



APREN Associação
de Energias
Renováveis

EREF

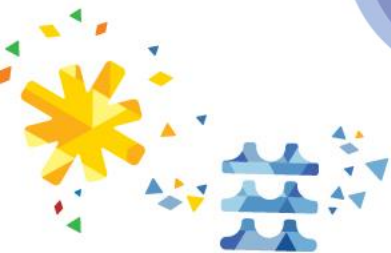
European Renewable Energies Federation



APREN-EREF EU-Portuguese Energy High-level Workshop

Portugal - on the way to a decarbonised energy system?

LISBON | 9th of May of 2018





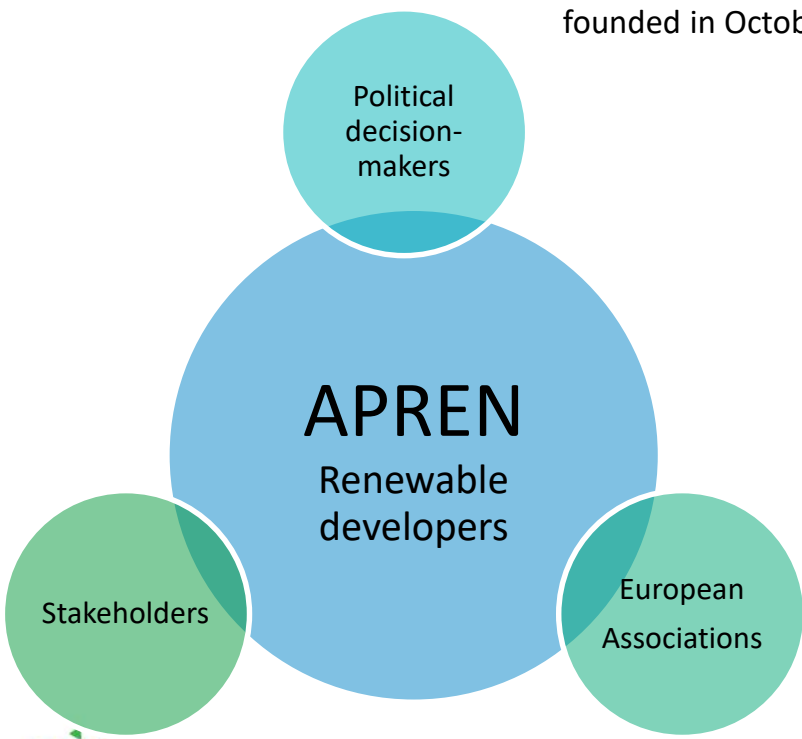
António Sá da Costa, President of APREN
Portugal - on the way to a decarbonised energy
system?



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



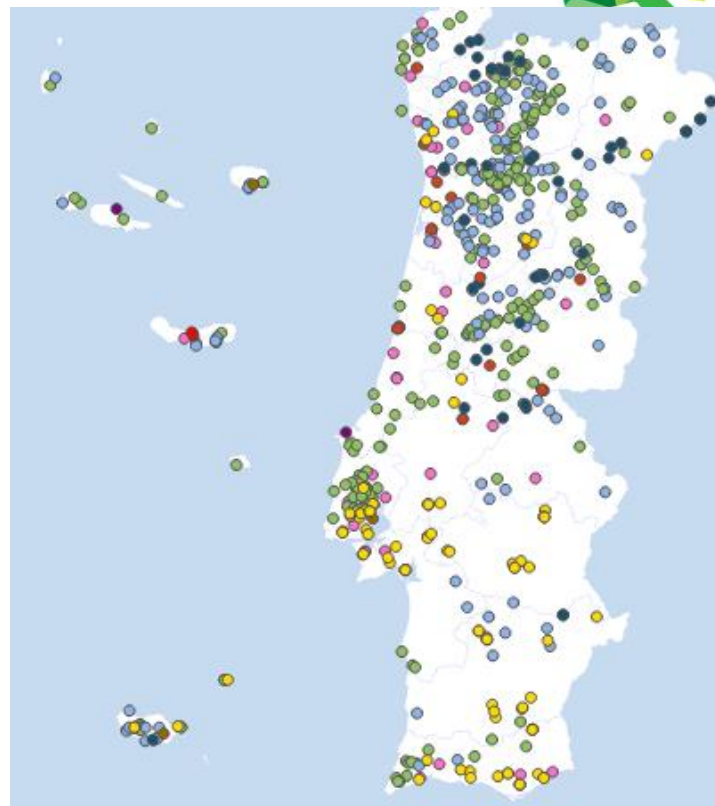
Collaboration with different entities:

- 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 %

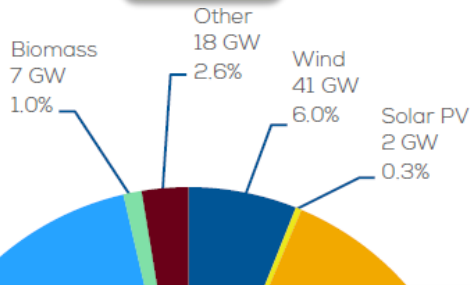
Note: To calculate APREN's share, was considered the values from DGEG publication "Quick Statistics - Renewables, December 2017". Micro and Mini-production units were excluded.



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

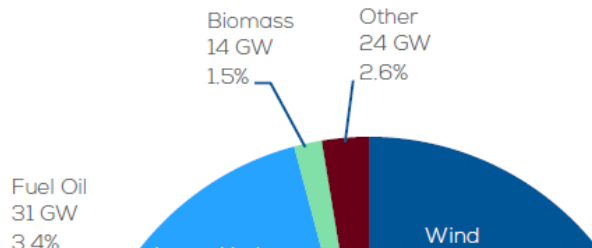
European Electricity Sector

2005



In 2016, the renewable power plants accounted for 44 % (405 GW) of the overall European power capacity (918 GW).

2016

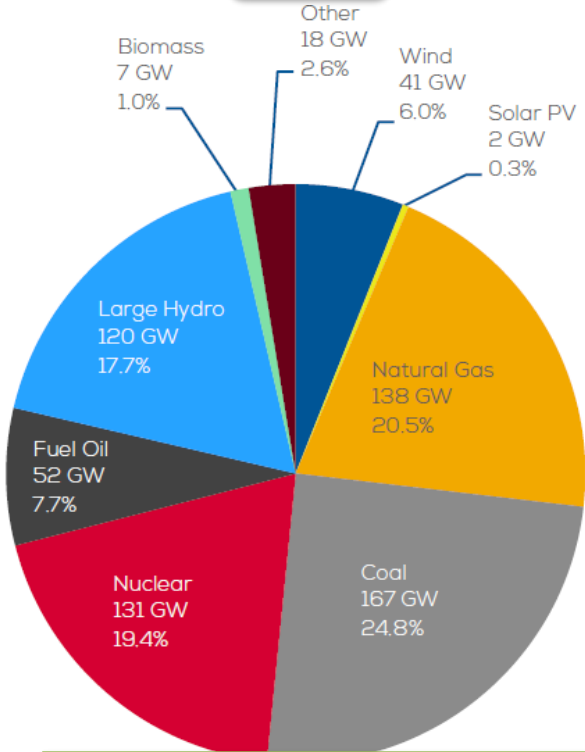


In 2005, the renewable power plants accounted for 25 % (170 GW) of the overall European power capacity (538 GW).

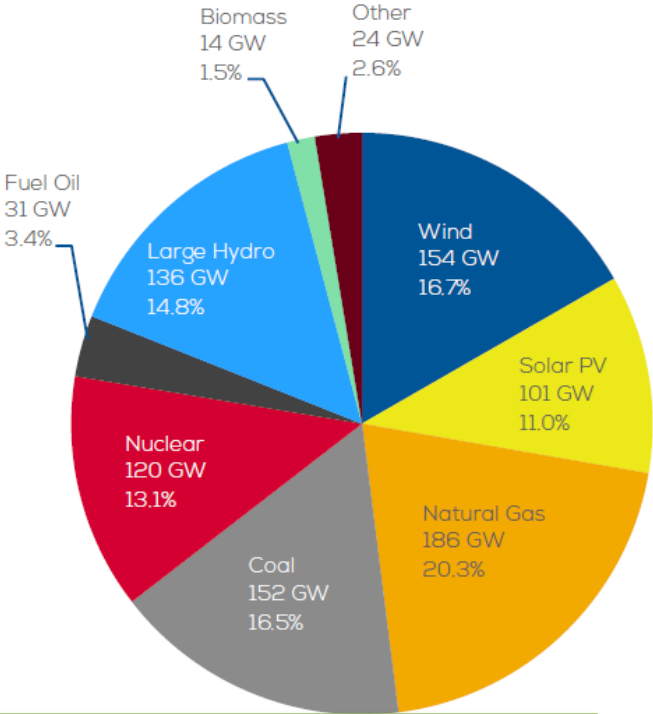
Source: 2016 European statistics, Wind Europe

European Electricity Sector

2005



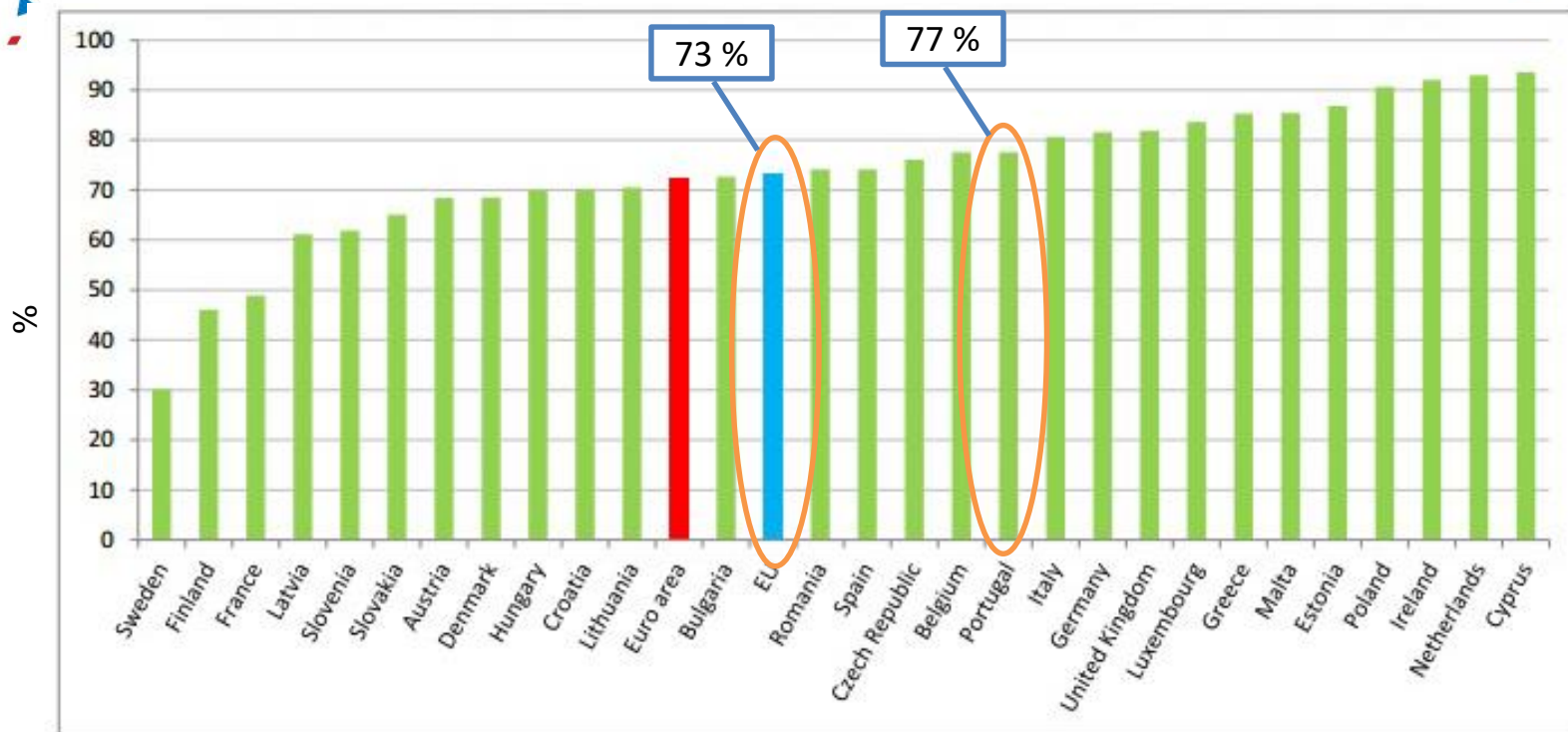
2016



In 11 years the renewable technologies more than doubled their installed power capacity.



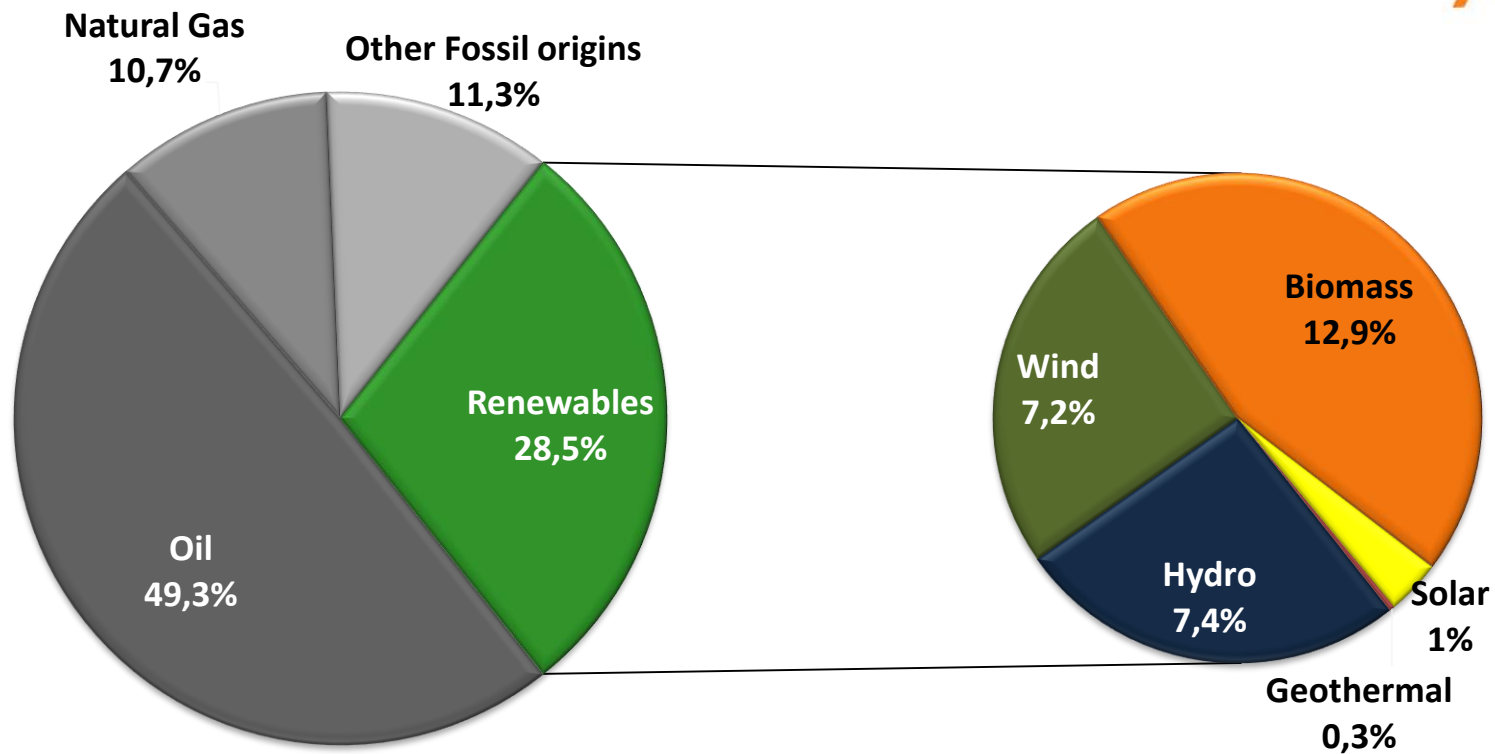
European Electricity Sector



Share of fossil fuels in energy consumption of the EU Member States

Source: European Commission, 2015

Portuguese Energy Sector 2016

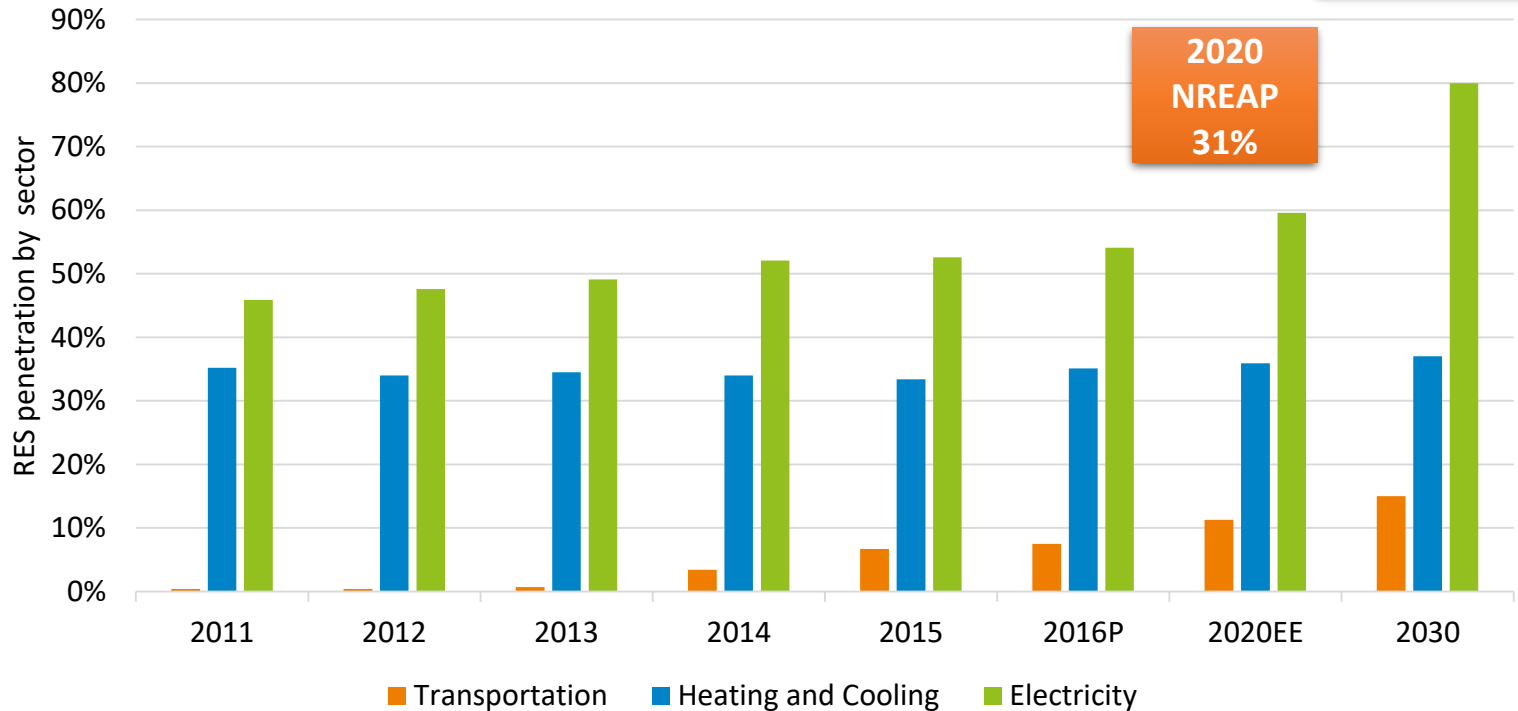


Renewables' share in the energy sector (electricity, transports and heating and cooling)

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

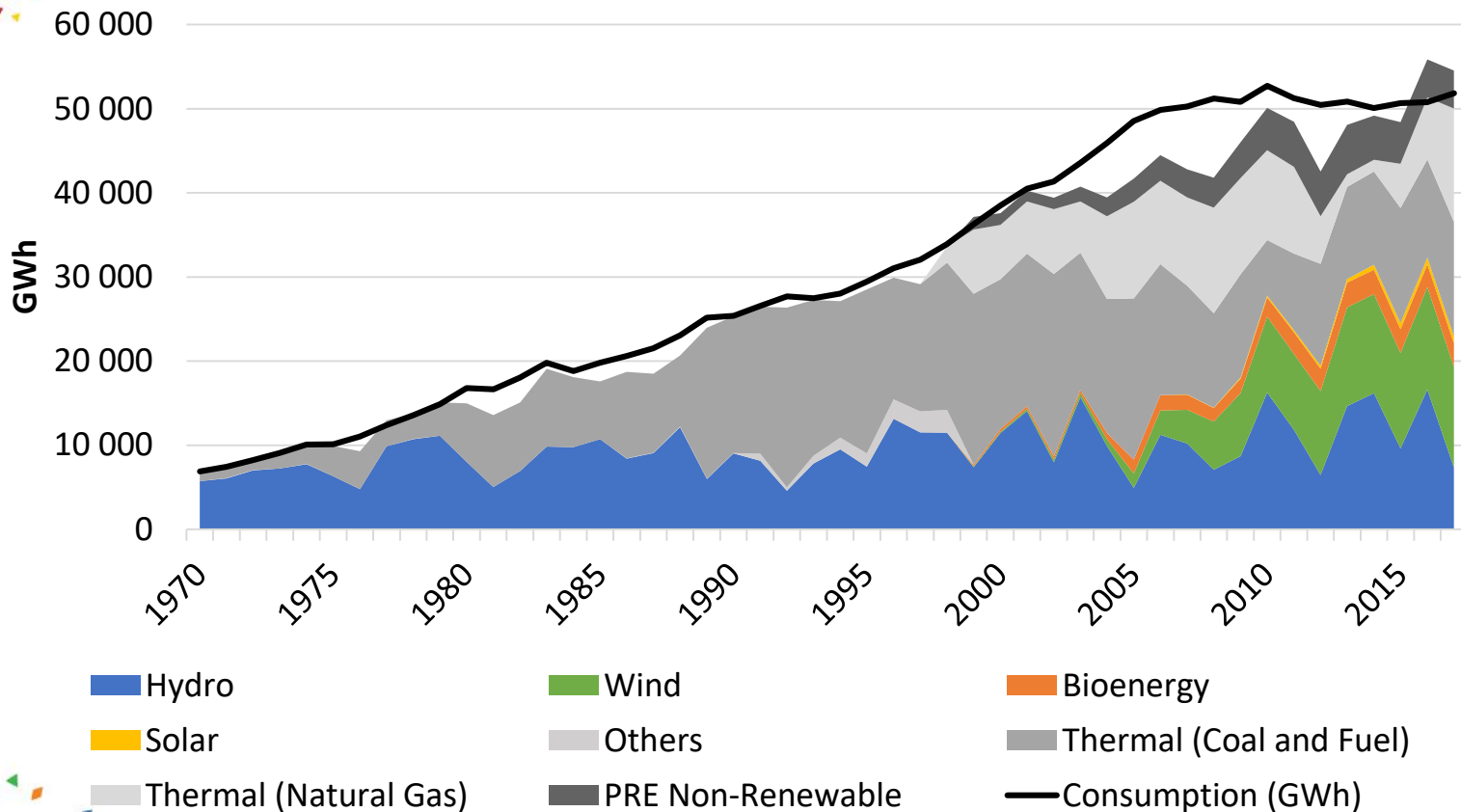
Portugal Renewable Energy Targets

2030
(In discussion)
>40%



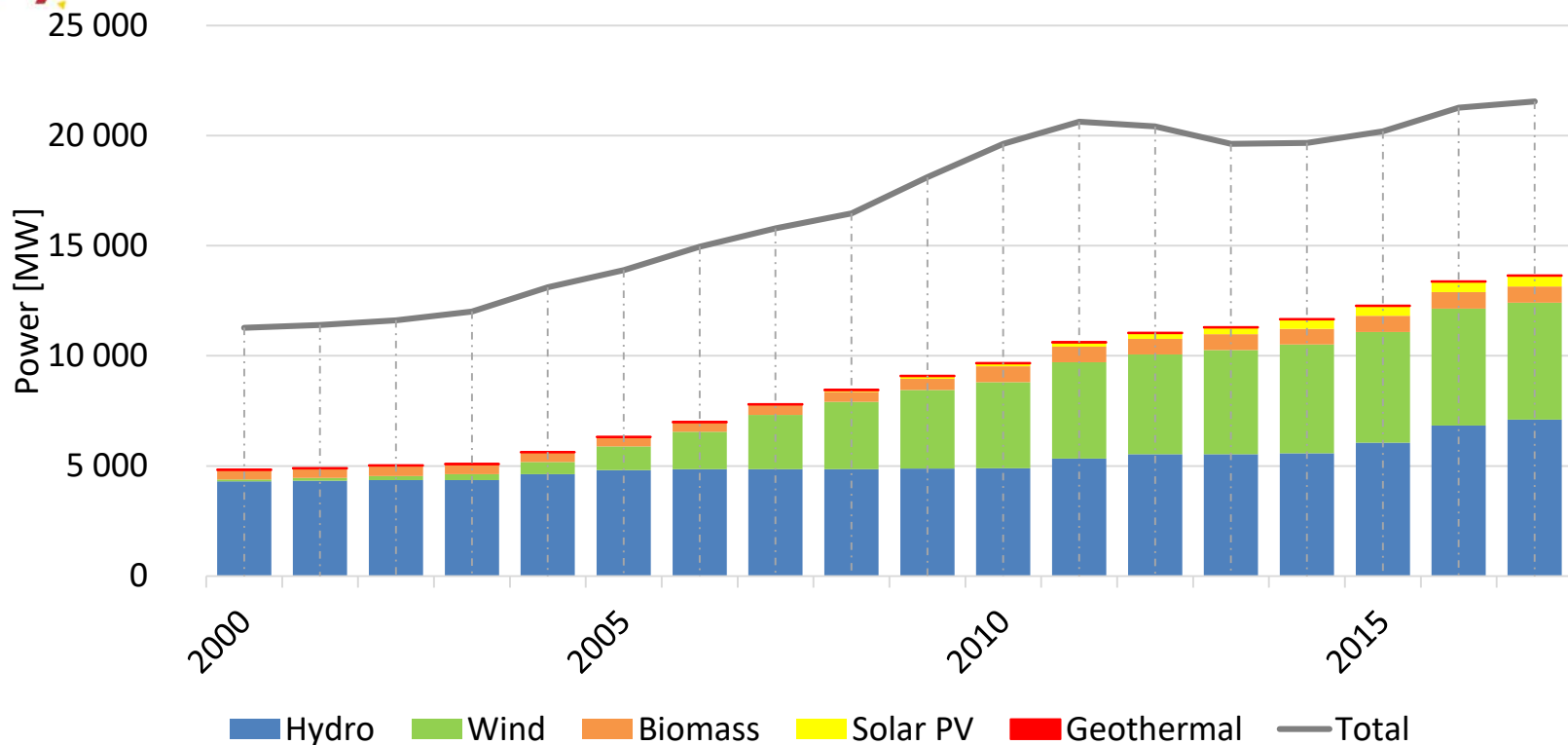
Source: PNAER, Compromisso para o Crescimento Verde

Evolution of the Mainland Portugal's Electricity Mix



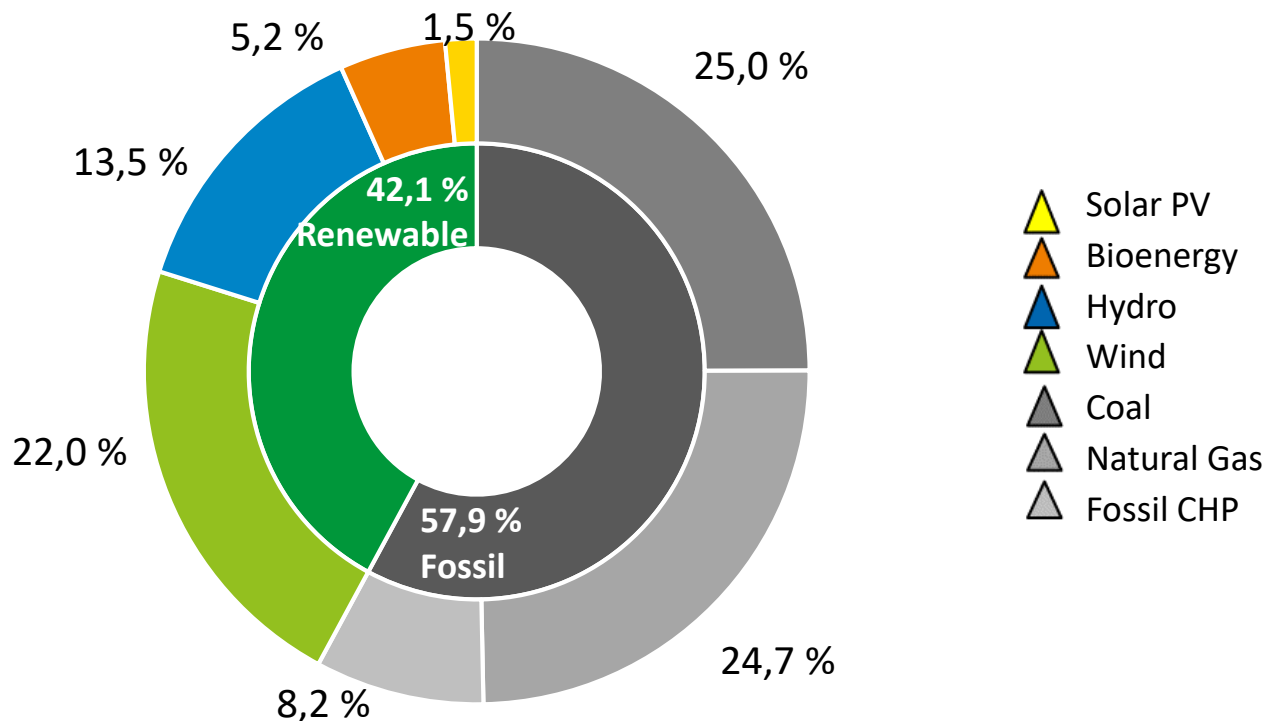
Source: REN, EDP; APREN's Analysis

Evolution of the Portuguese Power Capacity



Source: DGEG

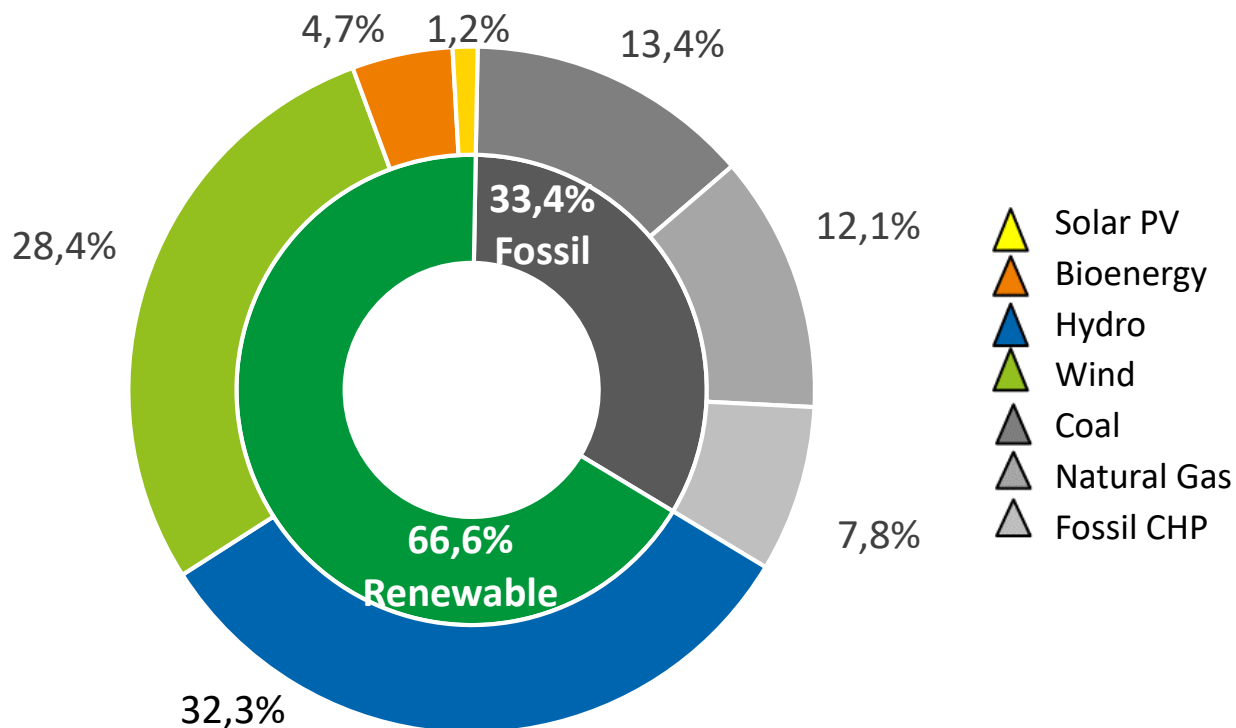
Mainland Portugal's Electricity Production Mix - 2017



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)

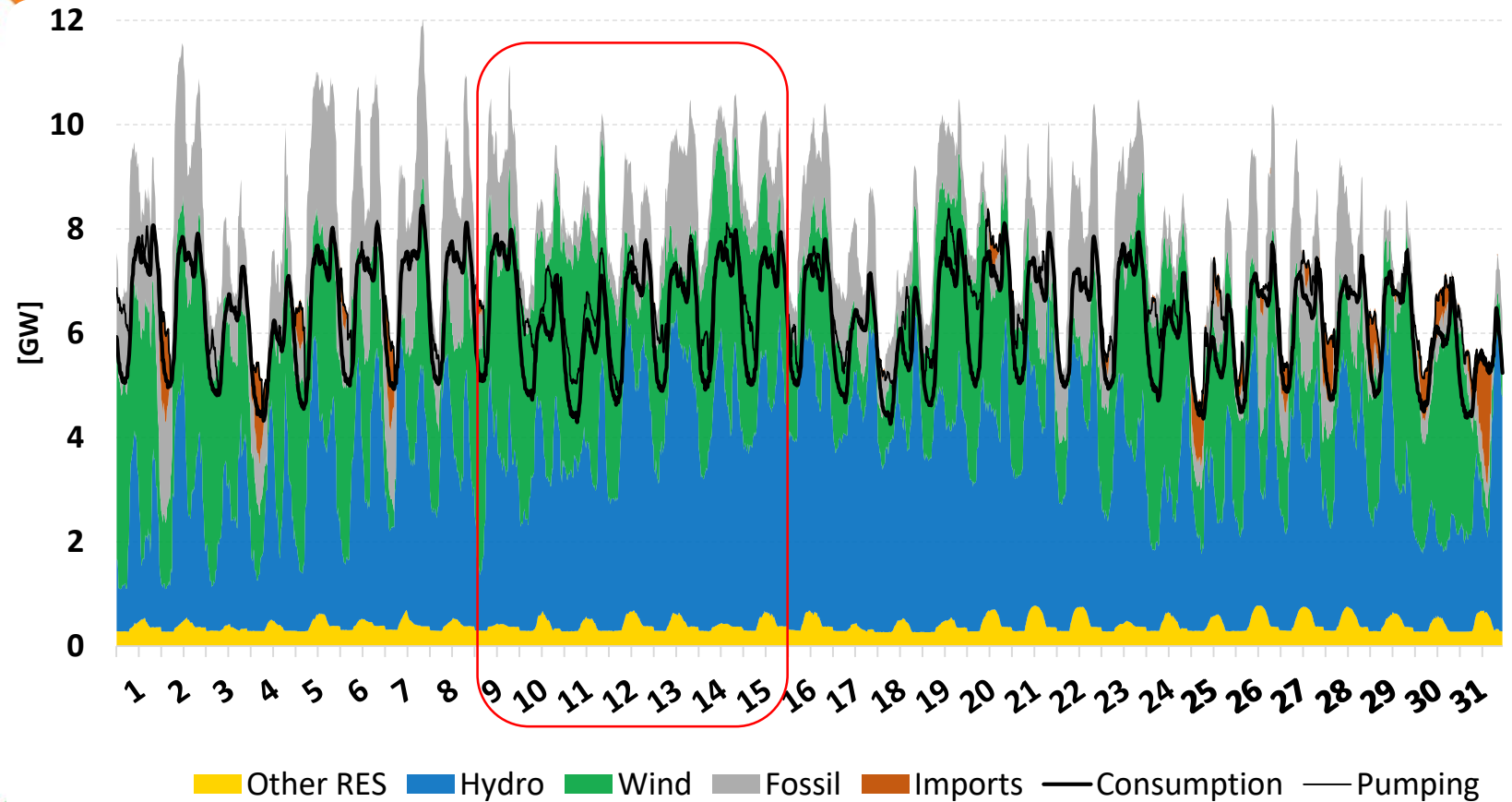
Mainland Portugal's Electricity Production Mix - 2018



Source: REN

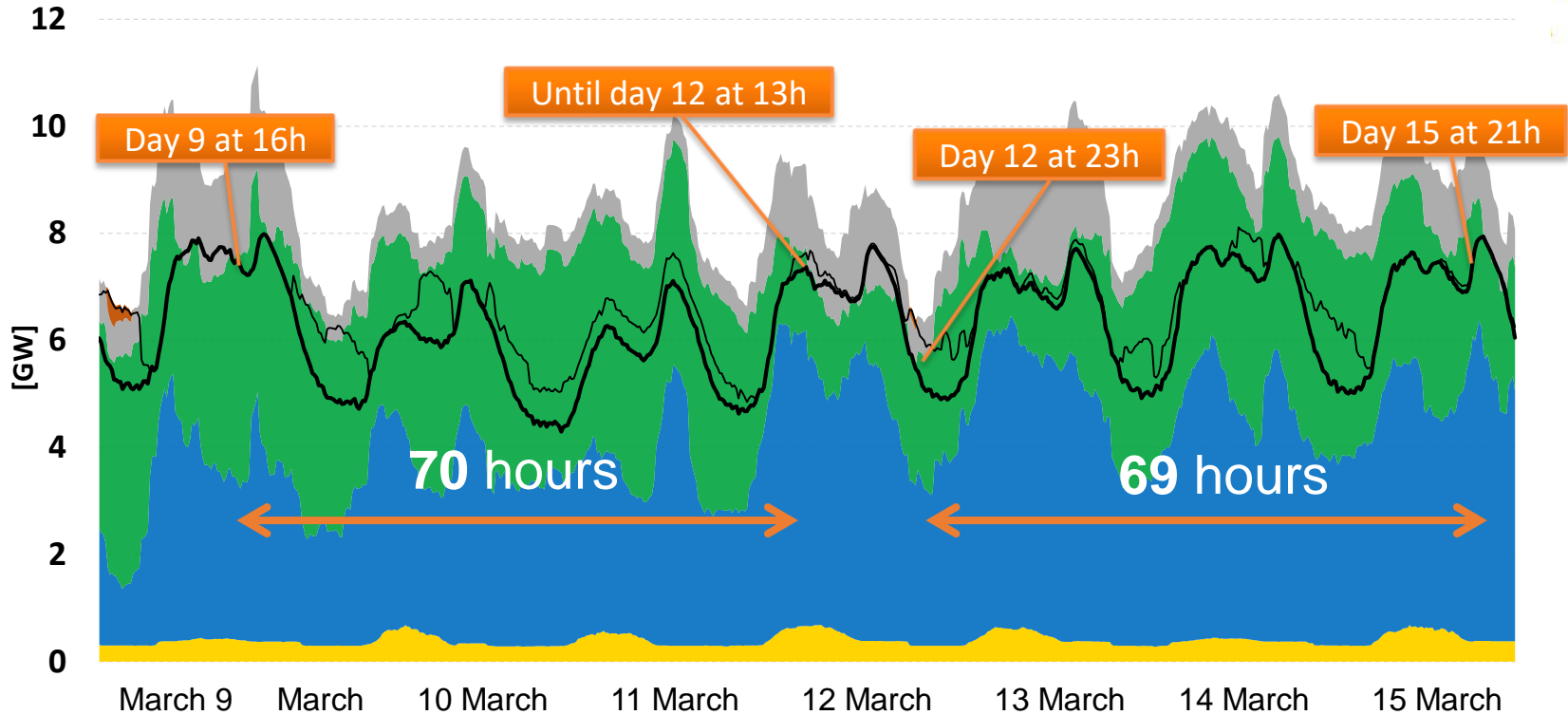
- Until the end of April of 2018 renewable sources accounted for 66,6 % (13,067 GWh) of the total electricity generated in Mainland Portugal (19,607 GWh).

Load Diagram of March 2018



Renewables = 103.6 % of the Consumption

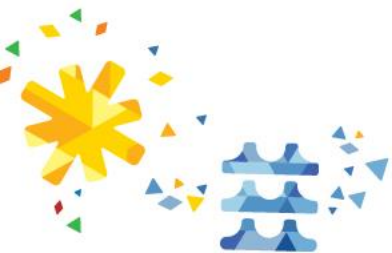
Load Diagram of March 2018



Other RES Hydro Wind Fossil Imports Consumption Pumping



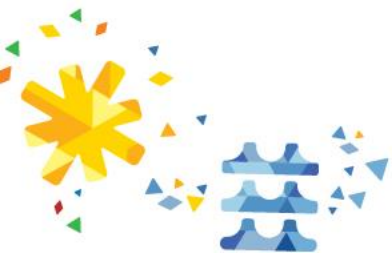
Electricity System with 100 % RES





**ARE RENEWABLES GOOD FOR
PORTUGAL?**

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



Job Creation Industrial Cluster



Factory's Location	Products
Viana do Castelo	Generators, Towers and Blades



Factory's Location	Products
Moura	Solar Panels



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

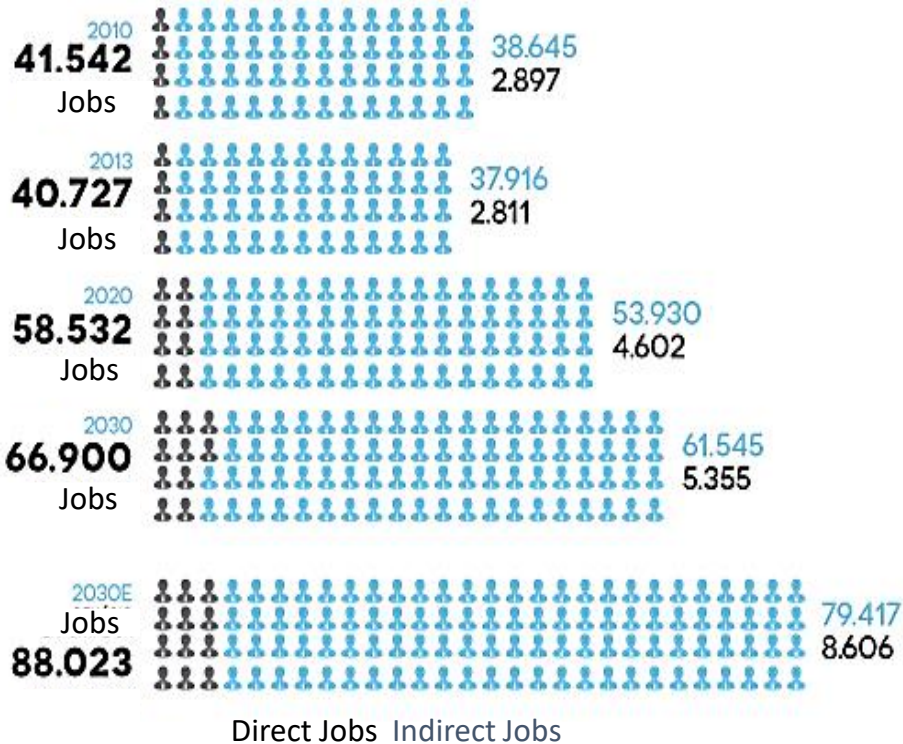


Factory's Location	Products
Maia and Arroiteia	Electrical Components

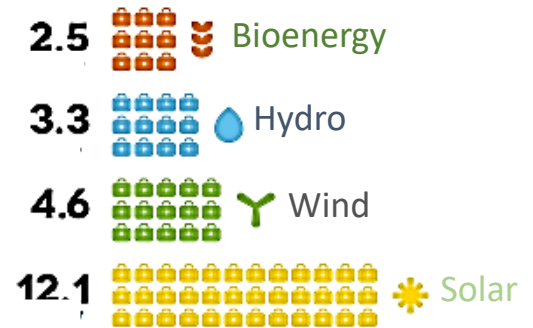


Job Creation

RENEWABLE ELECTRICITY POSITIVELY IMPACTS THE JOB CREATION [# Jobs]



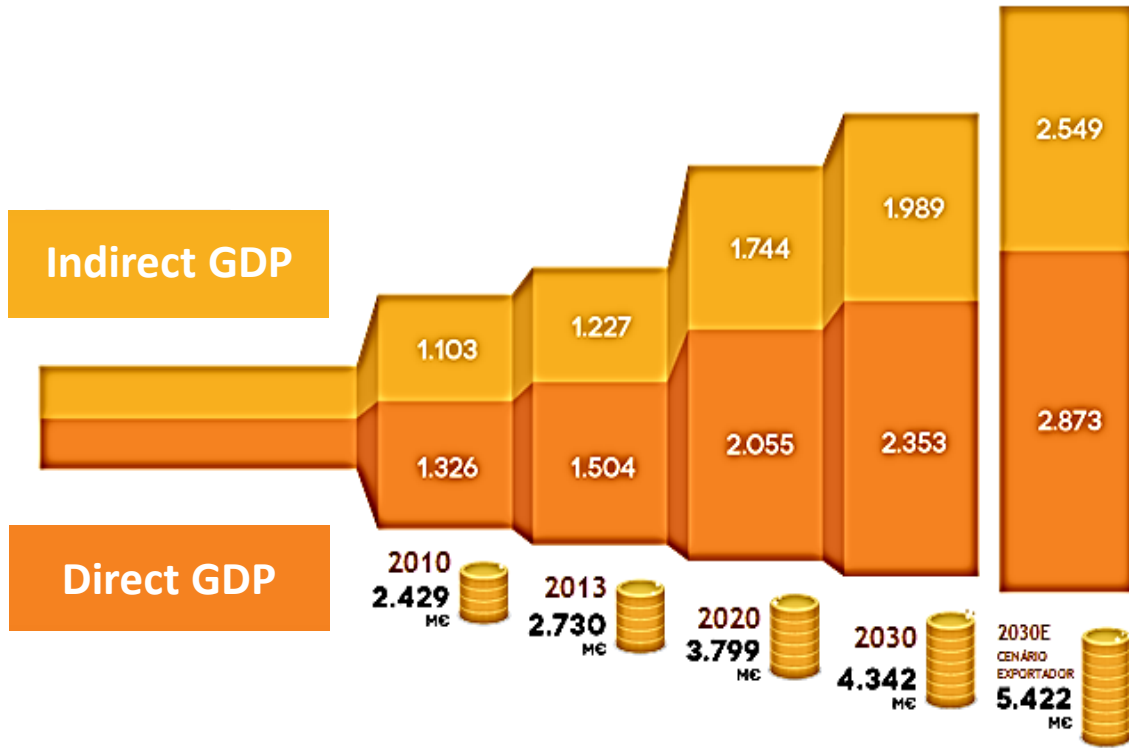
JOBS CREATED BY INSTALLED MW PER TECHNOLOGY BETWEEN 2010 AND 2013 [# Jobs/MW]



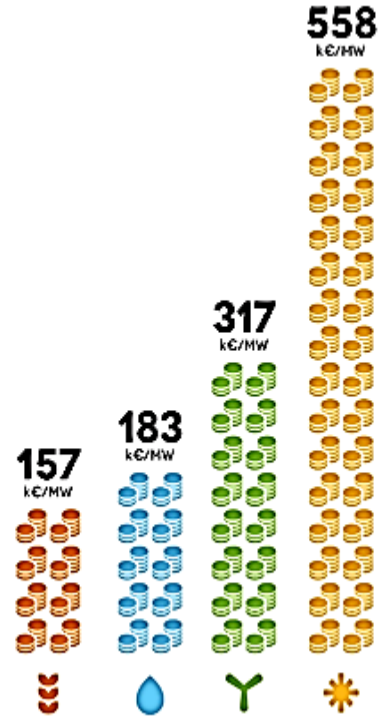
COMPARISON BETWEEN GDP CONTRIBUTION OF RENEWABLE ENERGY SECTOR AND THE GENERAL LABOUR FORCE [k€]



National GDP



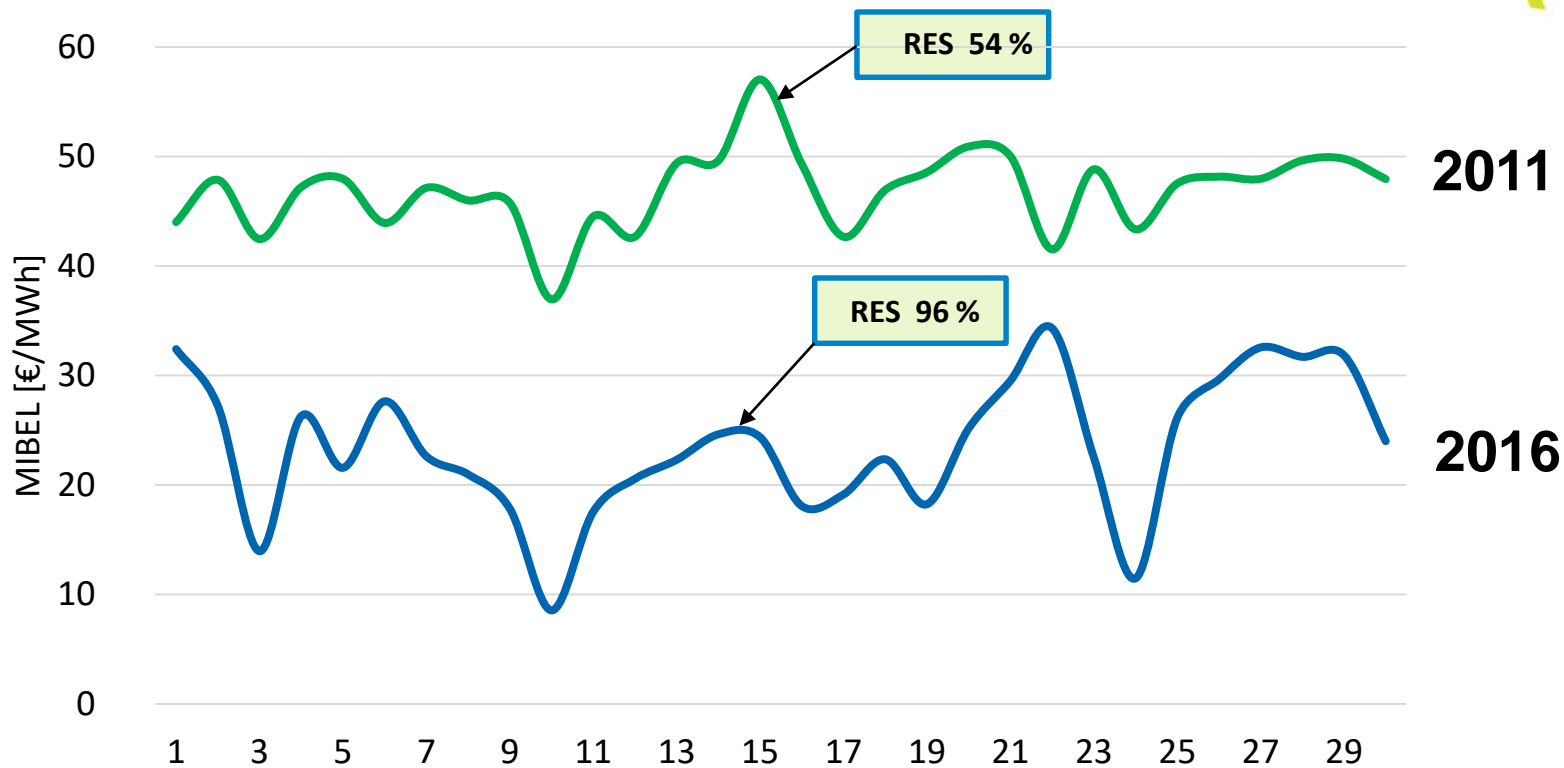
GDP GROWTH FOR TECHNOLOGY per INSTALLED MW BETWEEN 2010 and 2013 [k€/MW]



Bioenergy Hydro Wind SOLAR

RES IMPACT IN MIBEL

Real Case – April 2016 [Portugal]



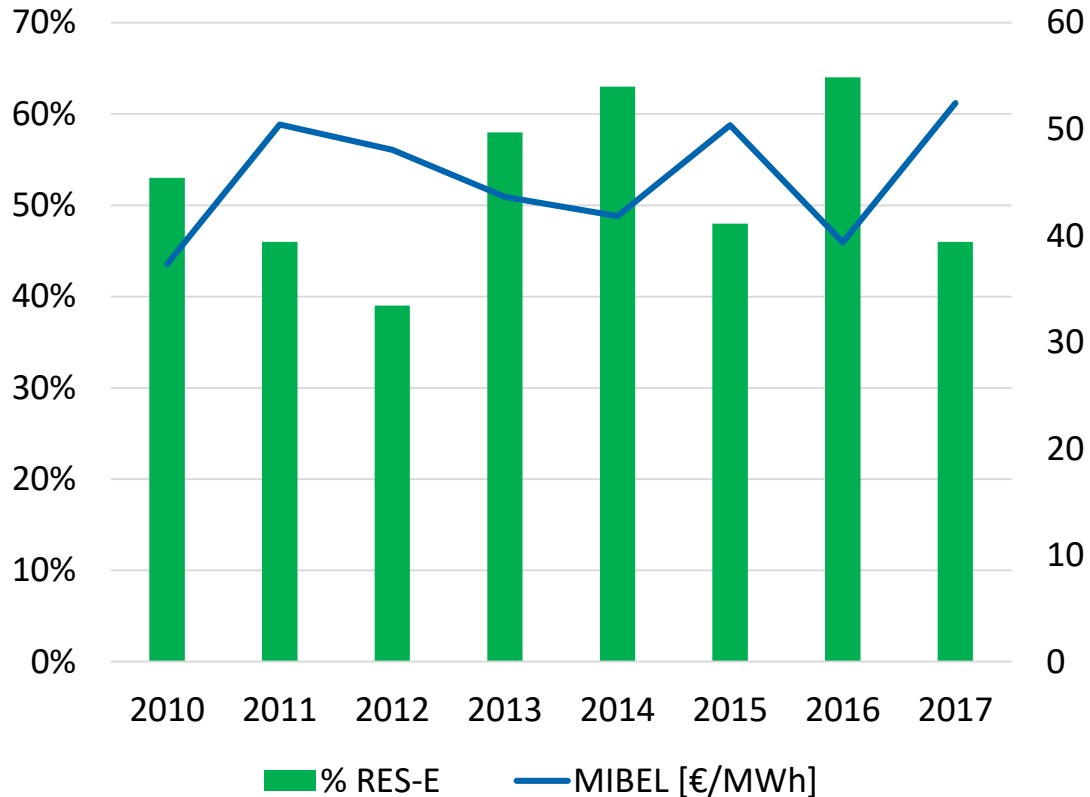
Source: MIBEL

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

RES IMPACT IN MIBEL

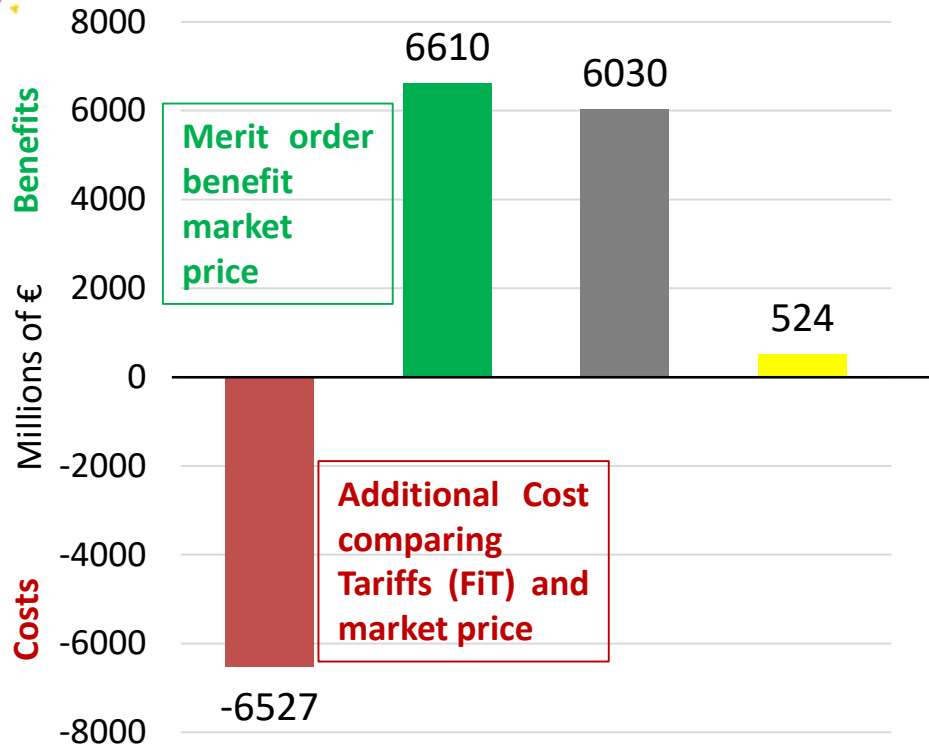
YEARLY ANALYSIS [Portugal]

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€.

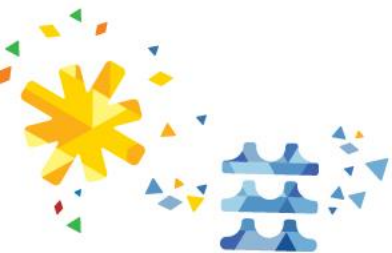
In addition there was benefits for the economy due to:

➤ Fossil Fuels Savings: 6 030 M€

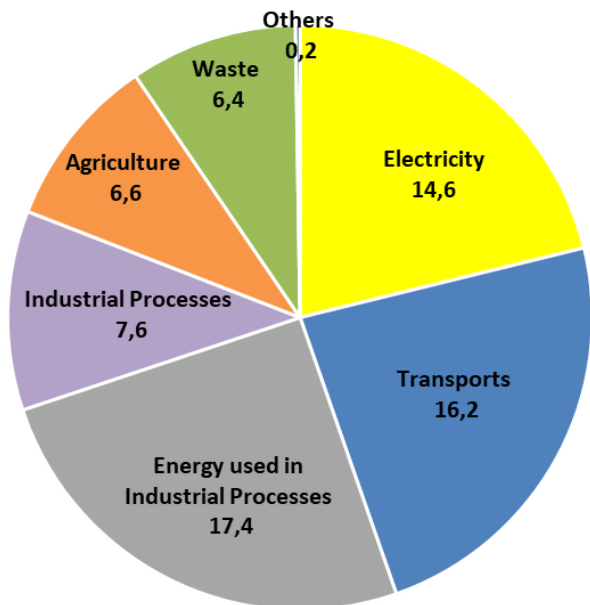
➤ CO₂ Emissions Savings: 524 M€



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

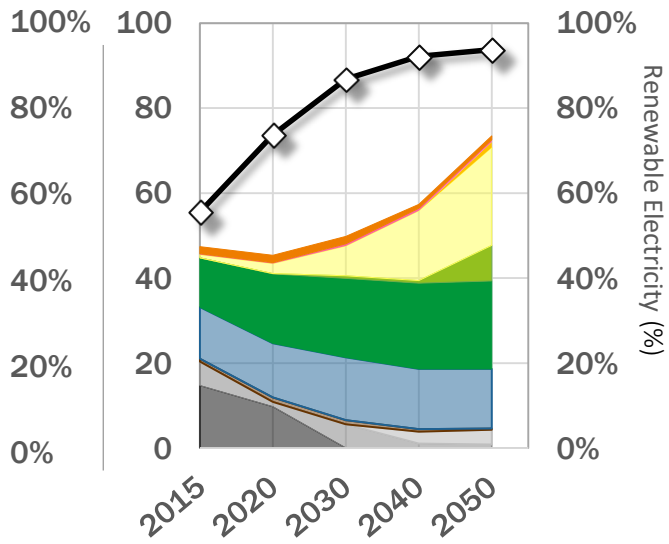
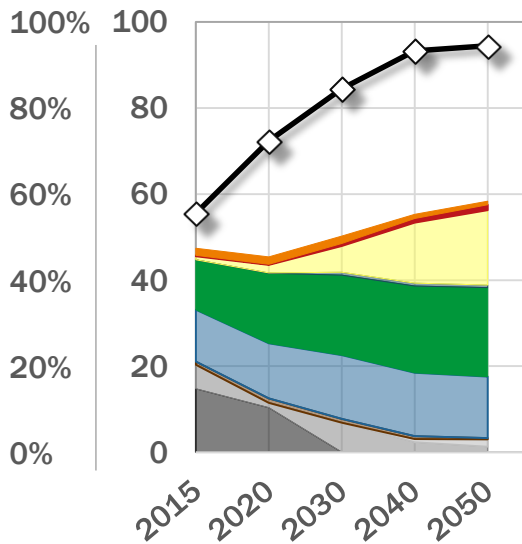
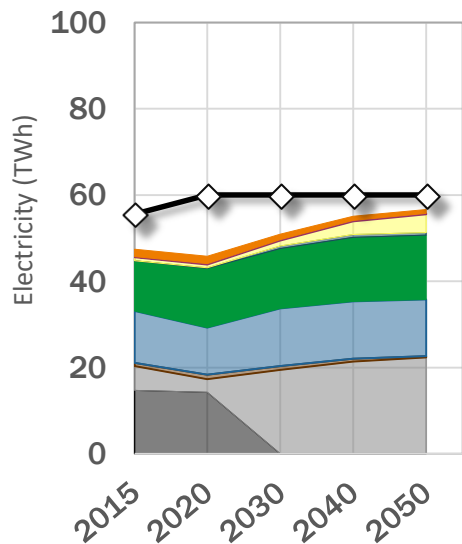


APREN/FCT-UNL

RES-E CONSERVATIVE

MITIGATION - 60%

MITIGATION - 75%



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

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





Costs of the Electricity System

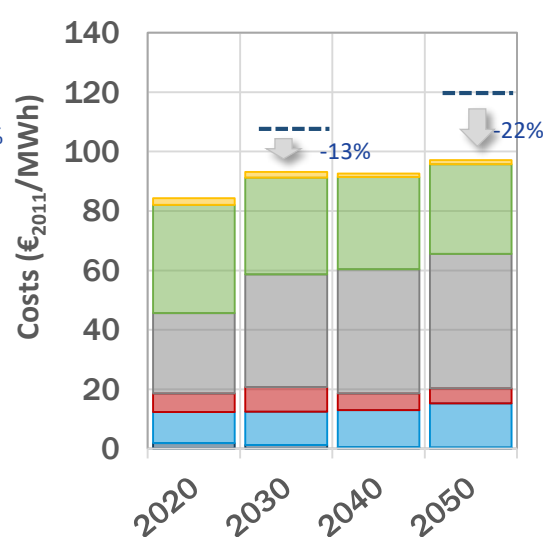
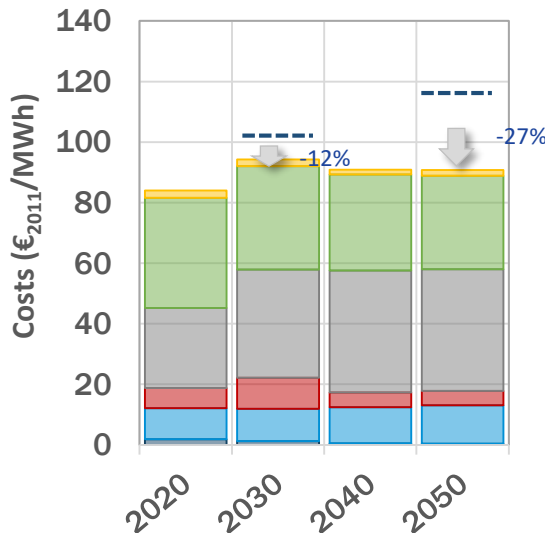
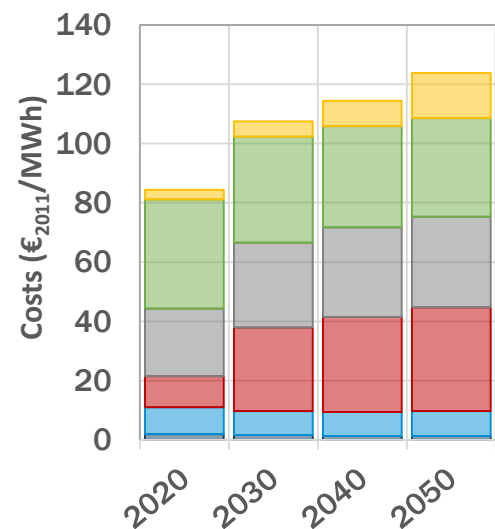


APREN/FCT-UNL

RES-E CONSERVATIVE

MITIGATION - 60%

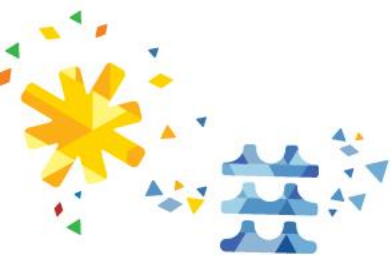
MITIGATION - 75%



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



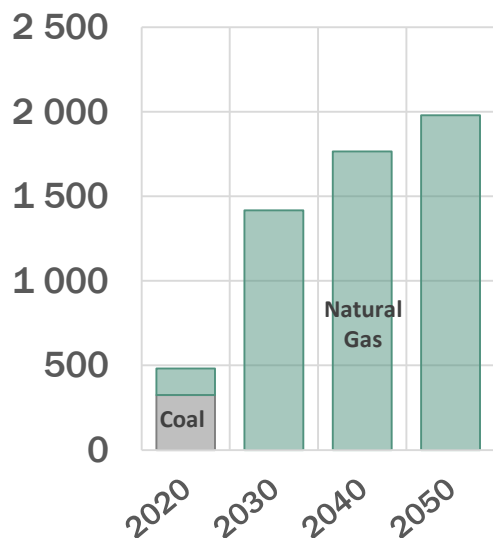


Costs of the Electricity System

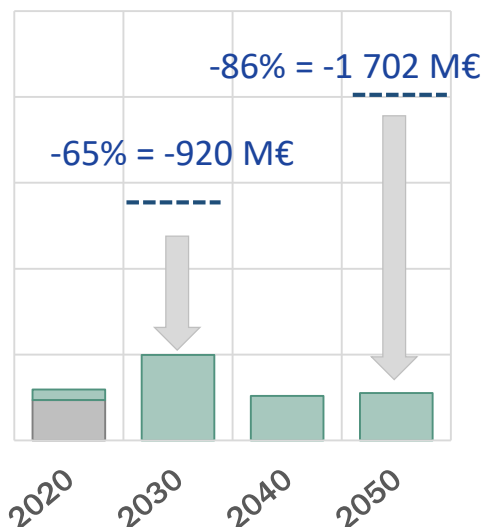


APREN/FCT-UNL

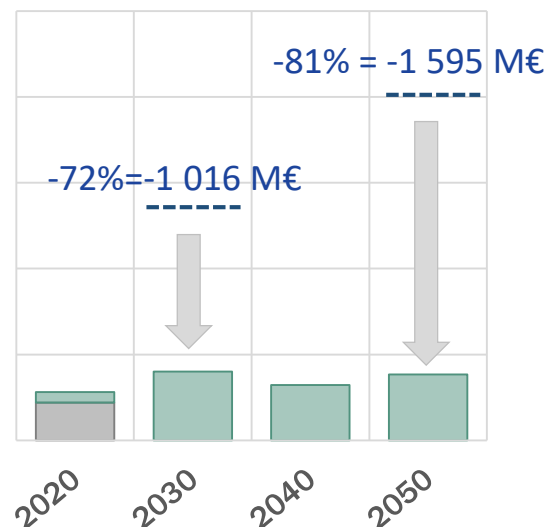
RES-E CONSERVATIVE



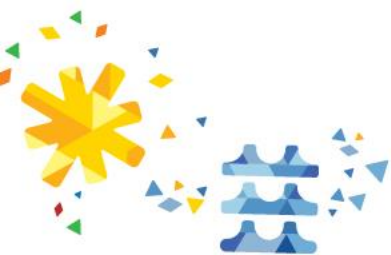
MITIGATION - 60%



MITIGATION - 75%

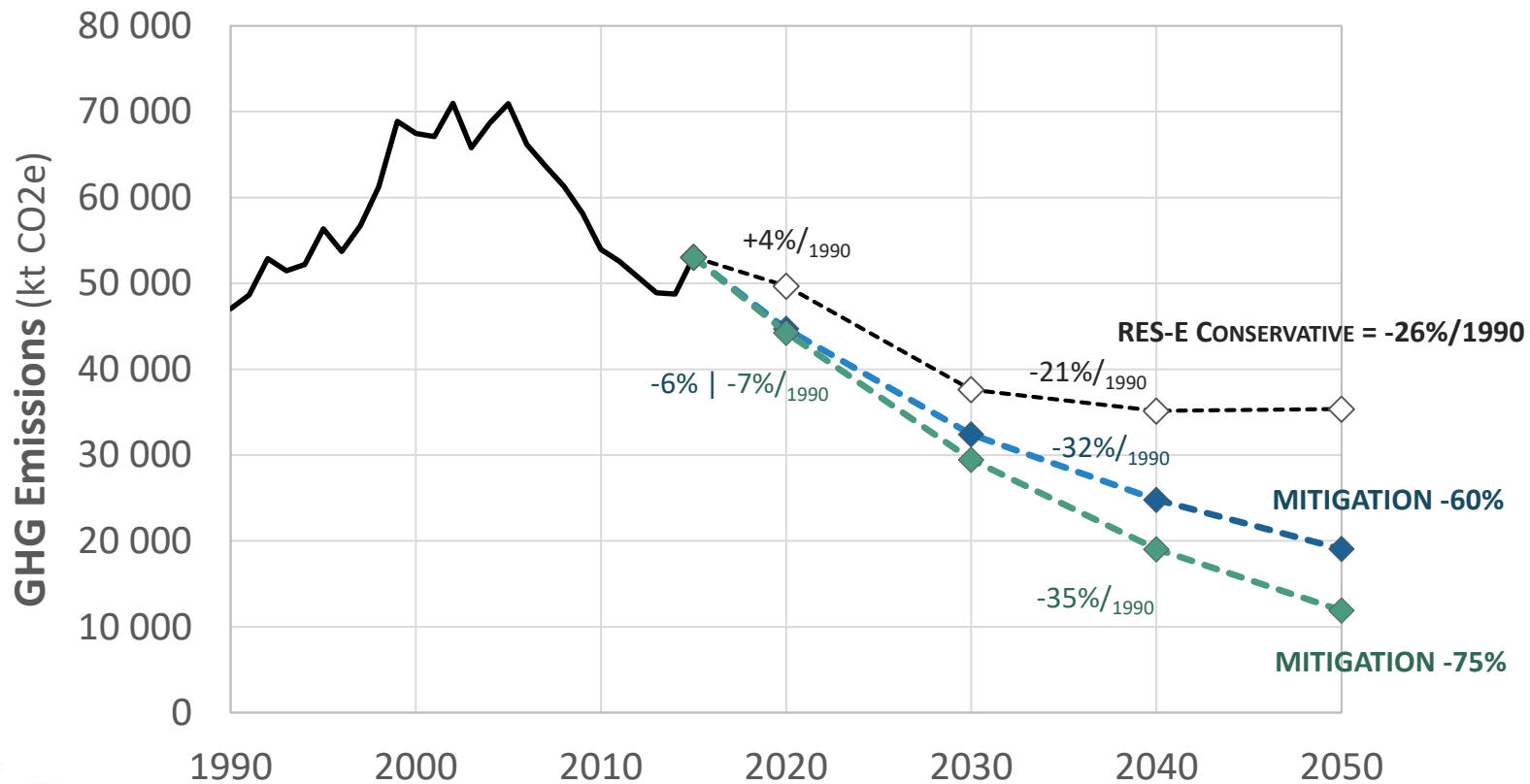


FROM 2030 ONWARDS SAVINGS ON ENERGY BILL CAN REACH VALUES ABOVE € 1 BILLION PER YEAR, EQUIVALENT TO **28%** OF THE PORTUGUESE ENERGY IMPORT BALANCE OF 2015.



GHG Emissions Energy + Industrial Processes

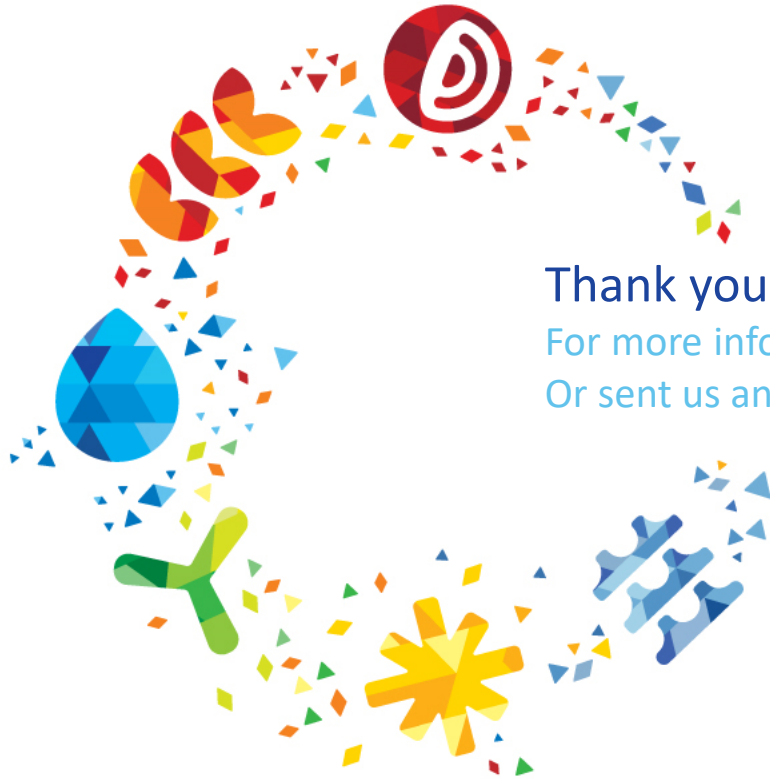
APREN/FCT-UNL



Summary

APREN/FCT-UNL

MAIN INDICATORS [ACCUMULATED VALUES FROM 2015 TO 2050]	RES-E CONSERVATIVE		MITIGATION -60%	MITIGATION -75%
			Δ/RES-E CONSERVATIVE	
PRIMARY ENERGY IMPORTS FOR ELECTRICITY GENERATION	PJ	5 357	-57%	-58%
GHG EMISSIONS RELATED TO THE ELECTRICITY SECTOR (CO2E)	kt CO ₂ e	414 986	-46%	-52%
GLOBAL COST OF THE ELECTRICITY SECTOR (INCLUDING CO ₂ 'S COSTS)	M€ ₂₀₁₁	190 651	-14%	-11%
ENERGY DEPENDENCY OF THE ELECTRICITY SECTOR 2050	%	56	10% (-46%)	10% (-46%)
NET JOBS	x 1 000	297	+74%	+92%



Thank you!

For more information please: www.apren.pt

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