



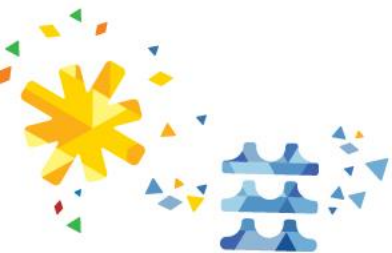
APREN Associação
de Energias
Renováveis



Cycle of Round Tables - “APREN and the Universities”
Day of the Sun

Solar PV Production in Portugal

IST | 3rd of May of 2018





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10:00 – 10:10

Opening

José Falcão de Campos, *Coordinator of the MSc programme in Energy Engineering and Management at IST*

10:10 – 10:30

Renewable Electricity Sector in Portugal

José Medeiros Pinto, *Secretary General at APREN*

10:30 – 10:50

The Challenges of the Solar Energy in the Iberian Market

Manuel Barbosa, *General Manager at Acciona*

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Self-consumption Units and Grid Connections

Francisco Pinto, *President at APESF*

11:10 – 11:25

Debate

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Coffee Break

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The integration of solar energy into the distribution network

Rui Bento, *Deputy Director at EDP Distribuição*

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The Impact of Solar PV Generation in Cities

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The Role of Solar PV in the New Energy Models: Digitalization, P2P and Energy Storage

Marc Rechter, *President at Enercoutim*

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José Medeiros Pinto, *Secretary General at APREN*



APREN Associação de Energias Renováveis



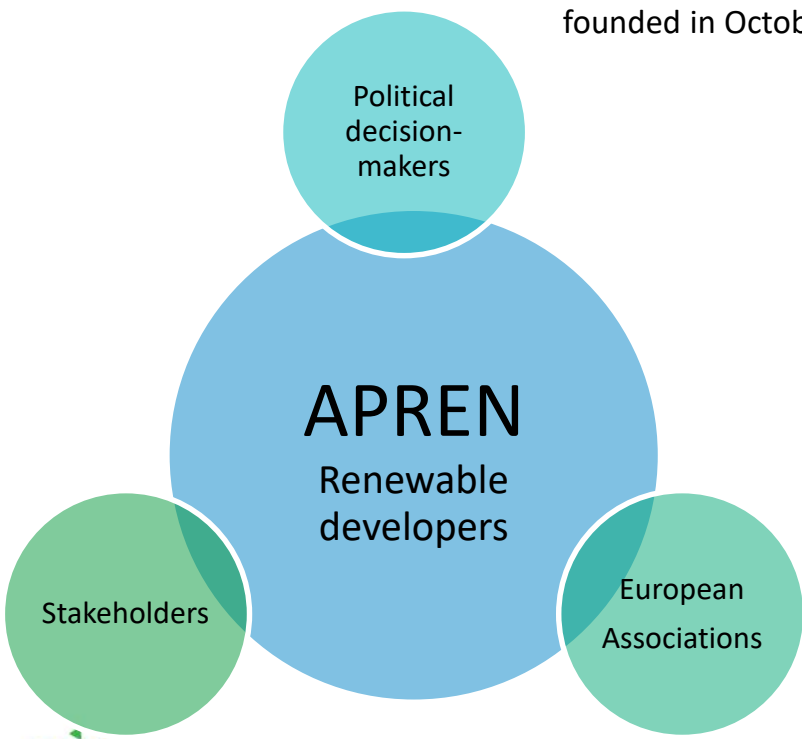
José Medeiros Pinto, Secretary General at APREN
Renewable Electricity Sector in Portugal



APREN - Portuguese Renewable Energy Association



The Portuguese Renewable Energy Association (APREN) is a non-profit association, founded in October 1988, with the mission of coordination, representation and defense of the common interests of its Members.



Political decision-makers

APREN
Renewable developers

Stakeholders

European Associations

APREN's mission :

- Promoting the deployment of renewable resources for electricity production;
- Support, encourage and collaborate directly with policy-makers and government entities to create a sustainable strategy for the energy sector;
 - Support, advise and promote the producers of renewable electricity;
- Inform and disseminate among all stakeholders in the energy sector the advantages and the importance of the Portuguese endogenous energy resources.

APREN, Europe and the World



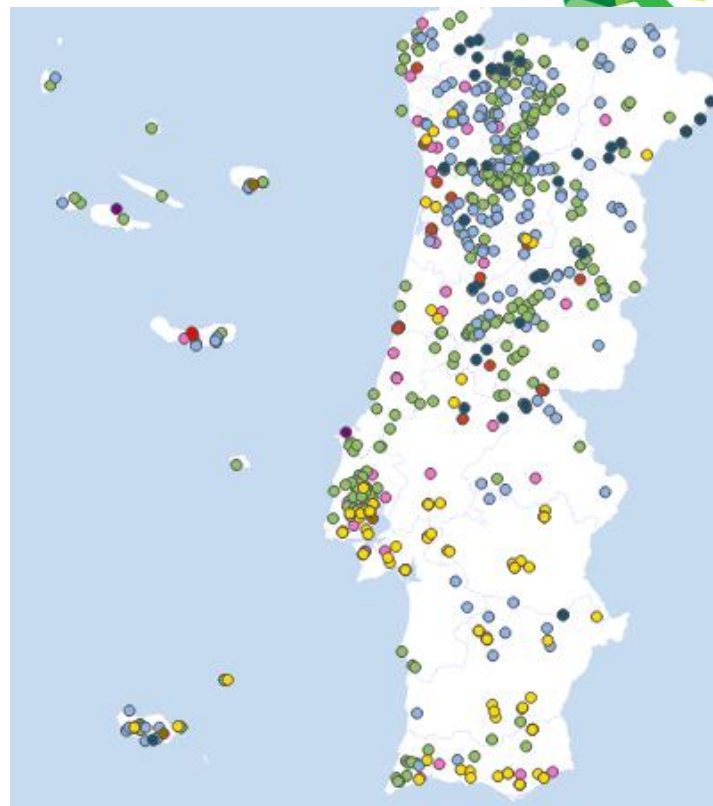
Collaboration with different entities:

- European Policies
- Energy Sector Trends
- European Projects
- Statistics
- Conferences

APREN's Share

Tecnology	Share
Wind	98 %
Hydro	99 %
Solar PV	29 %
Biomass	28 %
Geothermal	100 %
OVERALL RENEWABLES	93 %

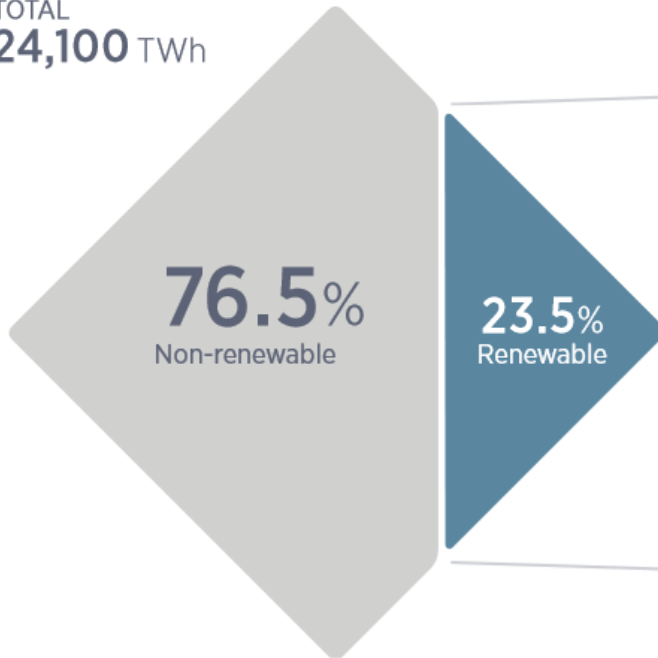
Note: To calculate APREN's share, was considered the values from DGEG publication "Quick Statistics - Renewables, December 2017". Micro and Mini-production units were excluded.



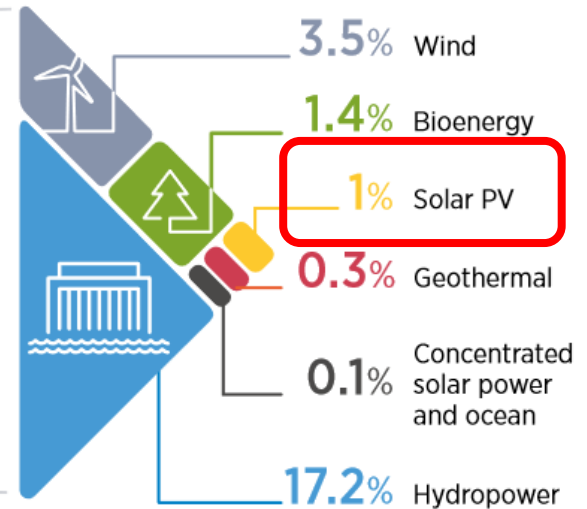
- Biogas
- Biomass
- CSP
- Geothermal
- Large Hydropower
- MSW
- Photovoltaic
- SHP
- Wave and Tidal
- Wind

World Energy Sector Electricity

TOTAL
24,100 TWh



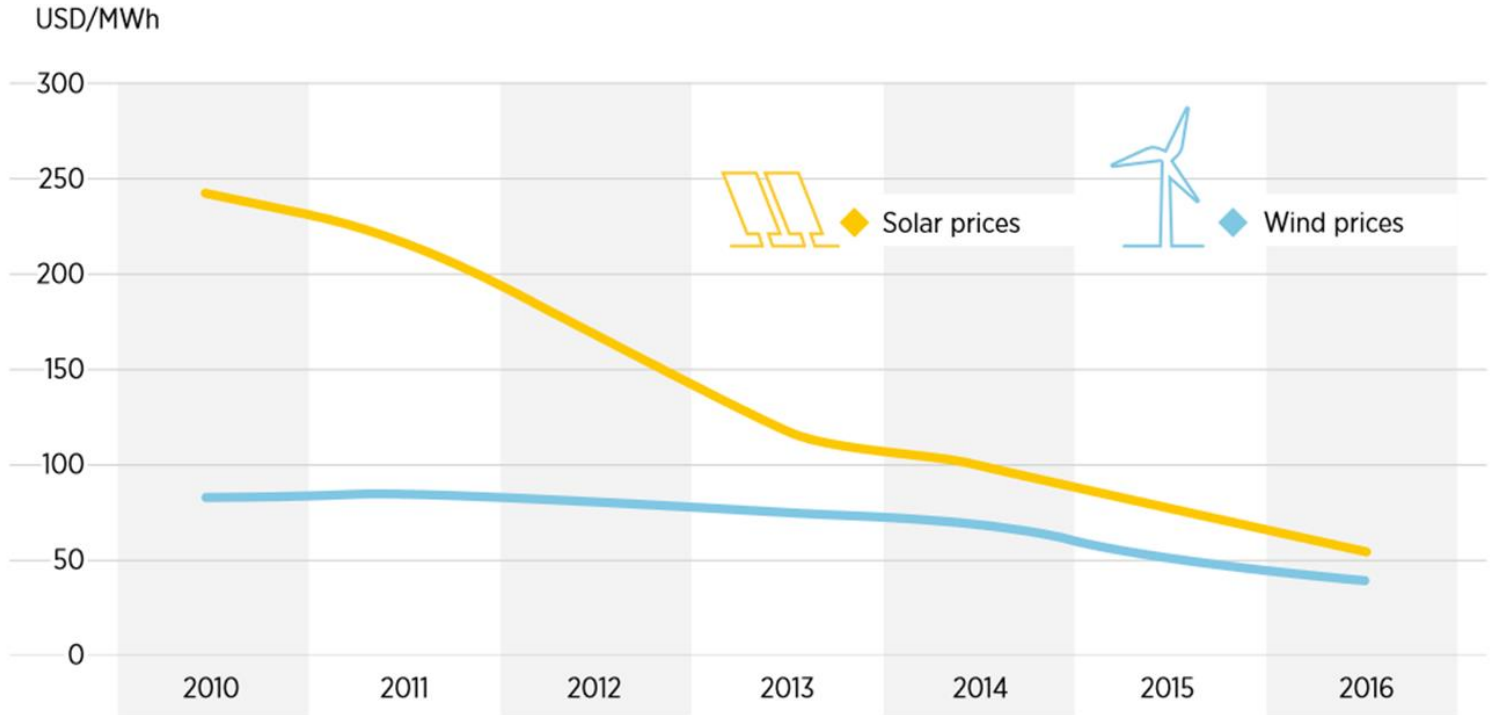
TOTAL RENEWABLE
5,660 TWh



Solar still represents 1 % of the world electricity generation

Source: REN21 (2015's data)

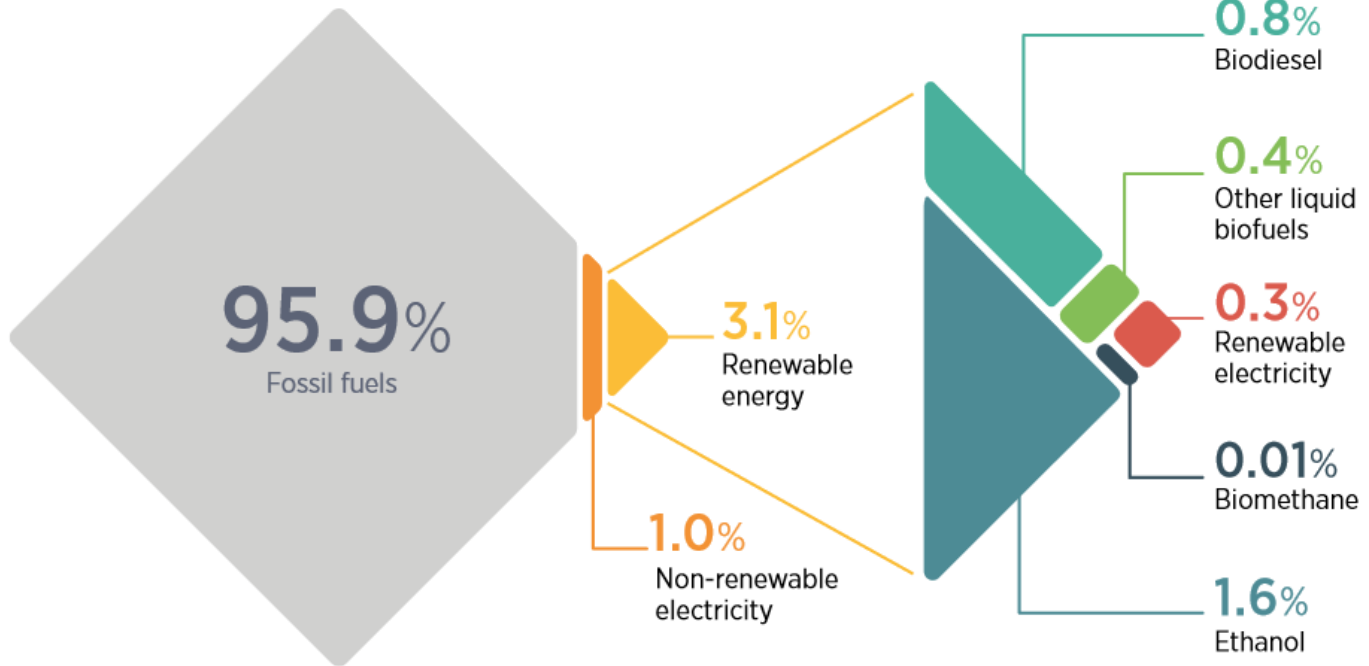
World Energy Sector Electricity



Average global prices resulting from solar PV and onshore wind auctions, 2010-2016

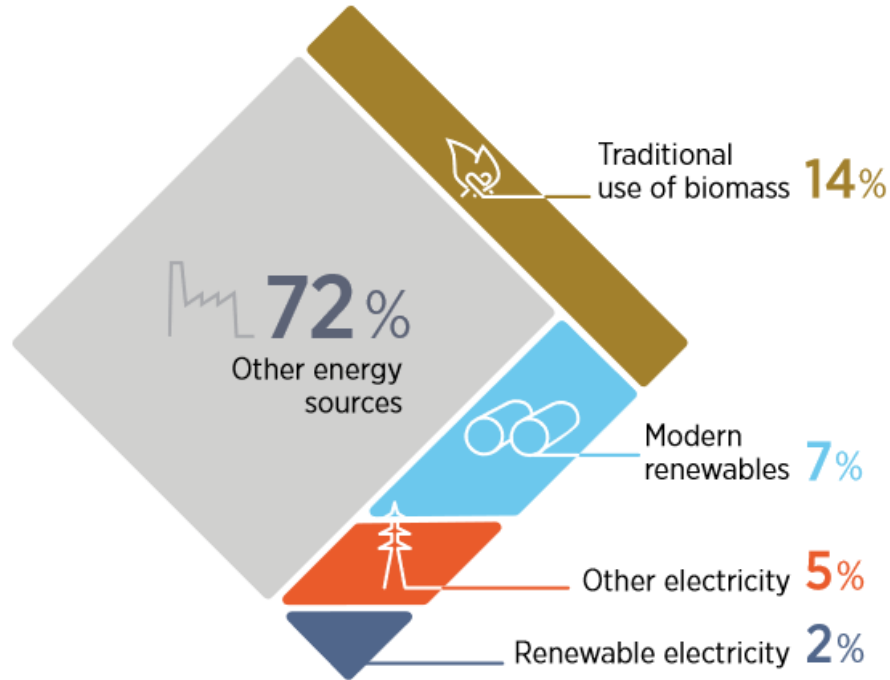
Source: Renewable Energy Policies, REN21

World Energy Sector Transports



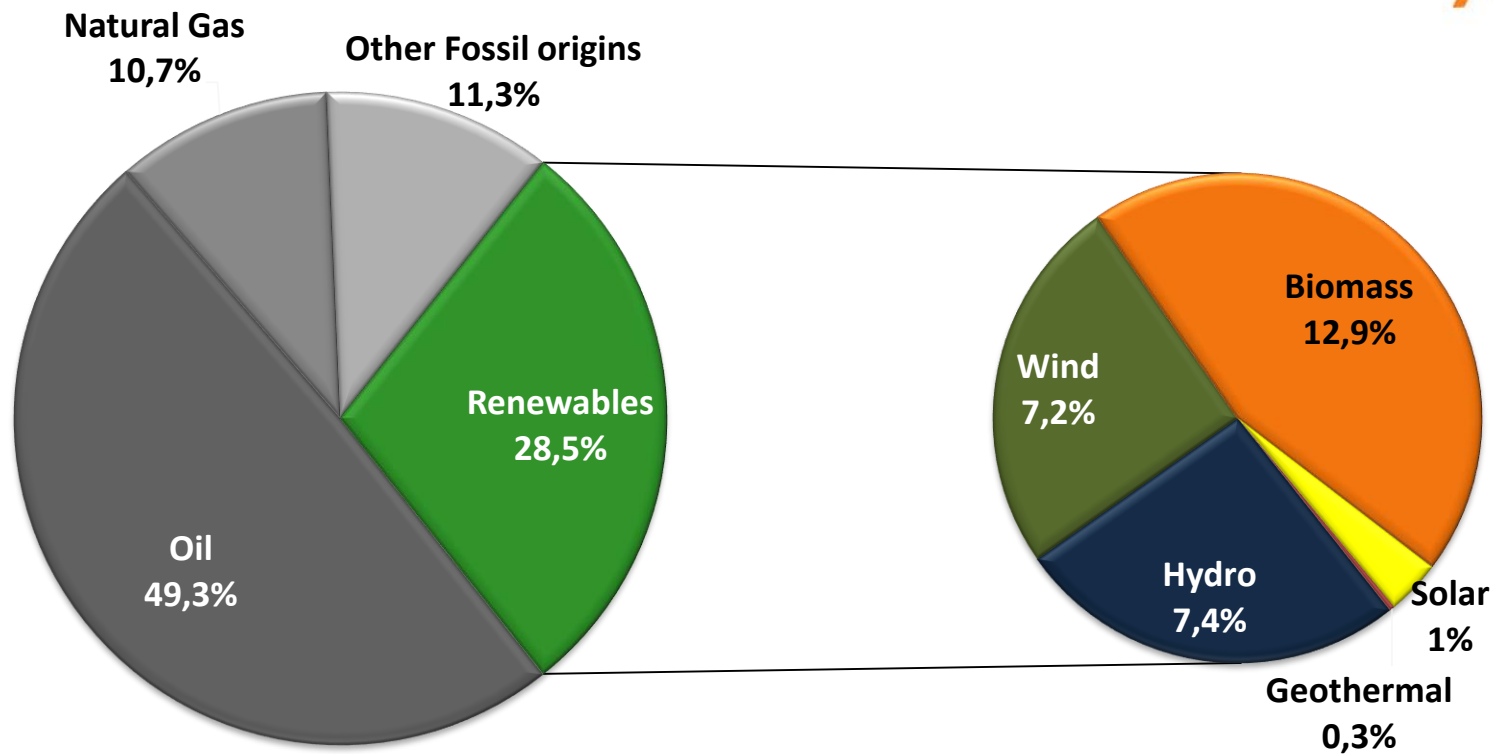
Source: REN21 (2015's data)

World Energy Sector Heating and Cooling



Source: REN21 (2015's data)

Portuguese Energy Sector 2016

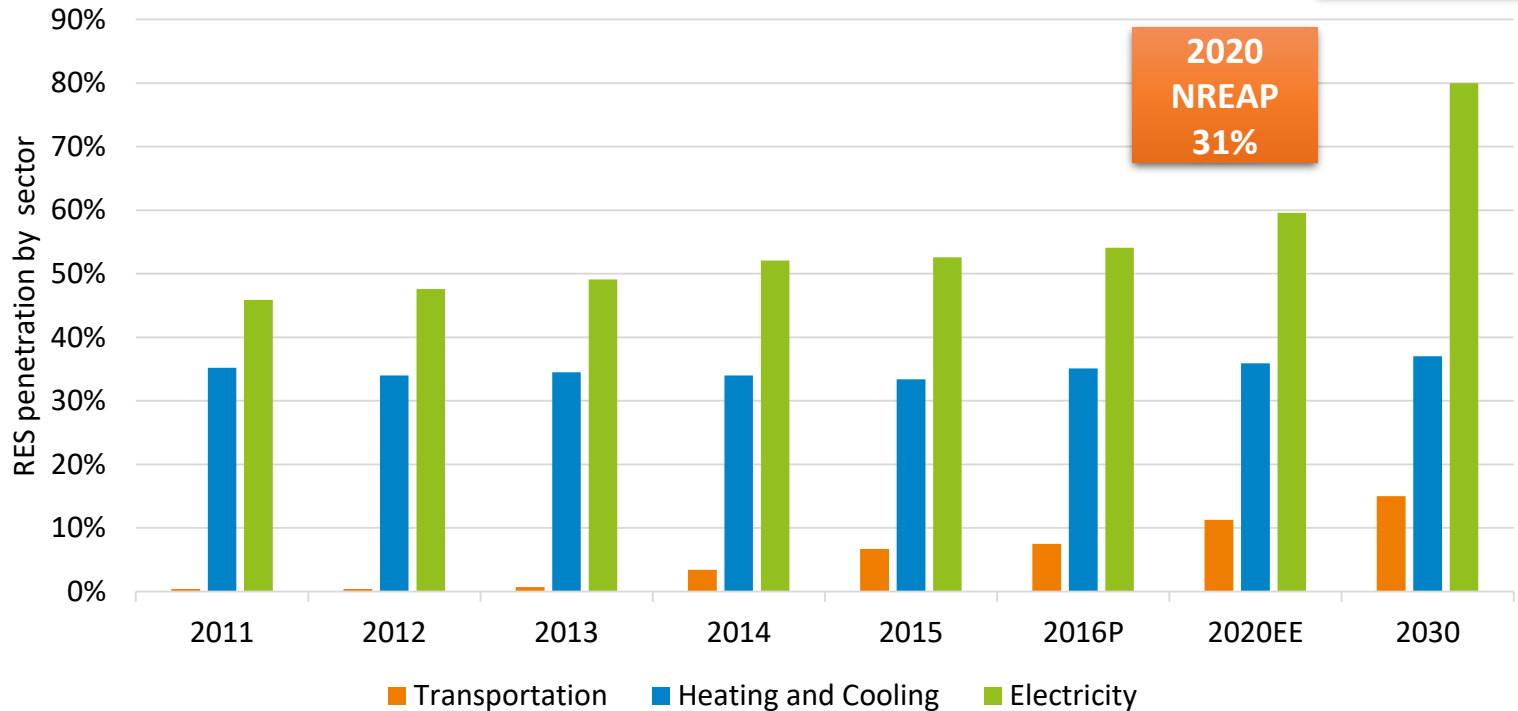


Renewables' share in the energy sector (electricity, transports and heating and cooling)

Source: DGEG (2016's data); APREN's analysis

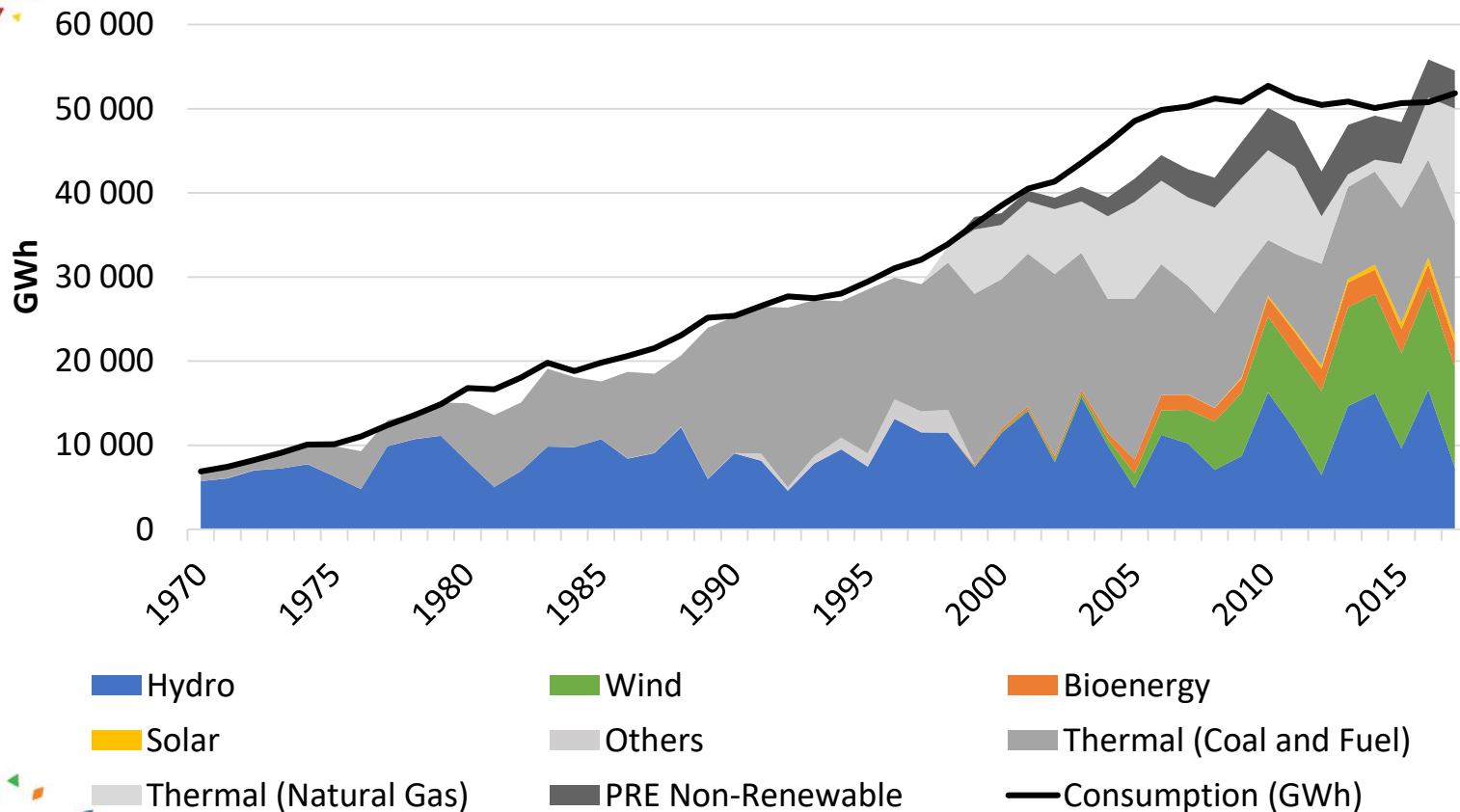
Portugal Renewable Energy Targets

2030
(In discussion)
>40%



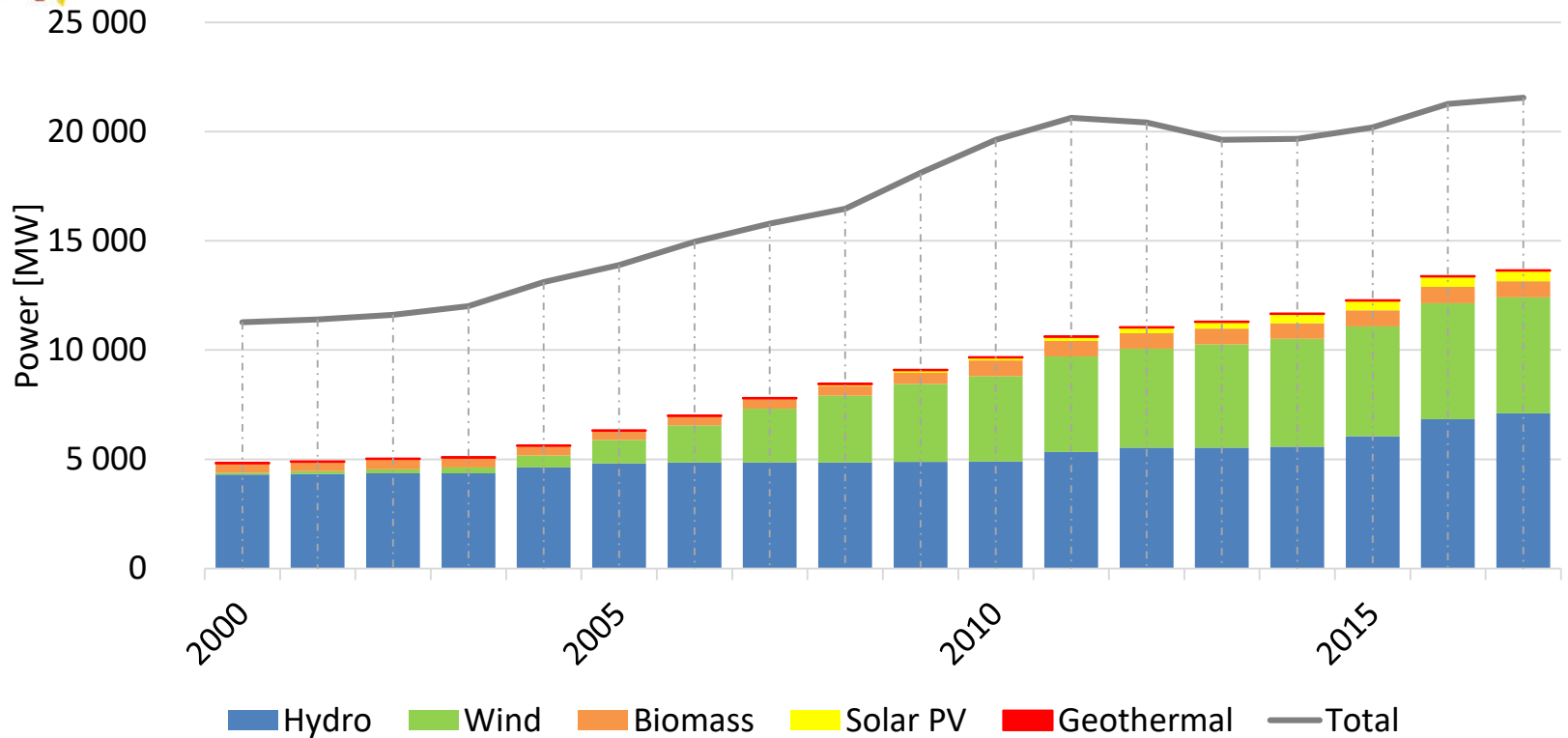
Source: PNAER, Compromisso para o Crescimento Verde

Evolution of the Mainland Portugal's Electricity Mix



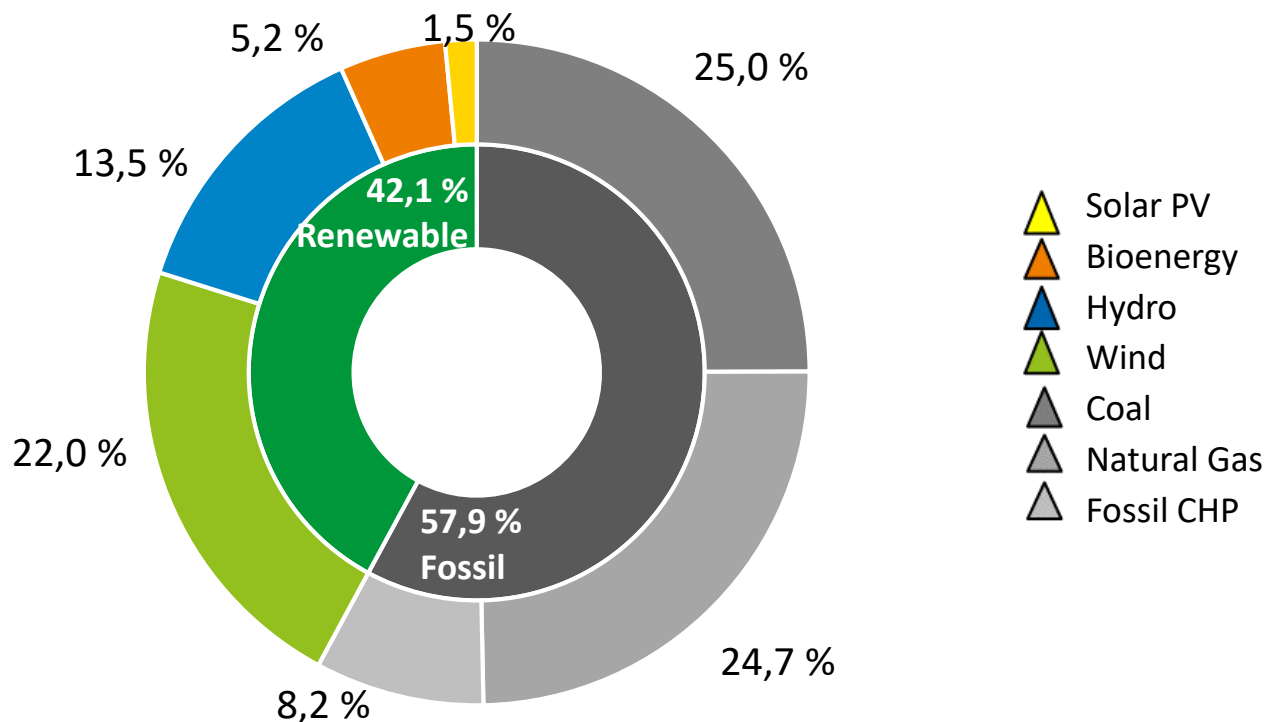
Source: REN, EDP; APREN's Analysis

Evolution of the Portuguese Power Capacity



Source: DGEG

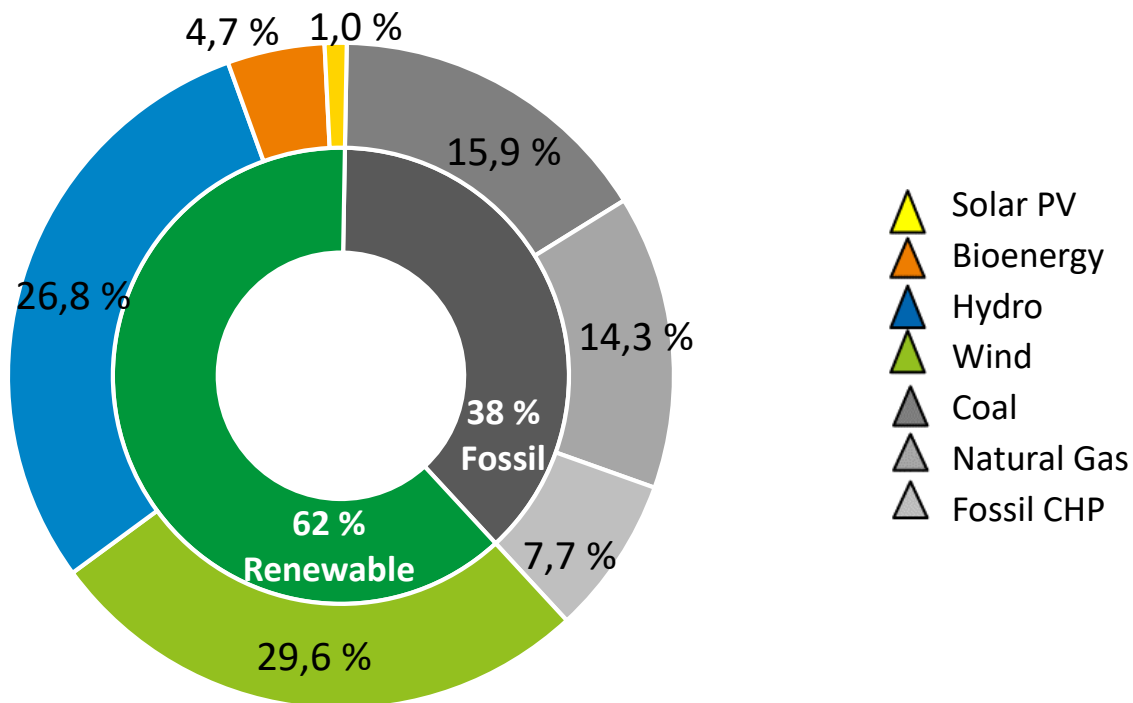
Mainland Portugal's Electricity Production Mix - 2017



Source: REN

- In 2017, renewable energy sources accounted for 42 % of the total electricity produced in Portugal.
- In terms of consumption renewables supplied 44% of the electricity needs (renewable – 22,956 GWh, consumption - 49,616 GWh)

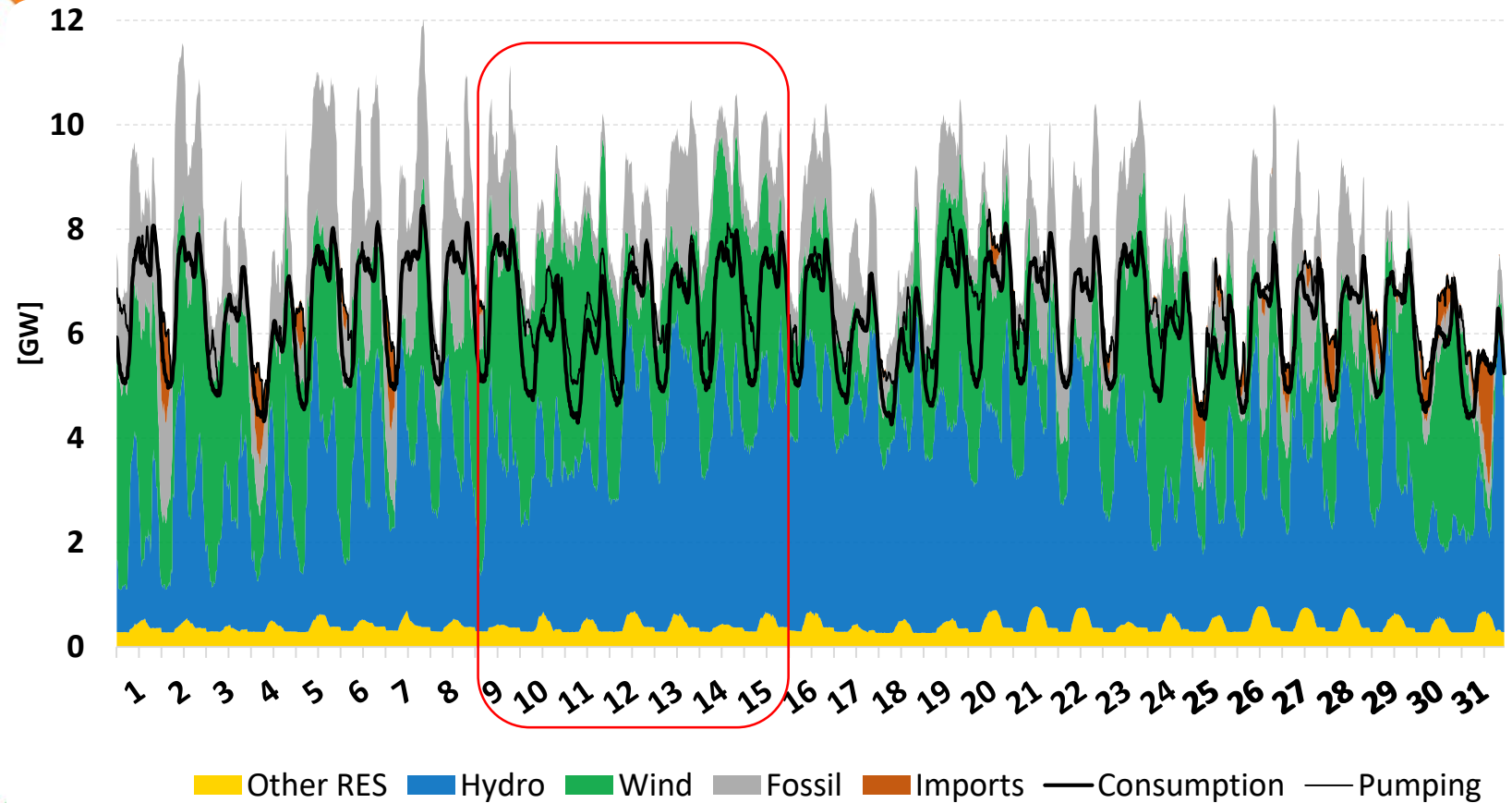
Mainland Portugal's Electricity Production Mix - 2018



Source: REN

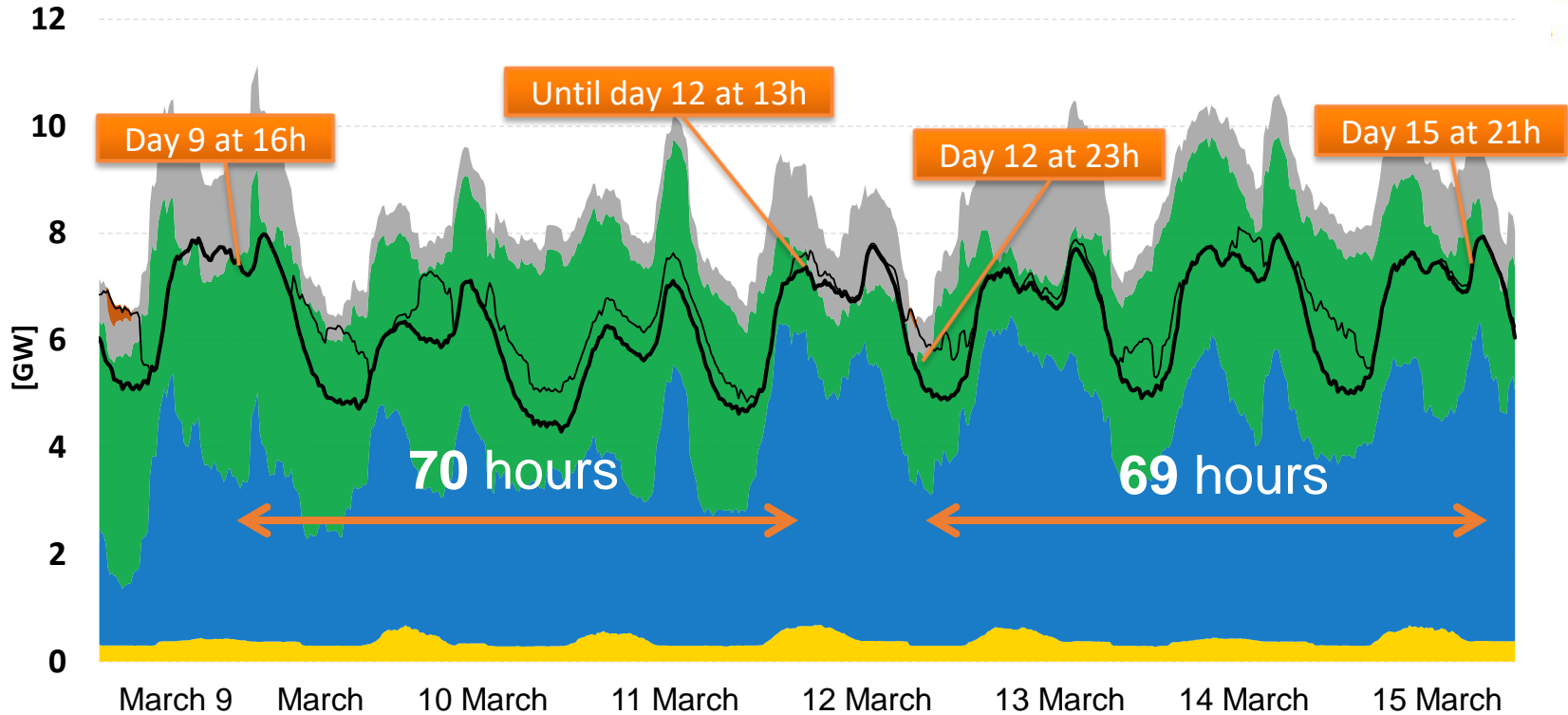
- In the first quarter of 2018 renewable sources accounted for 62 % (9,382 GWh) of the total electricity generated in Mainland Portugal (15,098 GWh).

Load Diagram of March 2018



Renewables = 103.6 % of the Consumption

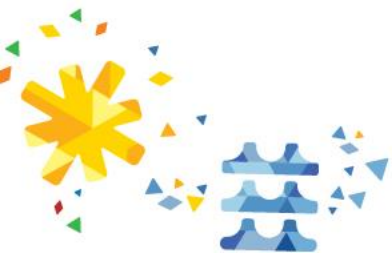
Load Diagram of March 2018



Other RES Hydro Wind Fossil Imports Consumption Pumping



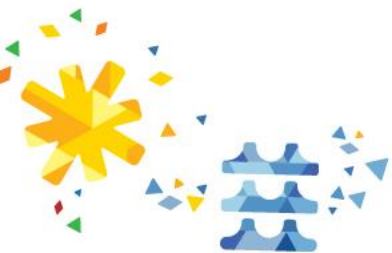
Electricity System with 100 % RES





**ARE RENEWABLES GOOD FOR
PORTUGAL?**

**AND HOW DOES IT AFFECT OUR
ECONOMY?**



Job Creation Industrial Cluster



Factory's Location	Products
Viana do Castelo	Towers and Blades



Factory's Location	Products
Moura	Solar Panels



Factory's Location	Products
Oliveira de Frades and Vagos	Blades and Nacelles

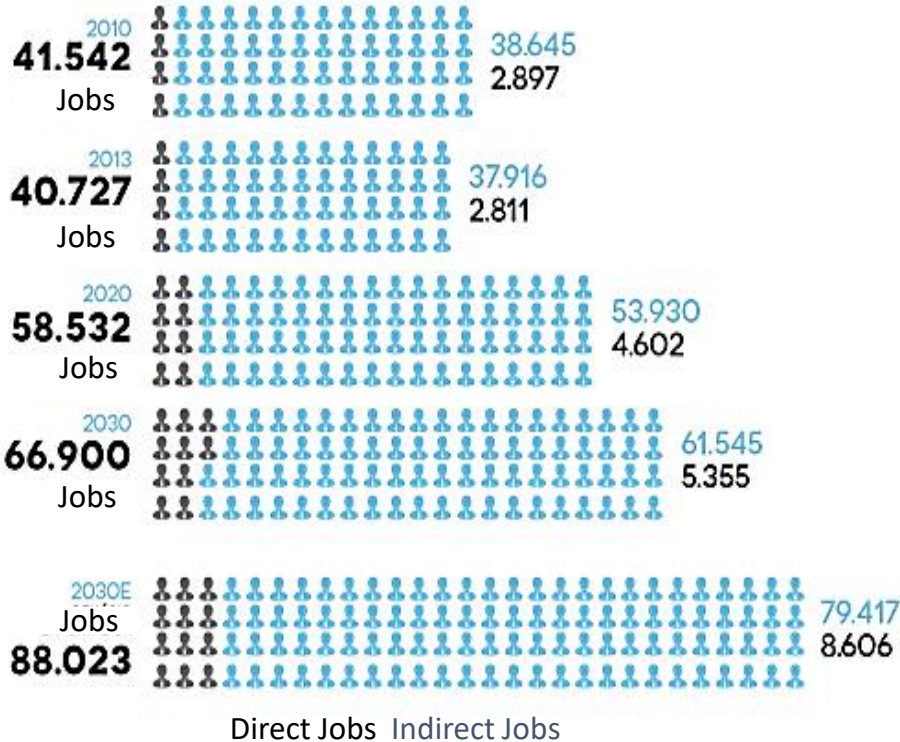


Factory's Location	Products
Sever do Vouga	Steel Equipment

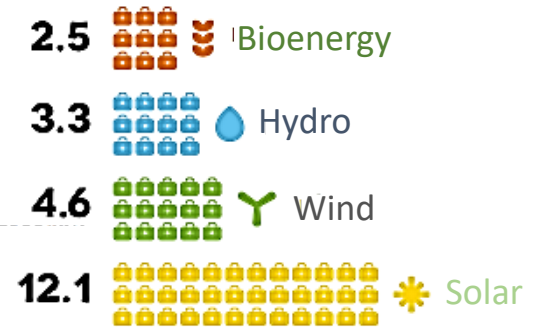


Job Creation

RENEWABLE ELECTRICITY POSITIVELY IMPACTS THE JOB CREATION [# Jobs]



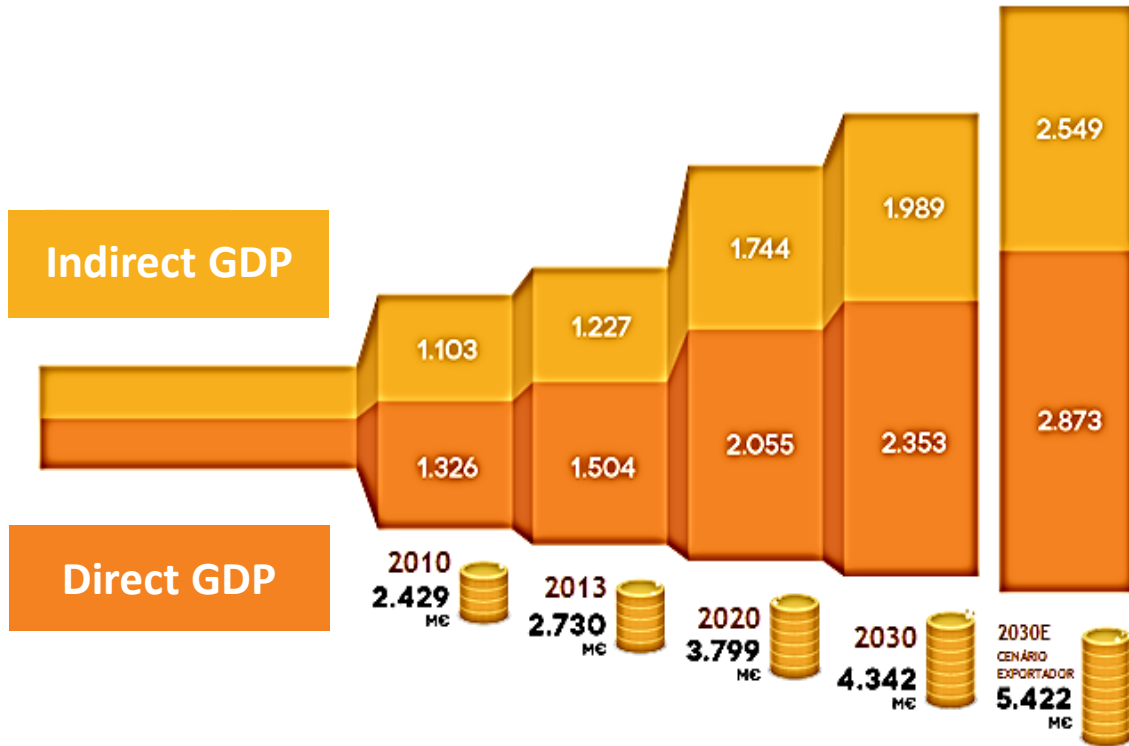
JOBS CREATED BY INSTALLED MW PER TECHNOLOGY BETWEEN 2010 AND 2013 [# Jobs/MW]



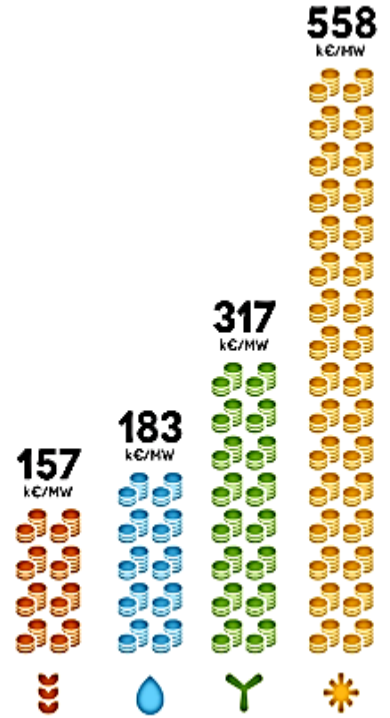
COMPARISON BETWEEN GDP CONTRIBUTION OF RENEWABLE ENERGY SECTOR AND THE GENERAL LABOUR FORCE [k€]



National GDP



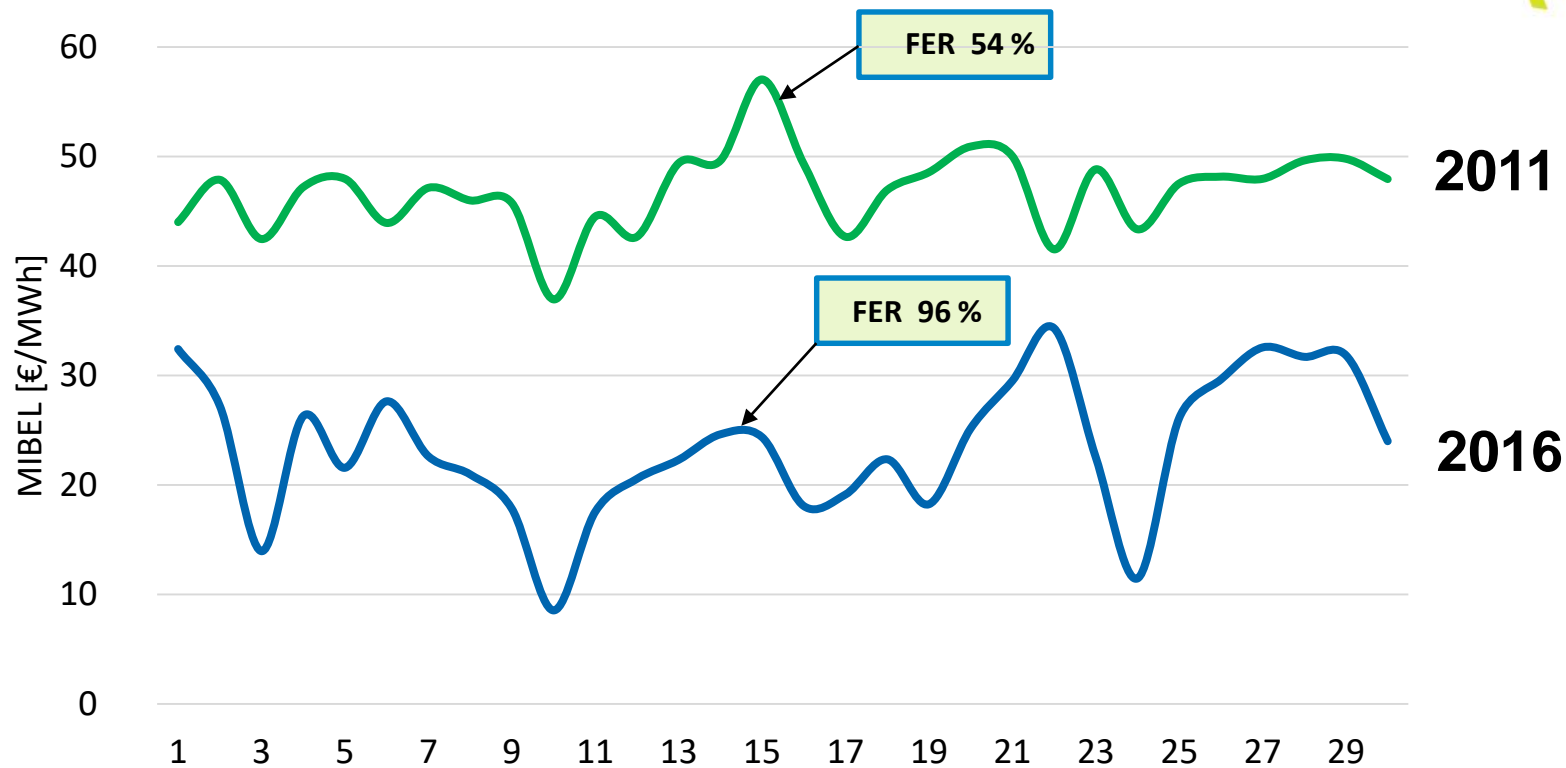
GDP GROWTH FOR TECHNOLOGY per INSTALLED MW BETWEEN 2010 and 2013 [k€/MW]



Bioenergy Hydro Wind SOLAR

RES IMPACT IN MIBEL

Real Case – April 2016 [Portugal]



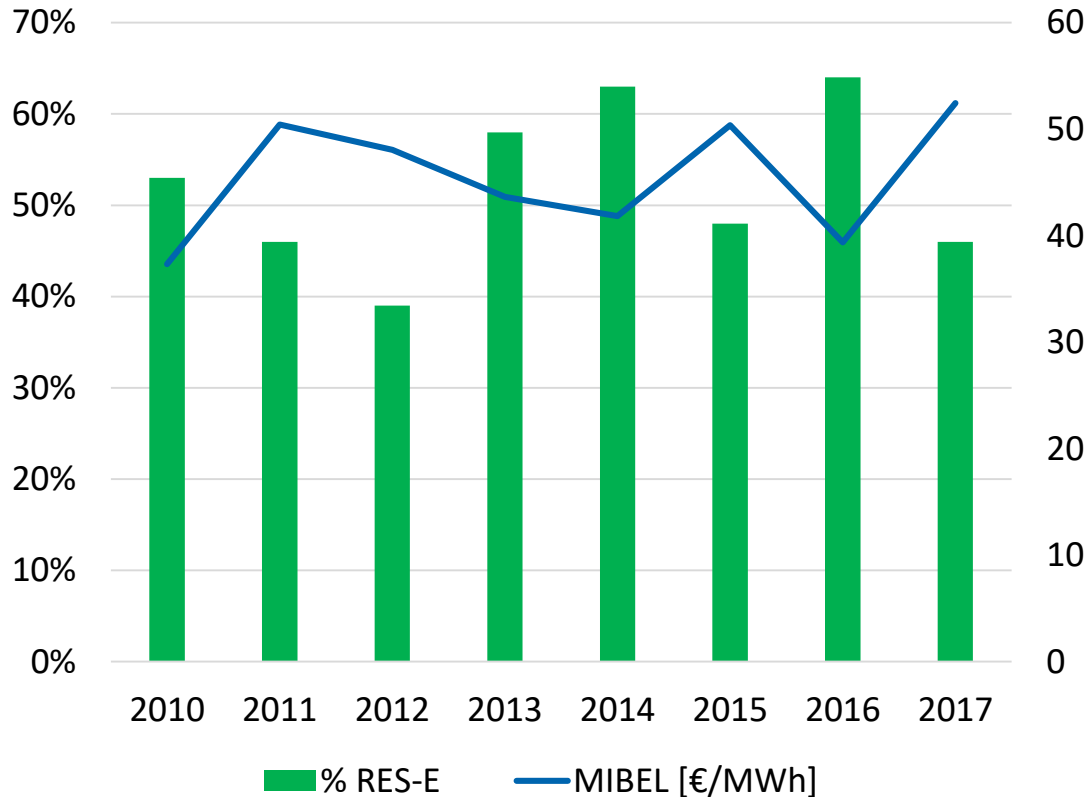
Source: MIBEL

AVERAGE PRICE OF APRIL 2011= 46,85 €/MWh
AVERAGE PRICE OF APRIL 2016 = 23,50 €/MWh

RES IMPACT IN MIBEL

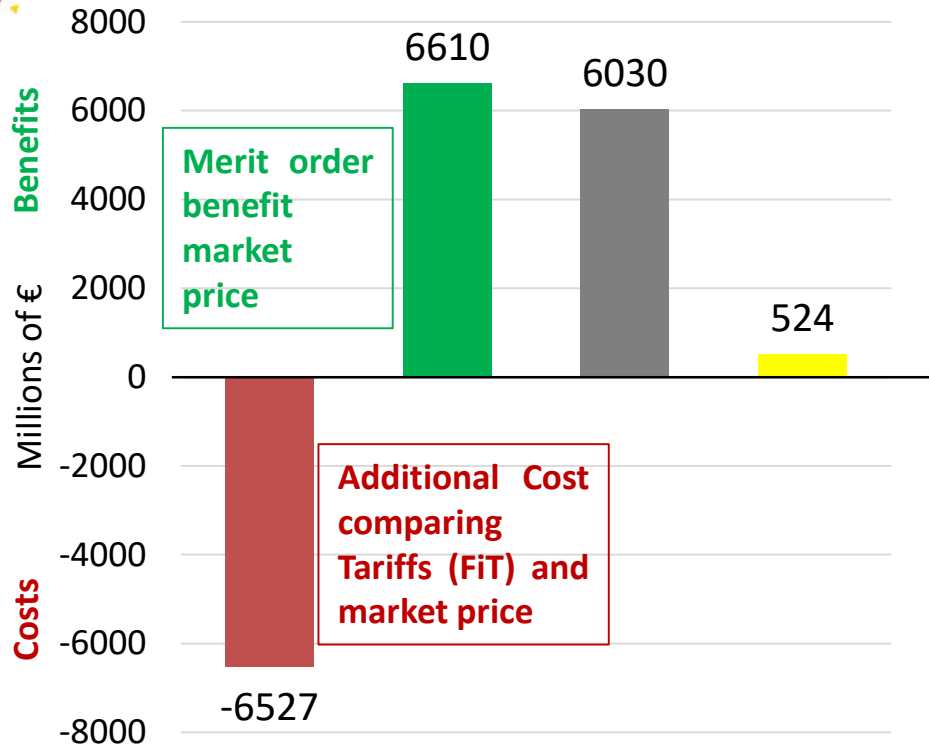
YEARLY ANALYSIS [Portugal]

Year	MIBEL [€/MWh]	% RES-E
2010	37,32	53%
2011	50,45	46%
2012	48,07	39%
2013	43,64	58%
2014	41,85	63%
2015	50,37	48%
2016	39,38	64%
2017	52,45	46%



Source: MIBEL

Electricity Renewable Benefits for the Electric Sector (2010-2017)



○ The savings due to order of merit effect was 6 610 M€.

○ The additional cost due to FiT was 6 527 M€.

○ The net benefit to the electrical system was a saving of 83 M€.

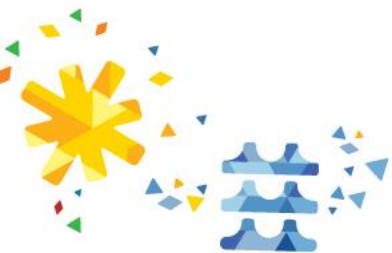
In addition there was benefits for the economy due to:

➤ Fossil Fuels Savings: 6 030 M€

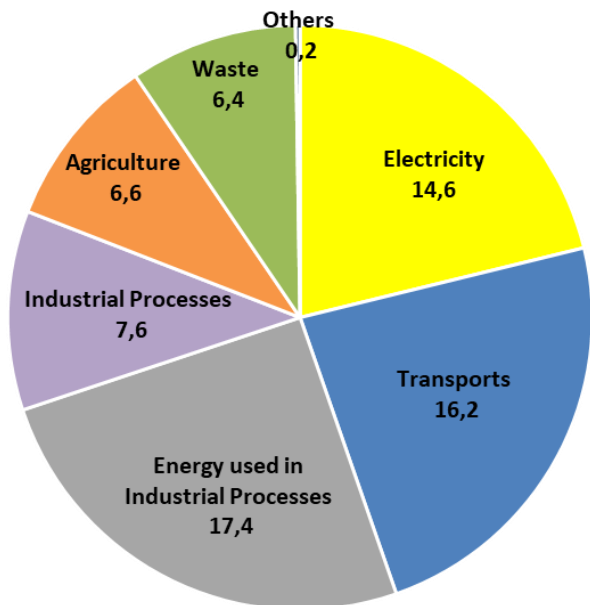
➤ CO₂ Emissions Savings: 524 M€



OUTLOOK OF THE PORTUGUESE ELECTRICITY SECTOR



Portuguese Energy Sector Emissions



Total	Forests Absorption [without fires]	Net Values
69	8	61

Units - Megatonnes

Source: Emissions Inventory 2017, APREN's Analysis

Note: Electricity Sector Emissions refer to 2015 and 2016's average



Outlook of the Electricity Sector

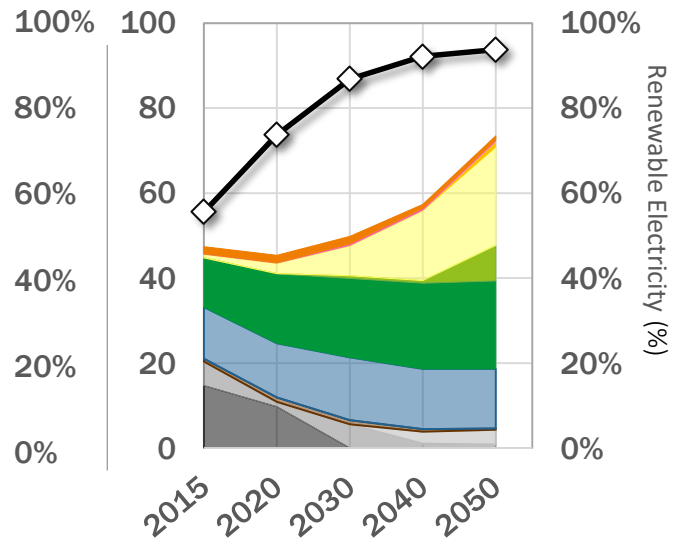
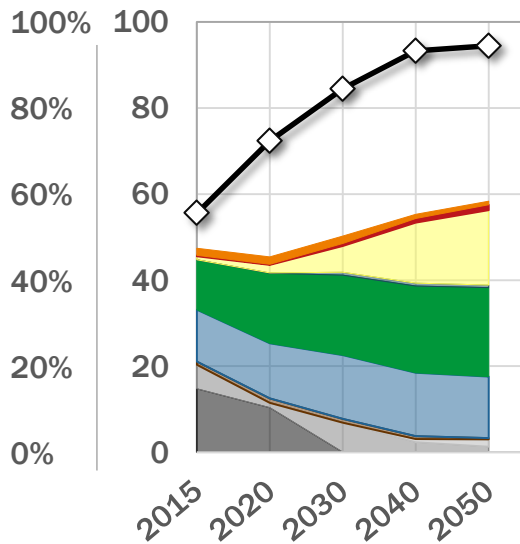
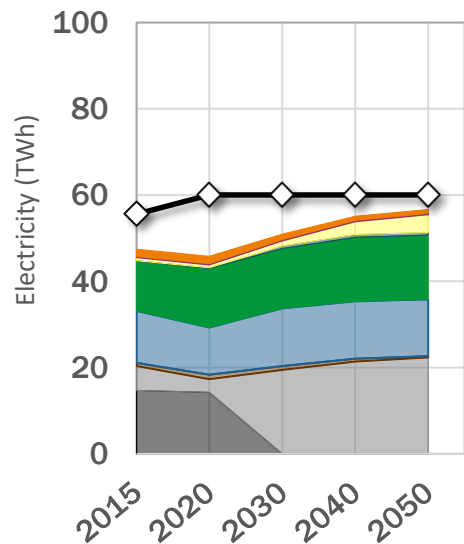


APREN/FCT-UNL

RES-E CONSERVATIVE

MITIGATION - 60%

MITIGATION - 75%



- Wind
- Geothermal
- Coal
- Wind Offshore
- Solar
- Natural Gas
- Bioenergy
- Hydro
- RES-E (Right Axis)

In the scenarios hydro supplies 1/4 of the Portuguese electricity consumption!





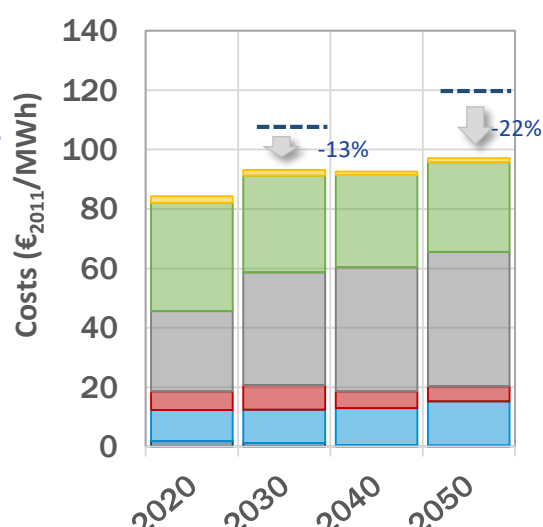
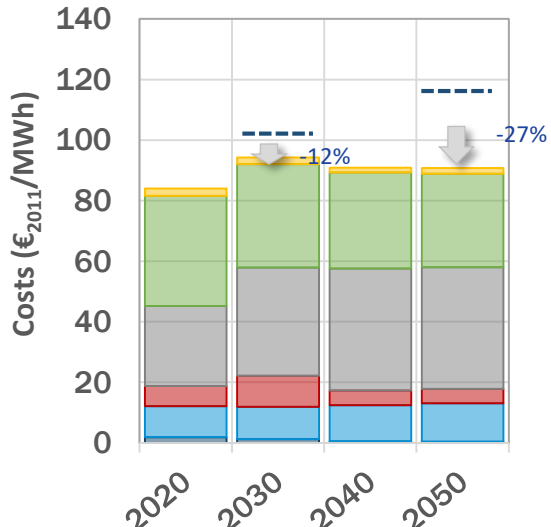
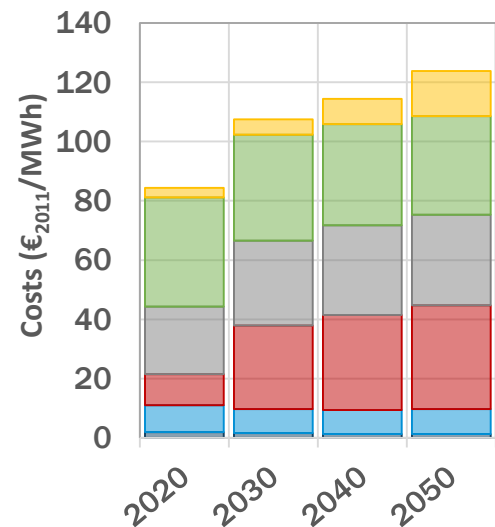
Costs of the Electricity System

APREN/FCT-UNL

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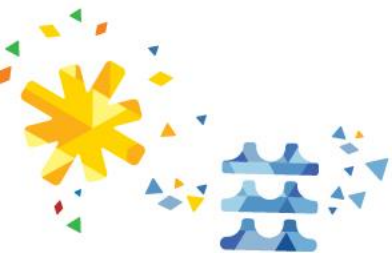
MITIGATION - 75%



Renewable Electricity (%)

■ O&M Variable
 ■ O&M Fixed
 ■ Fuel
 ■ CAPEX
 ■ Network - T&D
 ■ C02

SCENARIOS WITH MORE RES-E LEAD TO LOWER COSTS OF THE ELECTRICITY SYSTEM



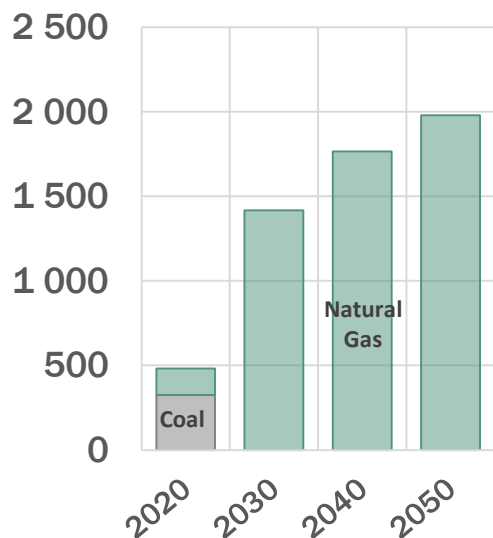


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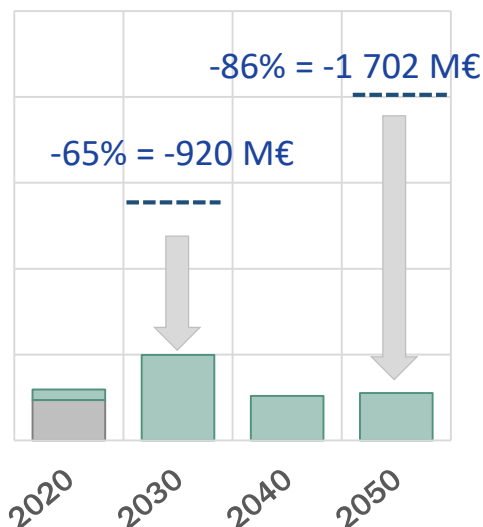


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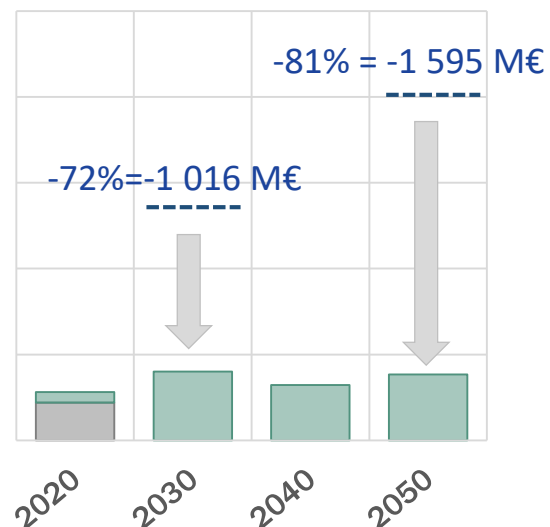
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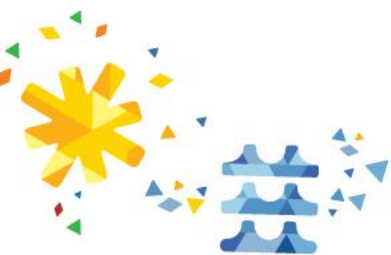
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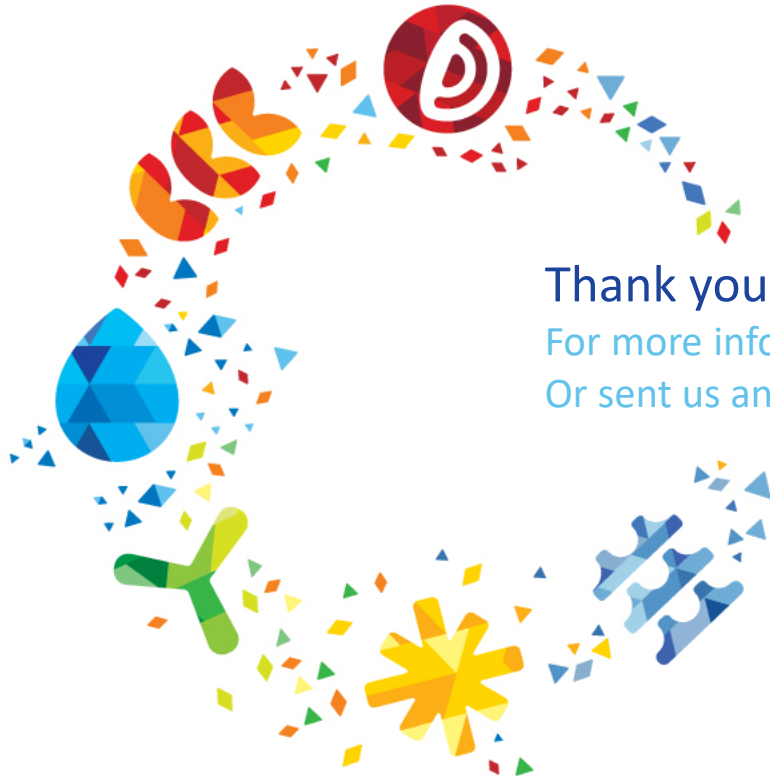


MITIGATION - 75%



FROM 2030 ONWARDS SAVINGS ON ENERGY BILL CAN REACH VALUES ABOVE € 1 BILLION PER YEAR, EQUIVALENT TO 28% OF THE PORTUGUESE ENERGY IMPORT BALANCE OF 2015.





Thank you!

For more information please: www.apren.pt

Or sent us an e-mail for: dep.tecnico@apren.pt



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