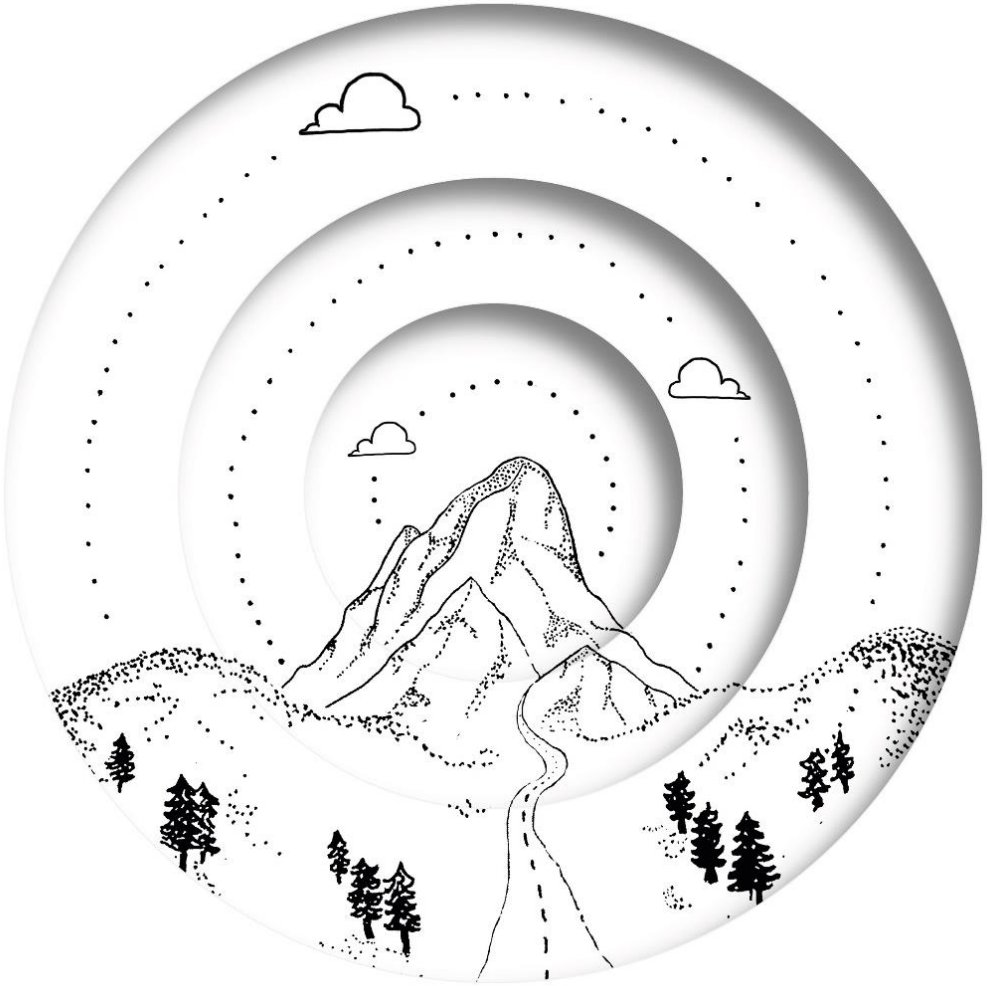
Deloitte.

ROMANIAN WIND ENERGY ASSOCIATION

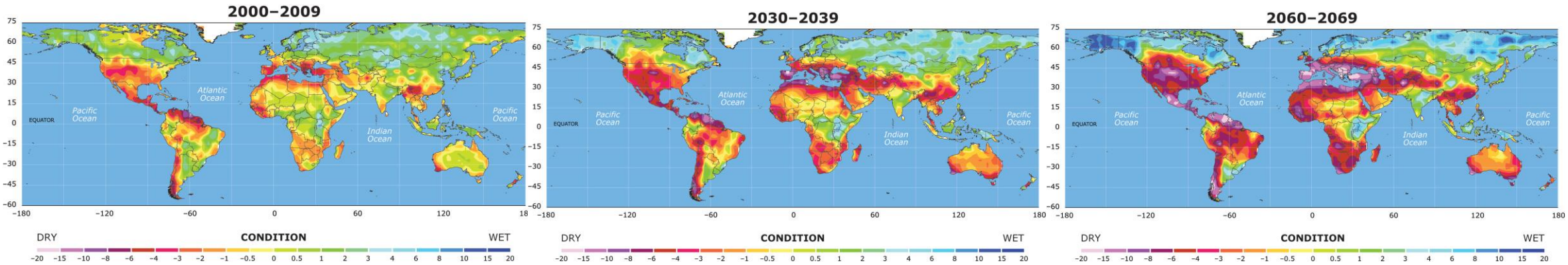


Towards a sustainable Romanian energy sector: Roadmap to RES in 2030

October 2018

Global context → 2ºC could be too much…

The new focus: Accelerating and Deepening the Transition to Sustainable Energy



We have 3 or 4 years in order to avoid 1.5ºC

- **Limit** the use of conventional cars, aircraft, trucks and ships
- Invest heavily in **carbon capture and renewable energy**, with state subsidies
- Invest in **insulation and electrification**
- **Build a welfare system** to support people and countries during the change

Source: United Nations Economic Commission for Europe, Accelerating and Deepening the Transition to Sustainable Energy, 2018

Global context → ...but 1.5ºC is the new target

Reducing global warming to 1.5ºC requires rapid, far-reaching and unprecedented changes in all aspects of society

Global man-made CO_2 emissions will need to **decline by 45%** from 2010 levels by 2030, to keep the world on track

In the **industrial** sector, **CO_2 emissions** would need to **reduce around 75-90%** through electrification, hydrogen and carbon capture and storage

To hit 1.5ºC target, **renewables will need to supply around 70% of electricity by 2050**.

In the **transport** sector, the **share of low-emission final energy** would need to rapidly ramp up from **less that 5% in 2020 to 35-65% in 2030**

Source: Global Warming of 1.5°C special report, Intergovernmental Panel on Climate Change (IPCC), 2018

Global trends

Enablers that are positioning renewable energy as the preferred "mainstream" energy source

GRID PARITY

Reaching price and performance parity on and off the grid:

- Globally, **wind and solar have reached grid parity** and are moving closer to performance parity with conventional sources

GRID INTEGRATION

Cost effective and reliable grid integration:

- Renewables have proved to be **less costly and difficult** to integrate than anticipated

TECHNOLOGY

Technology for automated, intelligent, blockchained and transformed renewables:

- **Automation** is dramatically **cutting time and cost** for **solar and wind production & operations**

Source: Deloitte Insights, Global renewable energy trends, 2018

**LCOE – Levelized cost of energy*

Romanian perspectives of the energy sector

Cost of RES will drive the future of the Romanian energy sector

Market forecast

- **Cost of technology will gradually decrease**, making RES cost competitive (grid parity for Romania is expected to be reached in 2025)
- For the 2021-2030 period, **the average investment in wind capacities will be ~ 1.086 EUR/kW and ~ 635 EUR/kW for solar capacities**
- The coal/ lignite plants **have to be refurbished** in order to be environmental compliant
- **Expanding the lifespan** of existing **nuclear facilities** and **commissioning U3 and U4** in 2030 and 2031, respectively
- The evolution of the consumption up to 2030 will be influenced by:
  - ✓ **electrification of transport**, reaching ~ 500,000 electric cars in 2030, and
  - ✓ the increase in electricity consumption in the residential sector (**electric heating and cooling)**

Infrastructure

- **Transition to smart grids** by introducing smart metering and grid digitalization
- Distribution and transmission systems modernization – **losses reduction**
- Develop **energy storage capacity** in order to ensure a proper balancing of RES
- **Interconnection** of the national electricity transmission network - **15%** (2030)
- Developing transport& distribution capacities for taking over **natural gas from the Black Sea**
- Expansion and modernization of **natural gas storage capacities**

Macroeconomics

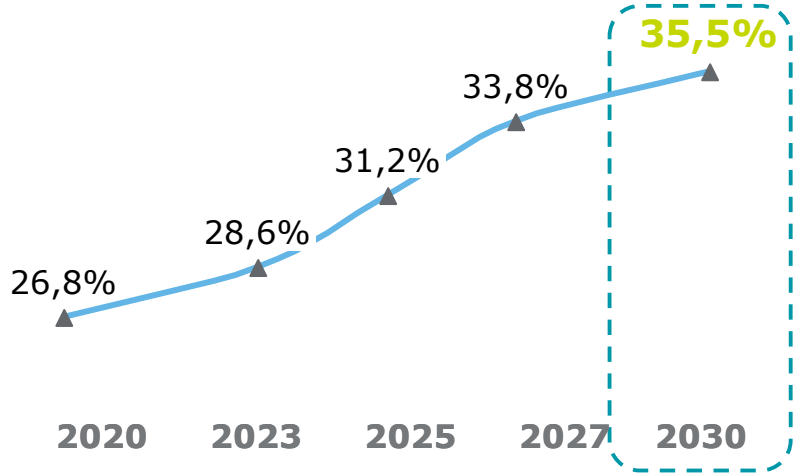
- In 2030 the electricity/ capita in Romania will reach **54%** of the 2015 EU average
- In 2020 the electricity/ capita in Romania will reach **45%** of the 2015 EU average
- Romania's population at the end of the analyzed period **~ 18 million people**

Source: Deloitte assumptions

RES roadmap for Romania: main results of the analyzed scenario

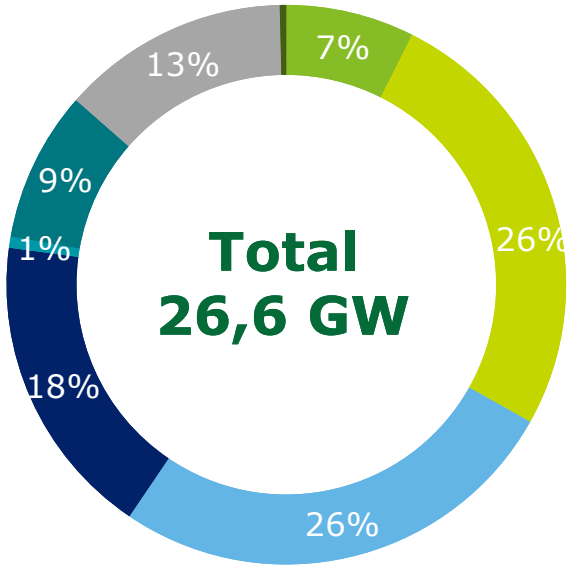
In 2030, the net installed capacity from renewable sources will be 64% higher compared to 2020

RES overall share, *[%]*

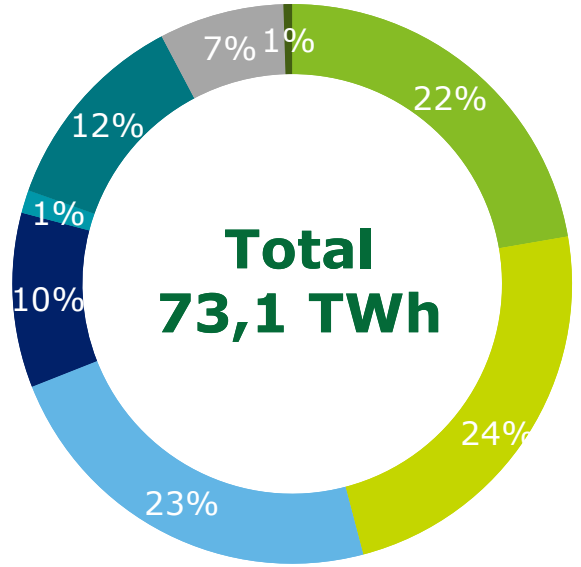


- Prohibitive environment costs for 3 coal units (CU)
- Increase of RES generation

Net installed capacity, by source, *[GW, %]*



Power electricity generation, by source, *[TWh, %]*



Source: Deloitte calculations

Spillover effects of the energy transition in Romania

Domestic investment in relevant economic sectors will generate 350 billion EUR in the Romanian Gross Domestic Product between 2021 and 2030

2021

2030

220 BILLION EUR

TOTAL INVESTMENTS IN ECONOMIC SECTORS

79.4 BILLION EUR

OF WHICH DOMESTIC INVESTMENTS

MULTIPLICATOR: **4.4**

350 BILLION EUR

IMPACT IN GDP

INVESTEMENTS IN:

Automotive — **41.9 BILLION**

- ✓ Manufacturing of electric vehicles, batteries and other components
- ✓ Development of recharging infrastructures
- ✓ New business models such as shared mobility

Construction — **19.2 BILLION**

- ✓ Energy rehabilitation of residential and service sector buildings

Source: Deloitte calculations

Policies and measures

Energy policies converge towards achieving the environmental targets set by the Paris Agreement, while maintaining national energy security

Develop predictable regulation for investments

- Ensure predictable regulation for investments in order to achieve lower capital costs

Ensure proper implementation of the Clean Energy Package

- Accelerate the development of well-designed and well-functioning electricity markets and improve the investment climate for clean power generation by fully implementing the Third Energy Package and the new Market Design legislation
- Engage in statistical transfers

Step up regional cooperation, integration and interconnected markets

- Ensure that existing grids and interconnection capacity are efficiently used to foster market integration

Remove regulatory and administrative barriers

- Remove barriers to enable integration of corporate PPAs
- Introduce certificates of origins system

Source: Deloitte expertise

Deloitte.