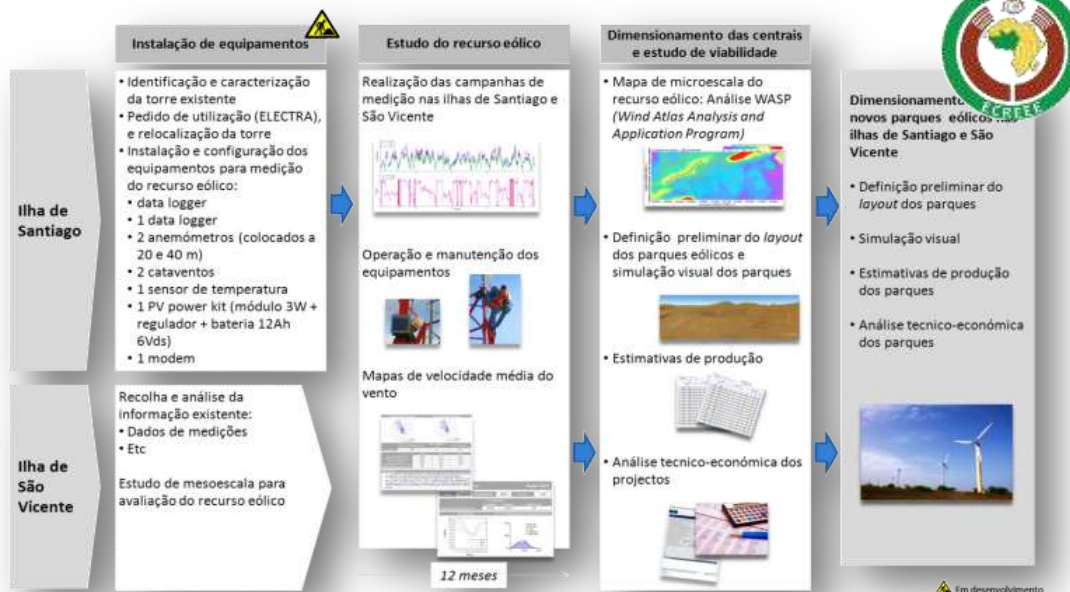
12 month campaigns

- Dimensioning and specification of the future Santiago and São Vicente wind farms
- Preliminary wind farm layout (micrositing) for both wind farms
- Energy production forecasts
- Technical-economical feasibility study for each wind farm

Meteorological mast erection works



Project methodology:



Fonte: Gesto Energia

LOSSES REDUCTION AND ENERGY QUALITY IMPROVEMENT PROGRAM



LOSSES REDUCTION PROGRAM

Information and Control

Development and implementation of an Energy Quality and Losses monitoring system



Acquisition of equipment to fight and reduce non-technical losses (meters, energy analyzers, etc)



Implementation of a sensibilization campaign against the fraud and thief of energy.

Implementação de uma campanha de fiscalização e desmantelam redes clandestinas

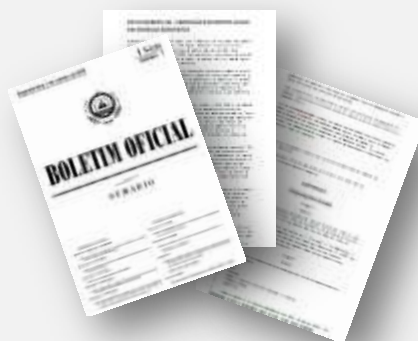


Public lightning consumption reduction campaign



Tariffs and Legislation

Support on the elaboration of a legislative actualization proposal and tariff framework revision



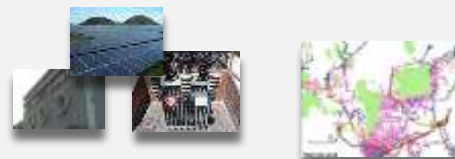
Domestic consumers power limiters supply and installation



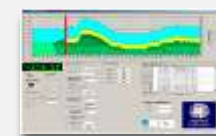
ENERGY QUALITY IMPROVEMENT

System Management

Development of an ELECTRA's assets geographical database system



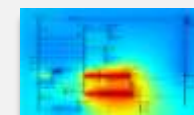
Development and implementation of a manual dispatch support system at Santiago, São Vicente and Sal islands



Selectivity Studies for the distribution network of Santiago, São Vicente and Sal

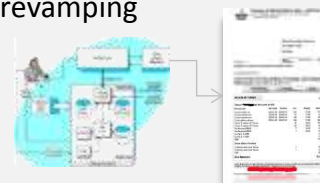


Development and implementation of a distribution grid management and rolling blackout support system



Systems and Processes

ELECTRA's Commercial Management System revamping



Internal processes revision and reorganization of the ELECTRA's Commercial Dep.



Systems and new support infrastructures integration



Commercial relationships Regulation development

Service Quality Regulation development



GESTO PRESENTATION

GESTO EXPERIENCE

CAPE VERDE EXPERIENCE

GESTO WIND EXPERIENCE

GESTO HAS LARGE EXPERIENCE IN WIND PROJECTS DEVELOPMENT SUPPORTED IN THE DEVELOPMENT OF A PIPELINE OF MORE THAN 4GW



Wind resource analysis

Mesoscale

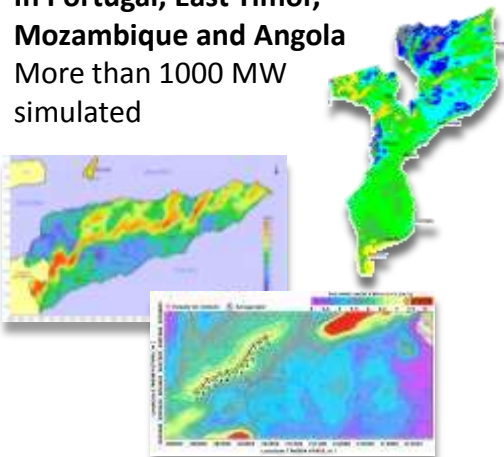
East Timor
15 007 km²
Mozambique
783 000 km²
Angola

Wind Measurements

East Timor: 4 met masts
Mozambique : 35 met masts
Portugal : More than 60 m masts
Brazil: More than 20 m masts
Poland: More than 15 m masts
Romania: More than 10 m masts

Wind micro sitting modeling

(WASP and Wind Farmer)
In Portugal, East Timor, Mozambique and Angola
More than 1000 MW simulated



Environmental / legal / electrical analysis

Geographies

Portugal, East Timor, Mozambique, Angola, Brazil, Romania, Poland and Venezuela

Environmental Impact Studies (EIS)

More than 100 EIS performed

Legal framework developed

Feed in tariff definition that enabled the development and construction of more than 2000 MW



Site Assessment

Geographies

Portugal, East Timor, Mozambique, Angola, Cape Verde, Brazil, Romania, Poland and Spain

Route surveys

More than 25 000 km

Site assessment

More than 200 sites visited and assessed



Project Identification

Development Support

Pipeline of more than 4 000 MW of wind projects

Greenfield Projects

East Timor: 4 projects more than 40 MW
Cape Verde: 30 projects more than 240 MW
Mozambique: 50 projects more than 800MW
Portugal: 80 projects more than 1500 MW
Brazil: 15 projects more than 500 MW
Poland: 20 projects more than 400 MW
Romania: 12 projects more than 300 MW

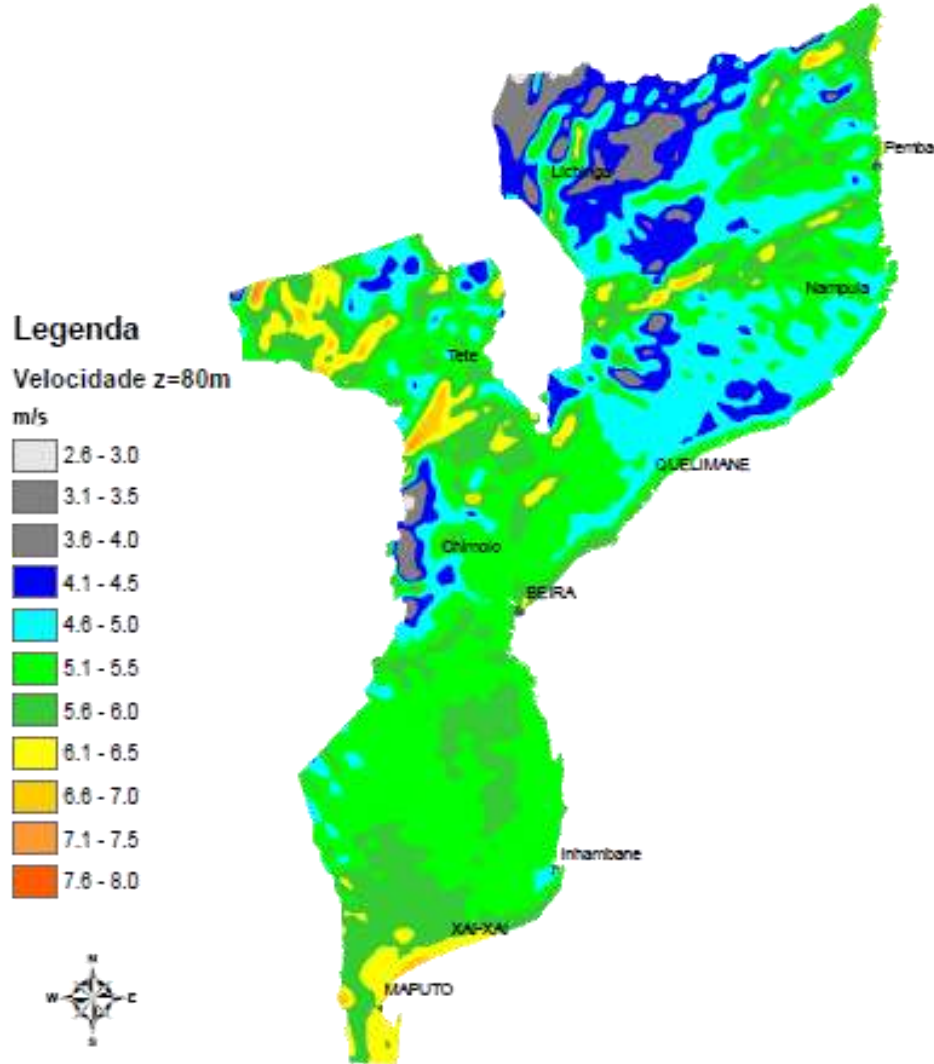
In operation or under construction

Portugal: 5 projects more than 300 MW
Brazil: 4 projects more than 120 MW
Poland: 5 projects more than 80 MW
Romania: 2 projects more than 30 MW

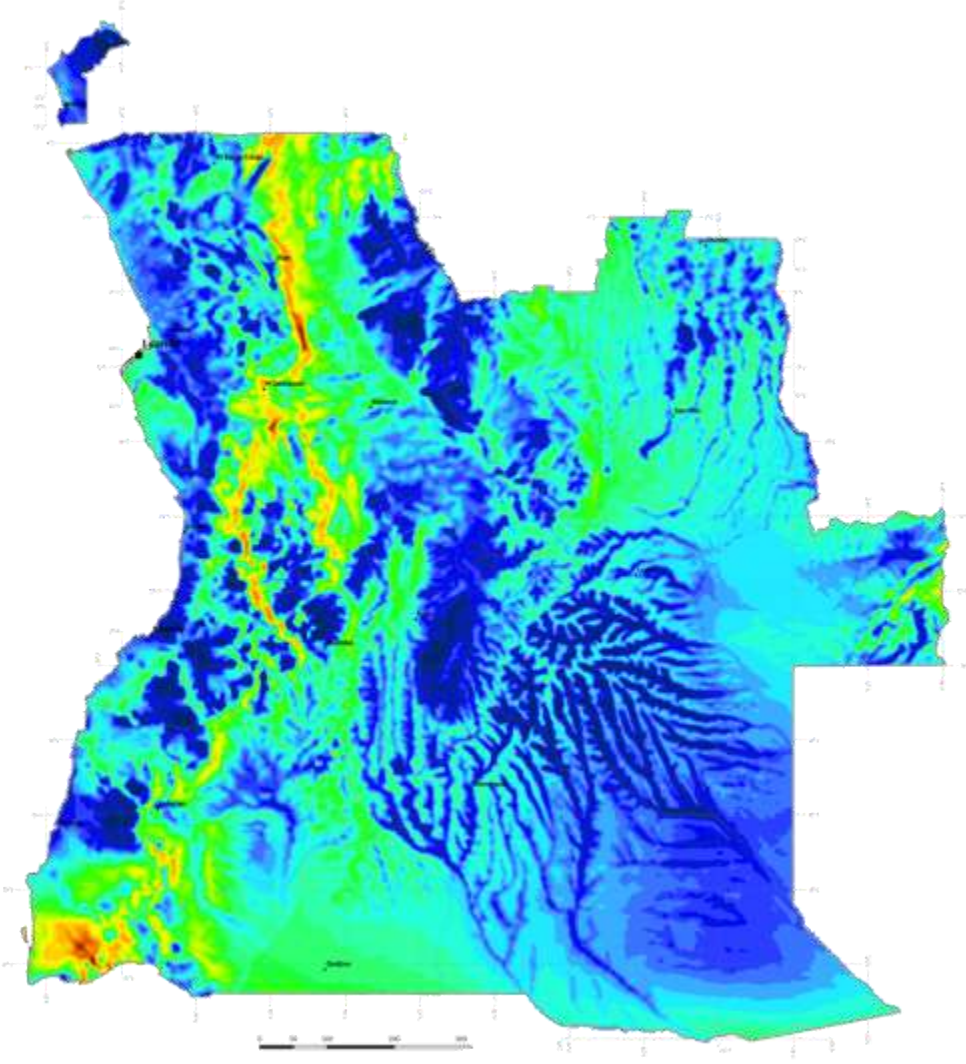


GESTO HAS DEVELOPED MESOSCALE WIND RESOURCE MAPS FOR EAST TIMOR, MOZAMBIQUE AND ANGOLA

MOZAMBIQUE EXAMPLE



ANGOLA EXAMPLE



Development of environmental analysis focused on key environmental issues that can be either, prohibitive constrains to the project, or potential impacts that can also have a financial impact in the project throughout the mitigation measures.

This analysis is usually complemented with a site visit by an environmental expert.

Example of Gesto Environmental Reports



Pre-feasibility Study for the Development of a CSP Power Plant in Namibia



Renewable Energy Atlas in Cape Verde



Site Assessment in South Africa



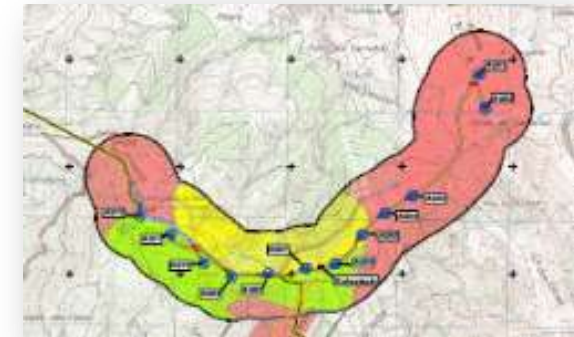
Renewable Energy Atlas in Angola



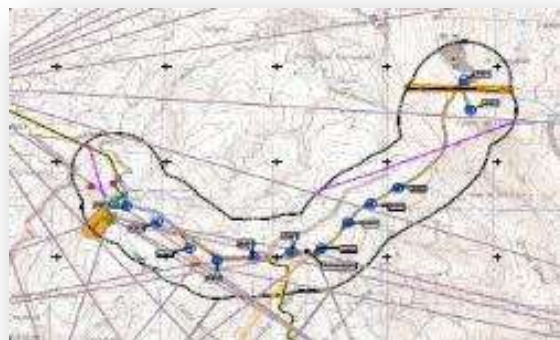
Example of environmental impact studies maps...

Development of constrain mapping identifying the available areas, the constrained areas (or areas to avoid) and the prohibited areas in the given site.

Soils and erosion



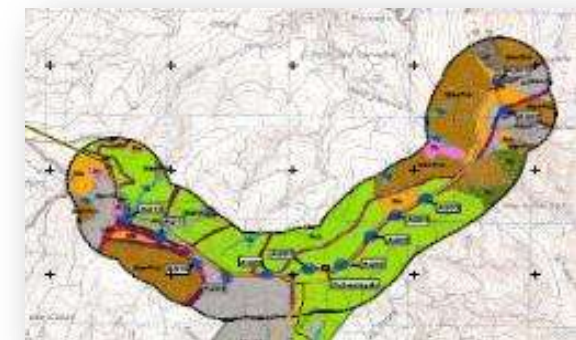
Servitudes and legal constrains



Visibilities – landscape



Ecosystems



MORE THAN 24.000 MW OF ASSESSED RENEWABLE PROJECTS ALL OVER THE WORLD (I)

A equipa Gesto tem uma vasta experiencia em site assessment no Continente Africano...

Moçambique



- 8.500 km
- 60 locais visitados

Cabo Verde



- 9 ilhas
- 64 locais visitados

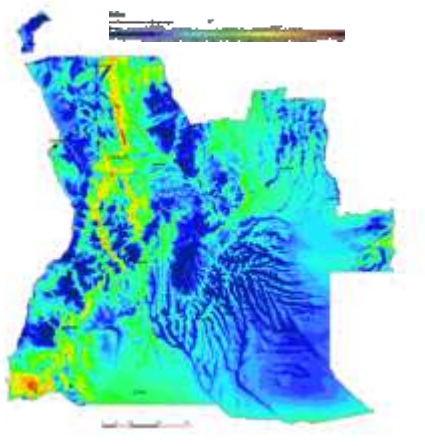
Angola



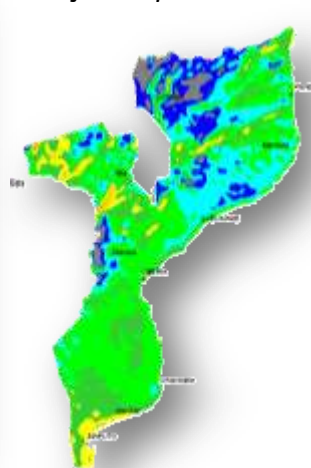
- 6.200 KM
- 40 locais visitados

Exemplos de estudos mesoscala desenvolvidos pela Gesto

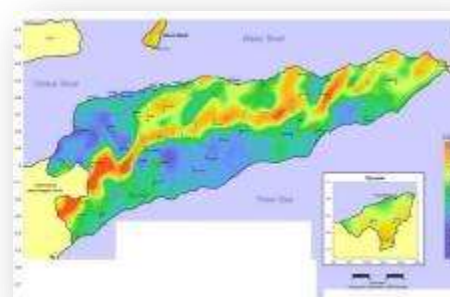
Angola



Moçambique



Timor-Leste



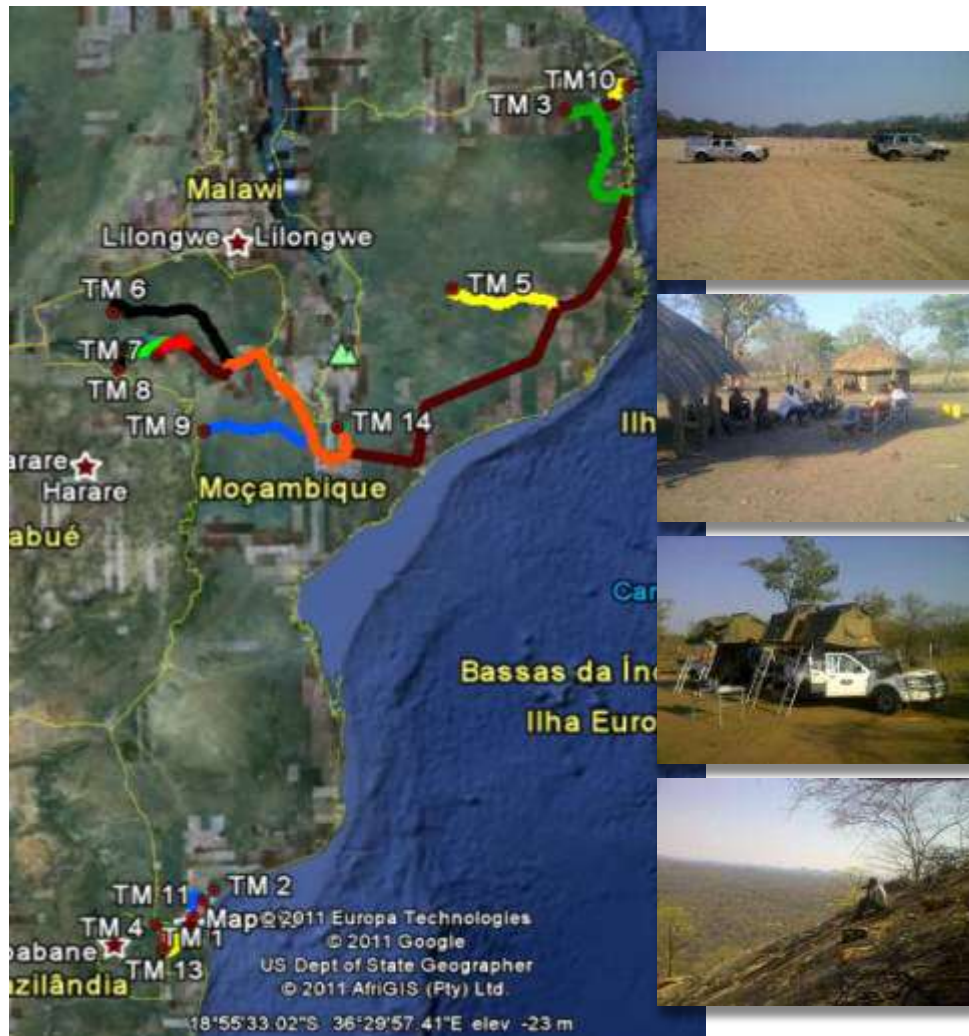
Além do recurso eólico a GESTO participou na identificação e estudo de mais de 24GW em todo o mundo...

País	Recurso	Potência (MW)
Portugal	Eólico	400
	Geotérmico	25
Espanha	Solar	20
Cabo Verde	Eólico	241
	Solar	315
	Geotérmico	3
Moçambique	RSU	7,5
	Eólico	1.100
	Solar	1.260
	Biomassa	98
Angola	Hídrico	4.732
	Eólico	600
	Hídrico	10.000
Timor-Leste	Solar	3.500
	Eólico	150
Namíbia	Hídrico	415
	Solar	1.000
África do Sul	Eólico	300
	Solar	40
Itália	Geotérmico	124

MORE THAN 24.000 MW OF ASSESSED RENEWABLE PROJECTS ALL OVER THE WORLD (II)

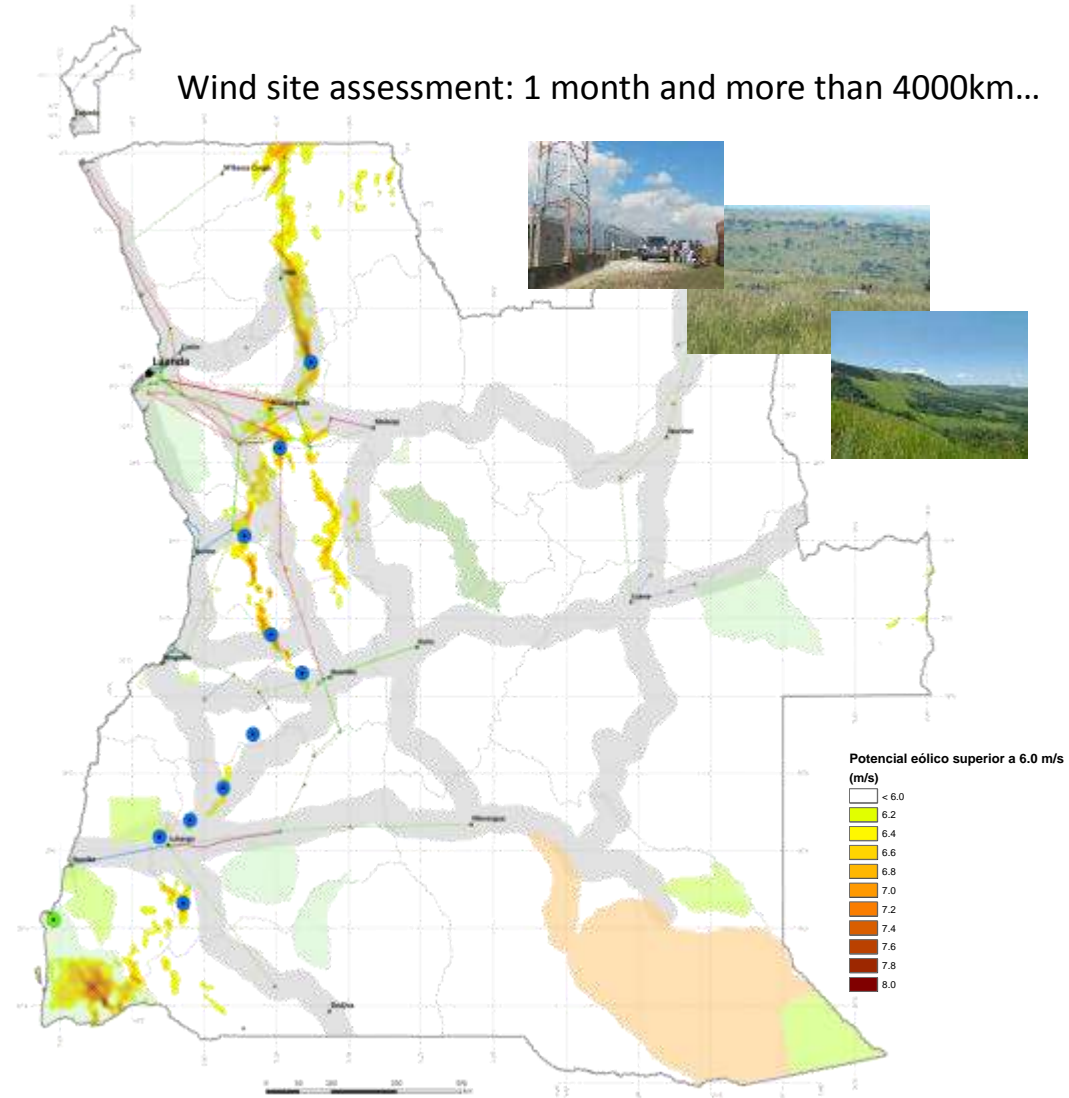
MOZAMBIQUE EXAMPLE

Wind site assessment: 1 month and more than 8500km...



ANGOLA EXAMPLE

Wind site assessment: 1 month and more than 4000km...



Average wind speed >5,5 m/s, 2017 electric grid, development corridors until and protected areas

Gesto team set more than 40 met masts around the world...

...and more than 6 years of worldwide experience in met masts maintenance...

Mozambique – 35 met masts



East Timor – 4 met masts



Cape Verde – 2 met masts



Other countries:

Portugal:

- *8 met masts*

Angola

- *2 met masts*



Example of Gesto's wind measurements and reports...

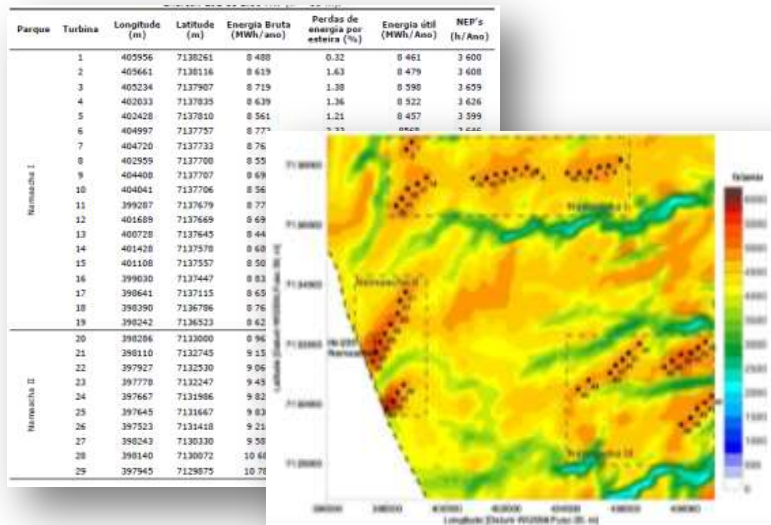


PRELIMINARY WIND FARM LAYOUT & PRELIMINARY PRODUCTION FORECAST / FINANCIAL MODEL & PRELIMINARY LCOE

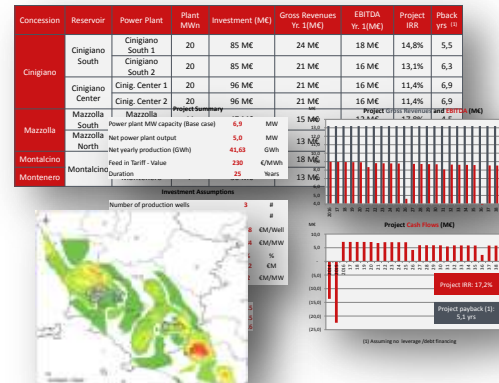


Gesto has large experience in renewables project evaluation and financial model development....

Example of Gesto's wind resource mapping and production forecast...



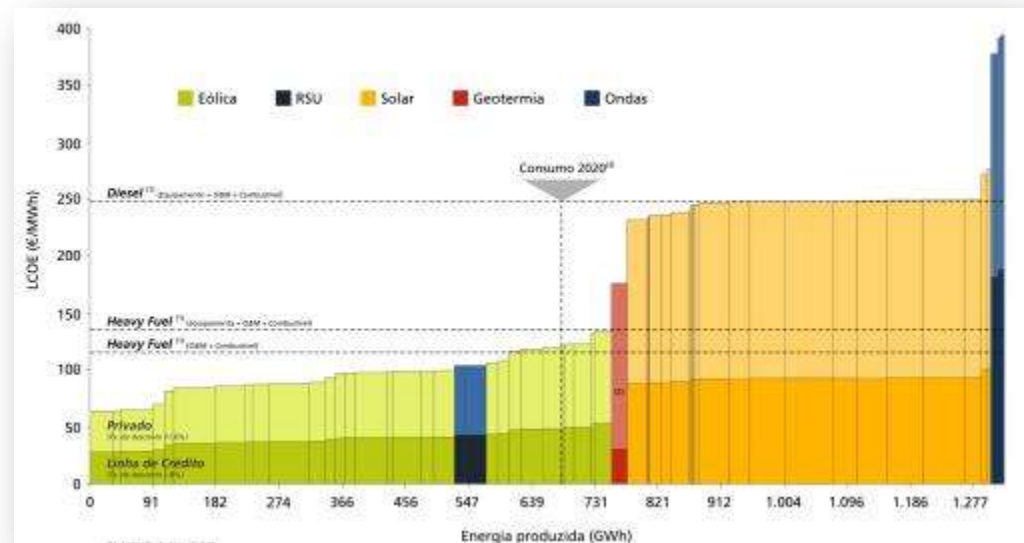
Gesti Italian Geothermal Project



South Africa Solar Project evaluation



Example of LCOE calculation for different technologies





Gesto

ENERGY CONSULTING



Gesto

ENERGY CONSULTING

PORTUGAL

ITÁLIA

ANGOLA

MOÇAMBIQUE

CABO VERDE

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