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# **Low Carbon Development Strategy for Croatian Electricity Sector Until year 2070.**

1-02

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# Low carbon development

- **Low carbon** development - becoming increasingly **important**
- The United Nations Framework Convention on Climate Change - **UNFCCC**
- Kyoto Protocol: last **COP21** was held in Paris - a legal binding agreement on climate and to keep global warming **below 2°C** above pre-industrial levels
- Low Emission Development Strategies - **LEDS**

# LEDS

- Highlights **disadvantages** and **prioritizes** activities for funding on the national level
- LEDS can be integrated and build on existing strategies (NSDS, NAMA...)
- Strategic plan:
  - promoting development pathway towards a **low-carbon sustainable development**
  - taking into account the **socio-economic** development **priorities** of the county

# LEDS development process

- **Political** support
- Important interested groups and stakeholders
- Institutional framework and **cross-sectoral** coordination body
- **Collection and analysis of data**,
- Identification of:
  - greenhouse gas emission **scenarios** and **projections**
  - climate change mitigation **policies** and **measures**
- Climate change measures **application** and **monitoring**.

# Croatian LEDS

- **Fundamental** document in the field of climate change mitigation
- Economic, development and environmental aspects
- Objective: to achieve a **competitive low carbon** economy by 2050 in line with relevant guidelines
- Contains three scenarios:
  - **NUR** - referent scenario
  - **NU1** - scenario of the **gradual** transition
  - **NU2** - scenario of the **strong** transition

# Croatian LEDS:

## Available **technical** measures

- **Energy efficiency** of residential and non-residential buildings
- **Smart grids**
- New **CHP** and central heating systems (**CHS**)
- Increase share of **RES**
- **Alternative fuels** for transport
- **Electrical** vehicles
- **Afforestation**
- ...

# Croatian LEDS:

## Available **non - technical** measures

- Implementing climate policy in **sectoral strategies**
- Establishing **central body** for coordination
- Necessary **legal adjustments**
- New **educational** curriculum
- **ETS** adjustments
- Efforts to encourage **behavior change**
- ...

# Power system options

- Increasing **energy efficiency**
- Increased use of **RES**
- Increased use of **CHP**
- Switching to fuels with **lower GHG production rate**
- **Nuclear** option
- **CCS** technologies
- Reduction of **losses** in transmission and distribution systems



# Croatian power system model

- Modelled in the „**PLEXOS for Power Systems**“
- Time horizon: **until year 2070.**
- External **market unavailability** after year 2020.
- Power plants (existing and **expansion candidates**)
- **CCS** technologies
- Electricity and heat **load** for each scenario
- Projections of future RES (especially **wind** and **photovoltaic**) capacity

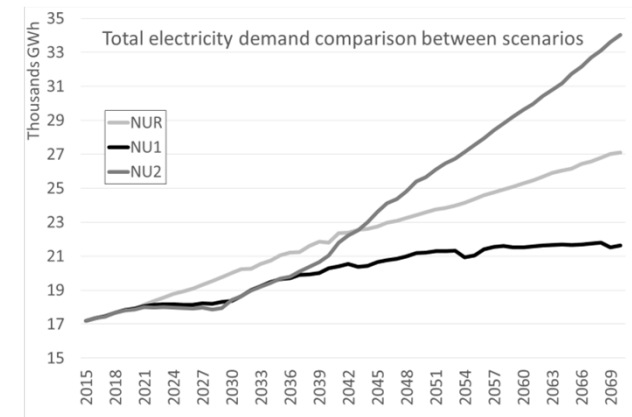
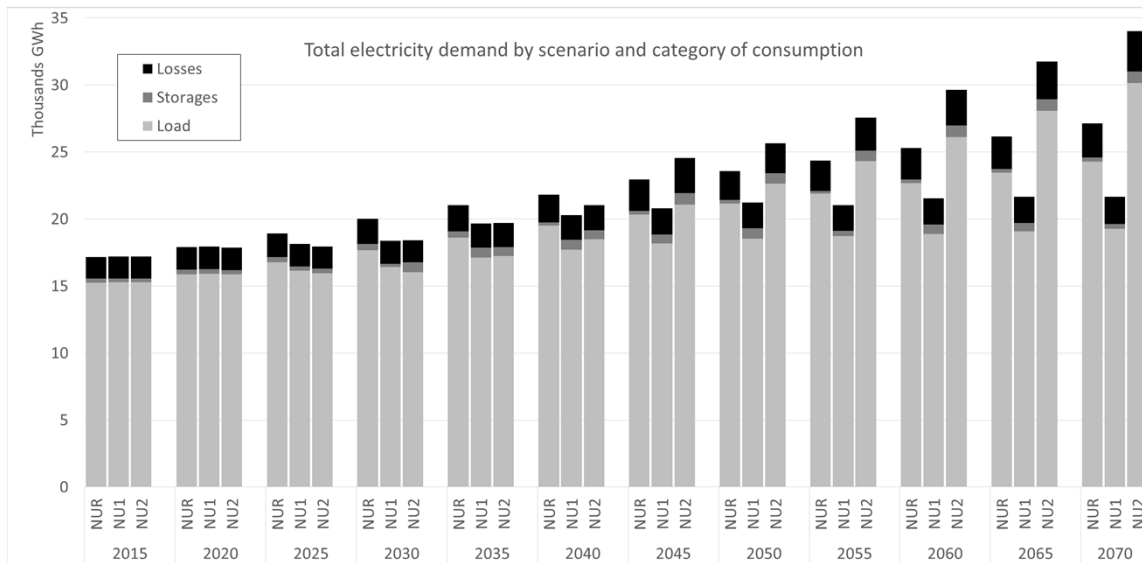
# Croatian power system model cont'd

- Power plants **outages** and new **entries**
- **Heat and steam** demand:
  - Cogeneration power plants
  - Heat boilers
  - Heat storage tanks
- **System reserve** capacity margin
- **Secondary reserve** providers:
  - Thermal power plants (gas) and
  - Hydro power plants



# Results...

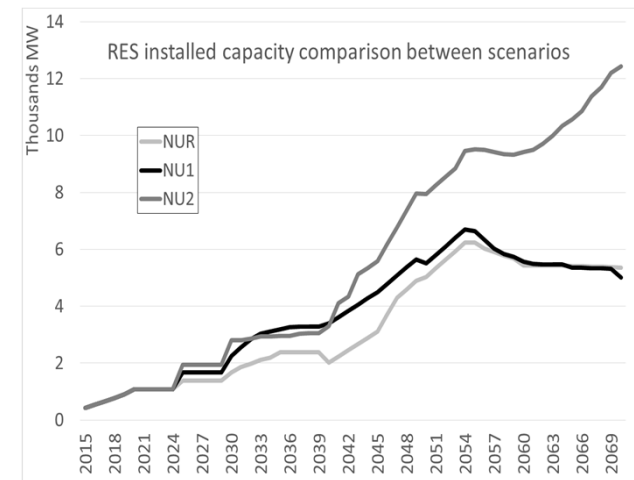
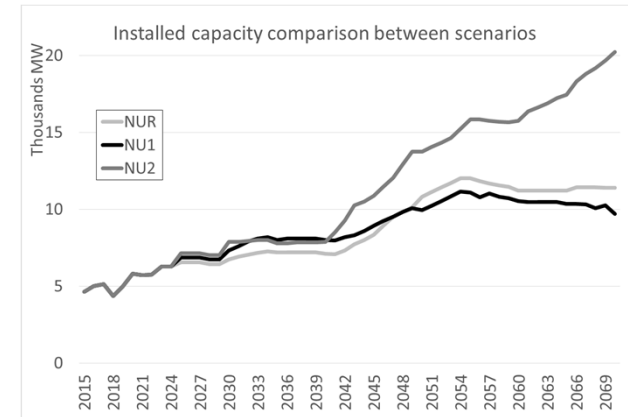
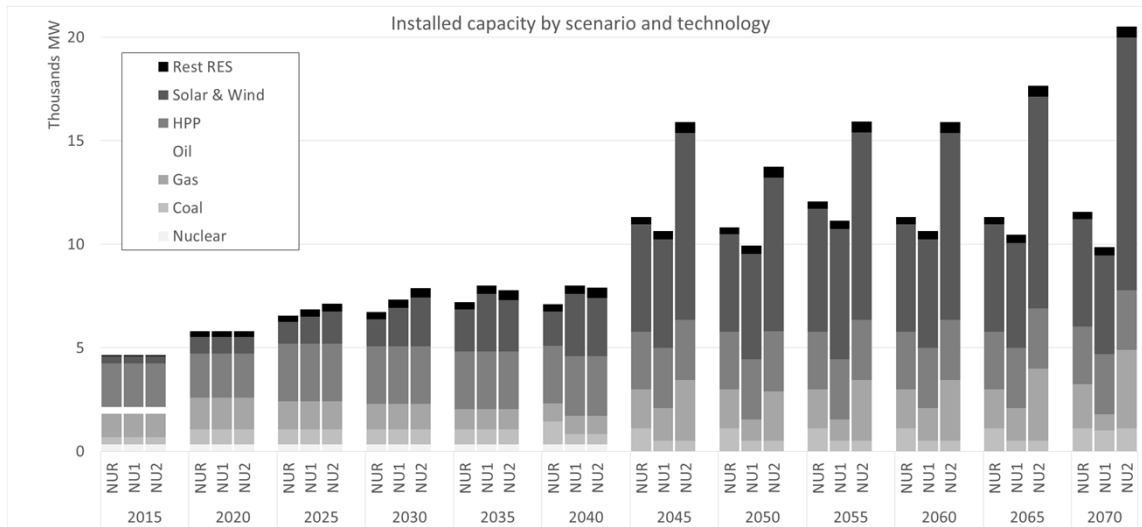
# Electricity demand



# Electricity demand cont'd

- Expected electricity load in 2070:
  - **Highest** in scenario **NU2**
  - **Lowest** in scenario **NU1**
- NU1:
  - **Energy efficiency** measures - **decreased** electricity demand during whole time horizon
- NU2:
  - **Energy efficiency** measures will - **decreased** electricity demand **until 2040**,
  - Intensive **electricity** usage in **transport** sector **after year 2040**. - significant **increase** in electricity demand

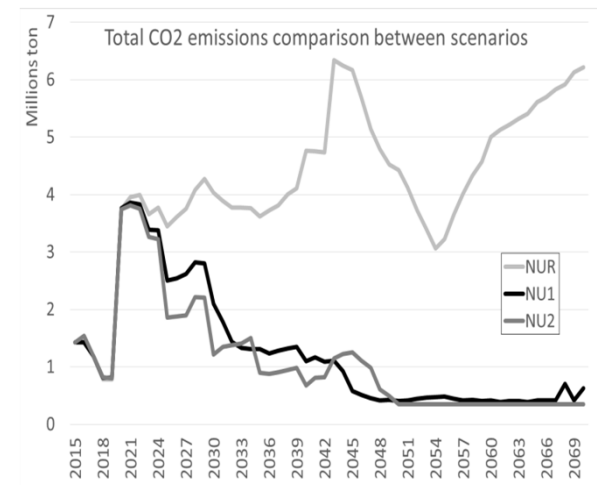
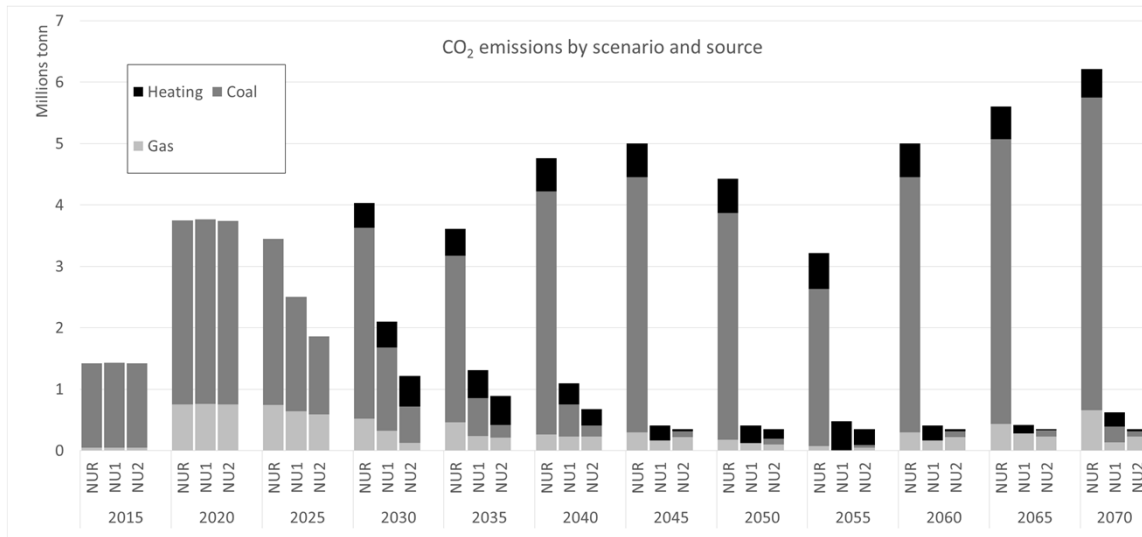
# Installed capacity



# Installed capacity cont'd

- Installed capacity in 2070:
  - **Highest** in scenario **NU2**
  - **Lowest** in scenario **NU1**
- In accordance to expected electricity demand:
  - In NU2 almost **twice larger** than in NUR
  - In NU1 **slightly lower** than in NUR
- RES:
  - **Dominat** capacity share regardless of scenario
  - **Low** capacity factor
  - **Need** for **flexible** support (HPP, gas fired TPP...)

# CO<sub>2</sub> emissions





# CO<sub>2</sub> emissions in year 2070.

- In **NUR** CO<sub>2</sub> emissions about 6 million tons:
  - **Low** emission prices (10 €/ton) and
  - **No constraint** imposed.
- In **NU1** below 1 million ton:
  - **Increase** in emissions price (10 €/ton in 2015 - 100 €/ton in 2050)
  - Still **no constraint** regarding generation of CO<sub>2</sub> emissions,
- In **NU2** GHG emissions lower than in NU1:
  - **Increase** in emissions price (10 €/ton in 2015 - 100 €/ton in 2050)
  - **Additional constraint** on generation of emissions
- Significant **emission spike in NUR** - NPP Krško decommission in 2042

# Conclusion

- Croatian LEDS is based on scenario analysis: **NUR; NU1 and NU2**
- Focus on **power system**
- In 2070 GHG emission are expected to be **significantly lower** in NU1 and NU2 in comparison to NUR scenario due to:
  - **Increased emissions price** in NU1 and
  - Additionally **constraining** emissions production in NU2
- Critical future event - nuclear power plant **Krško decommission** in 2042.

## Conclusion cont'd

- In all scenarios **significant RES share increase** is expected especially in photovoltaic and wind power - **volatile** nature
- Additional **flexible** power plants should be also commissioned.
- *If assumptions and measures stated in Croatian LEDS would be implemented and achieved, then Croatia will be able to develop and design its power system in alignment with international and European requirements regarding CO<sub>2</sub> emissions that are set.*



# Questions

Thank YOU for your attention!