



# Hrvatska energetska tranzicija Ubrzana dekarbonizacija

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FSB

Potpredsjednik HATZ-a



# Lazard Levelized Cost of Energy Comparison

Historical Utility-Scale Generation Comparison in US

## 2021









16 February  
Record in wind production

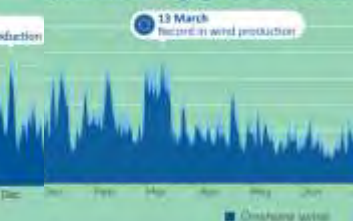
# Wind is actually baseload with excess



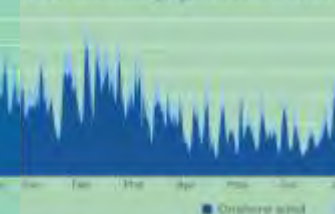
European wind energy generation in 2018



European wind energy generation in 2019



European wind energy generation in 2020



European wind energy generation in 2021



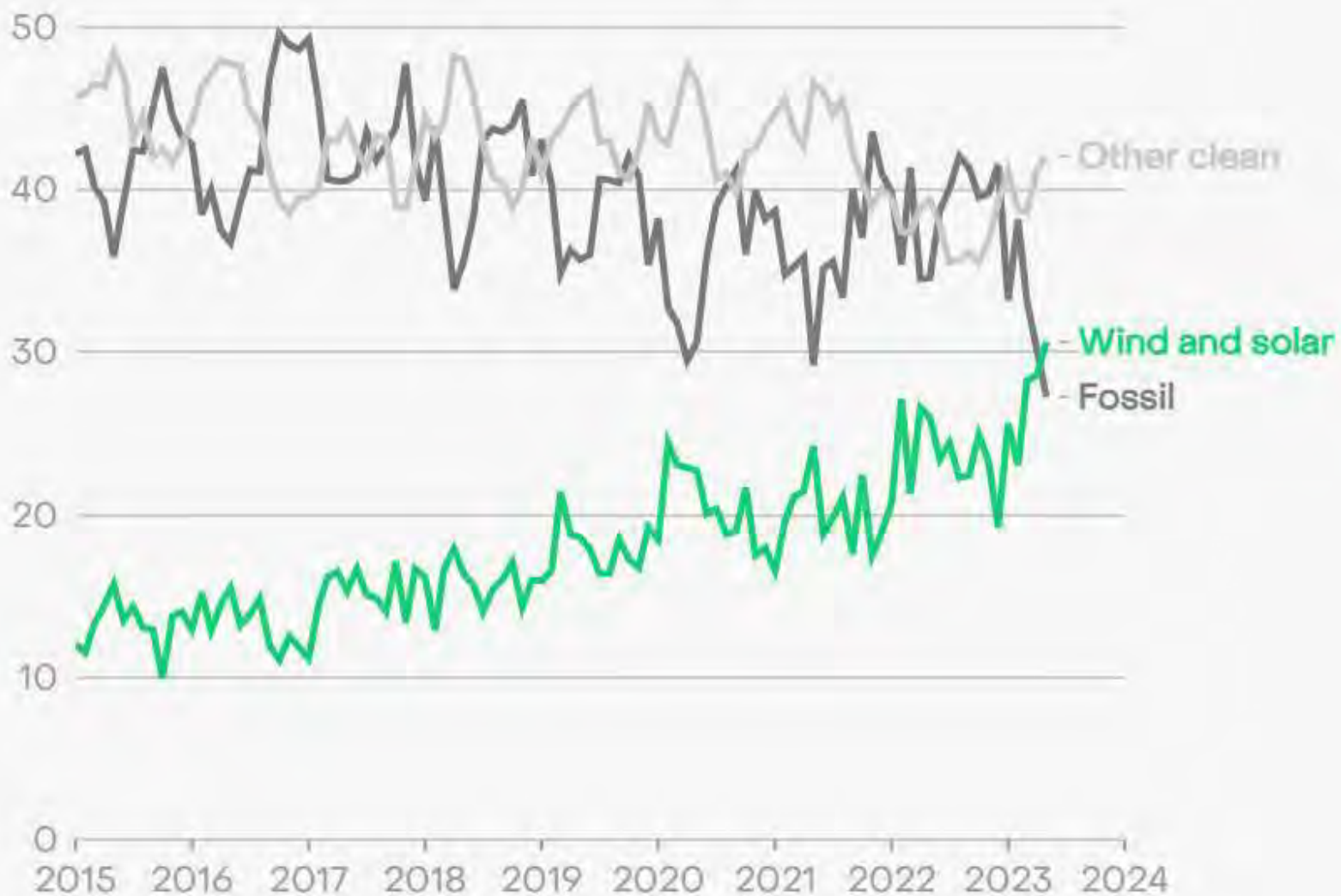


# Budućnost struje su obnovljivi



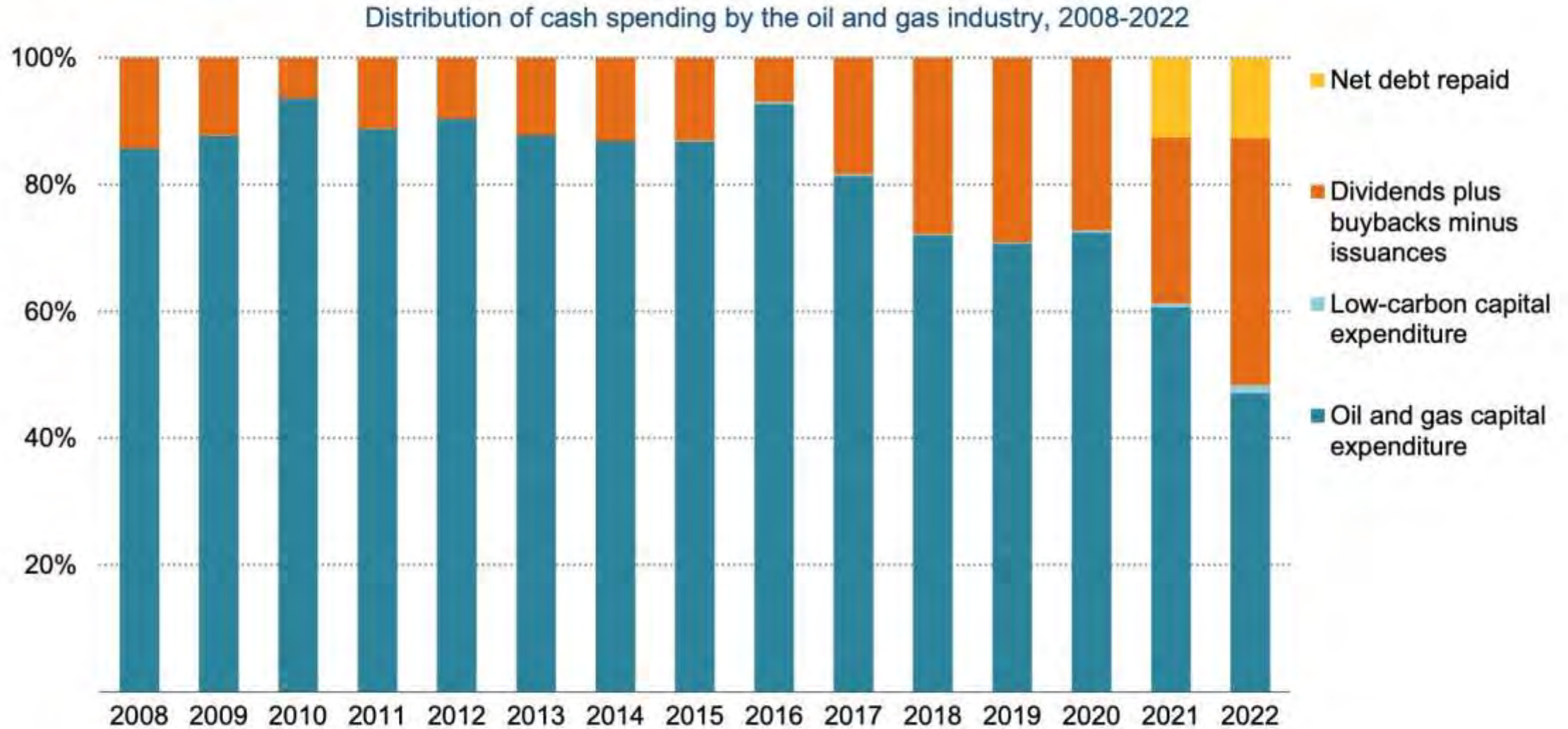
# Wind and solar produce more of EU electricity than fossil fuels for the first time

Share of electricity generation (%)



**Svibanj 2023**  
**Vjetar i solar po prvi puta jači u EU of fosilnih izvora**

# Less than half of the oil and gas industry's unprecedented cash flow from the energy crisis is going back into traditional supply and only a small fraction to clean technologies



IEA. CC BY 4.0.

Source: IEA analysis based on data from S&P Capital IQ.



# Tranzicija velikih?

- DONG -> Ørsted
- PPD -> ENNA?
- INA -> offshore?
- GPZ -> Zagreb Energy Company?



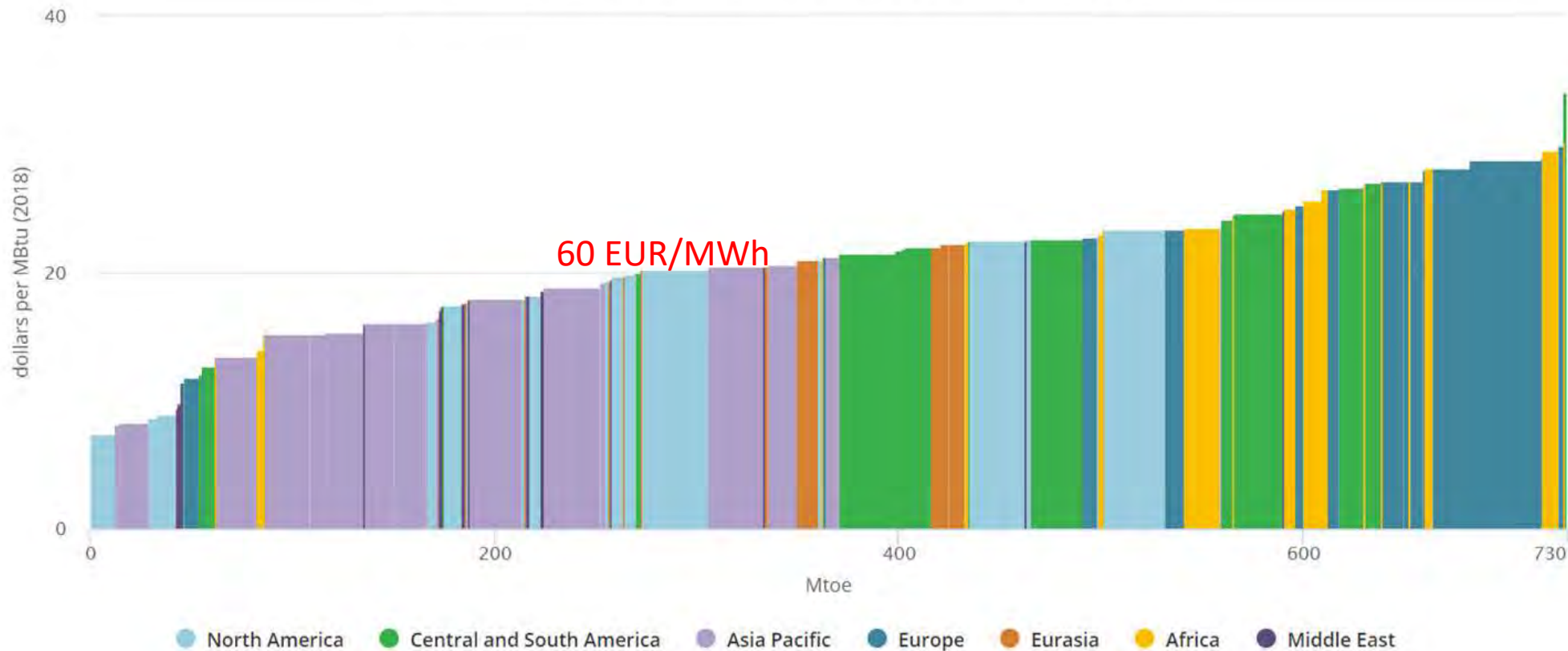
# Da li je moguće deplinoficirati Hrvatsku do 2035?

- Sve je moguće, ali je pitanje koliko košta?
- Što je potrebno, i kada?
- Koje će tehnologije zamijeniti fosilni plin?

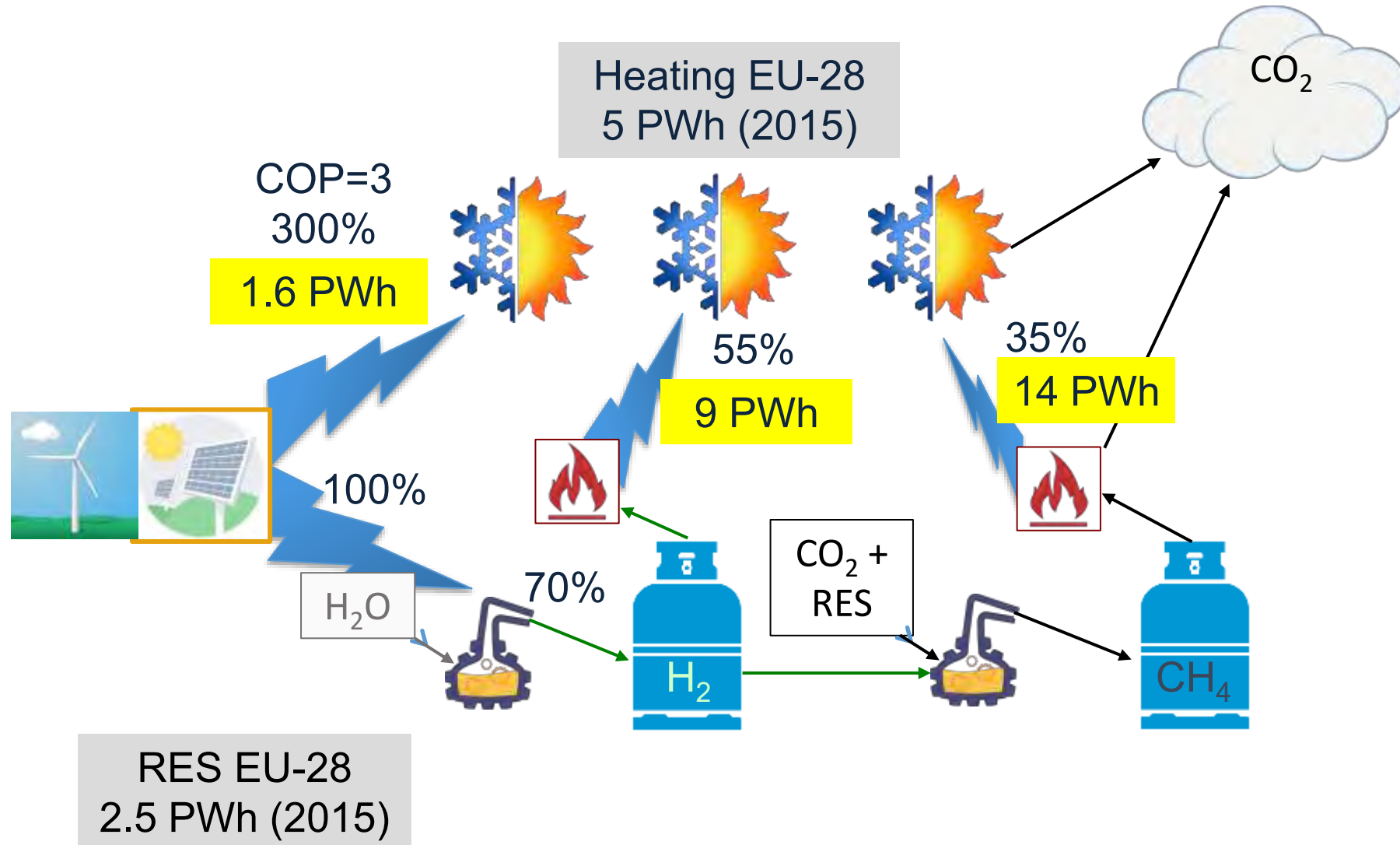
# A da li uopće možemo dekarbonizirati plin? Biometan?

10% of prirodnog plina po cijeni od 60 EUR/MWh

Global sustainable technical potential of biomethane, 2018



# Vodik za grijanje?

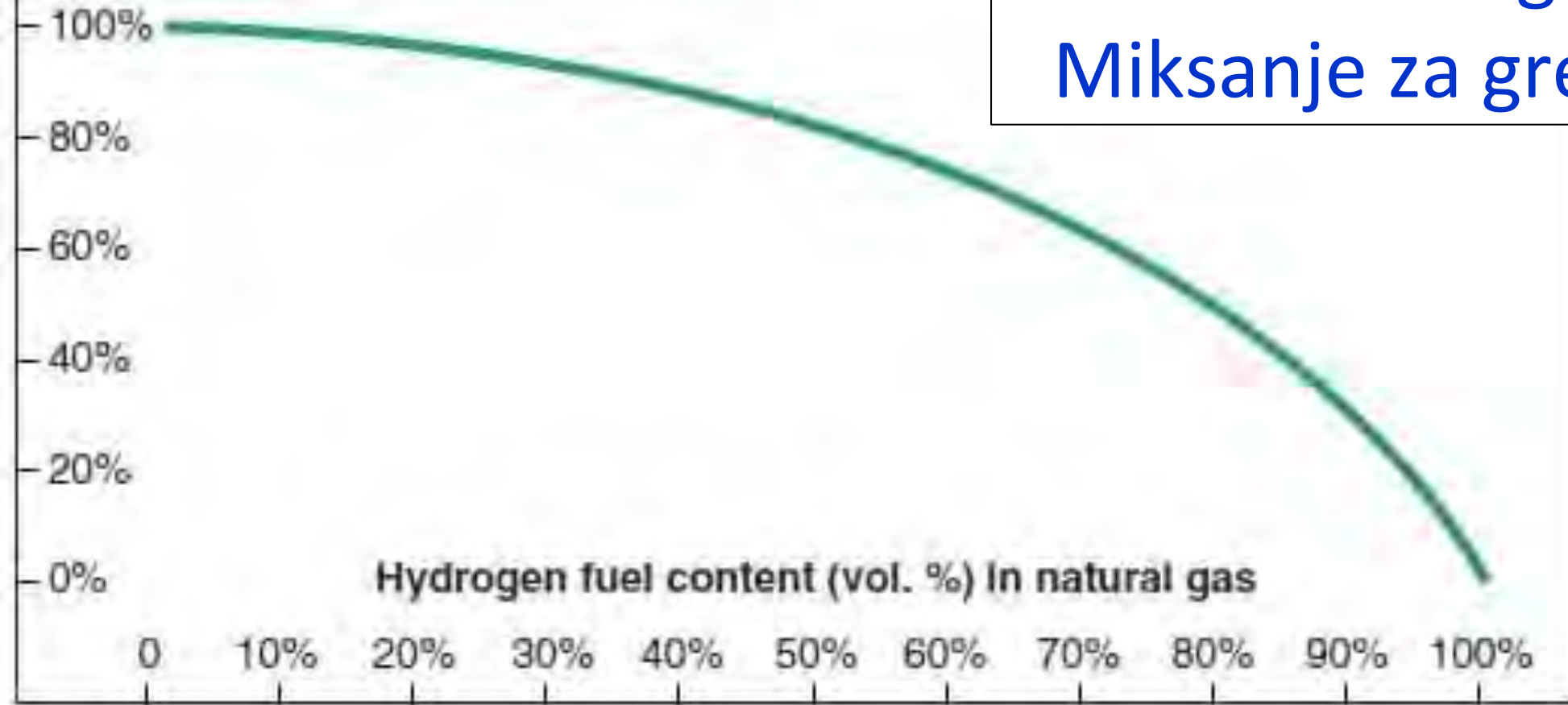




**Mixed Fuel CO2 Emissions.** Typically hydrogen and natural gas mixtures are defined on a volumetric basis; about 80% by volume H<sub>2</sub> is needed to reach a 50% reduction in CO<sub>2</sub> emissions.

**Relative CO<sub>2</sub>**  
(percent mass)

Vodik za grijanje?  
Miksiranje za greenwashing



## GHG emission reduction

# EU policies on gas boilers

### 1. U.K.

Ban on gas and oil boilers in new homes from 2025.

### 2. BELGIUM

Ban on fossil heating systems in newbuilds from 2025 in Flanders.

### 3. NETHERLANDS

Ban on new natural gas connections since 2018.

### 4. FRANCE

De-facto ban on gas boilers in new homes from 2022 due to introduction of emissions limits.

### 5. GERMANY

De-facto ban on new fossil-powered heating system via a requirement of 65% renewables input from 2024.

### 6. AUSTRIA

Sale of new gas boilers, and repair of old ones, banned from 2023.

### 7. DENMARK

Ban on new gas boilers since 2013. Plan to move 50% of households using gas heating to district heating by 2028.

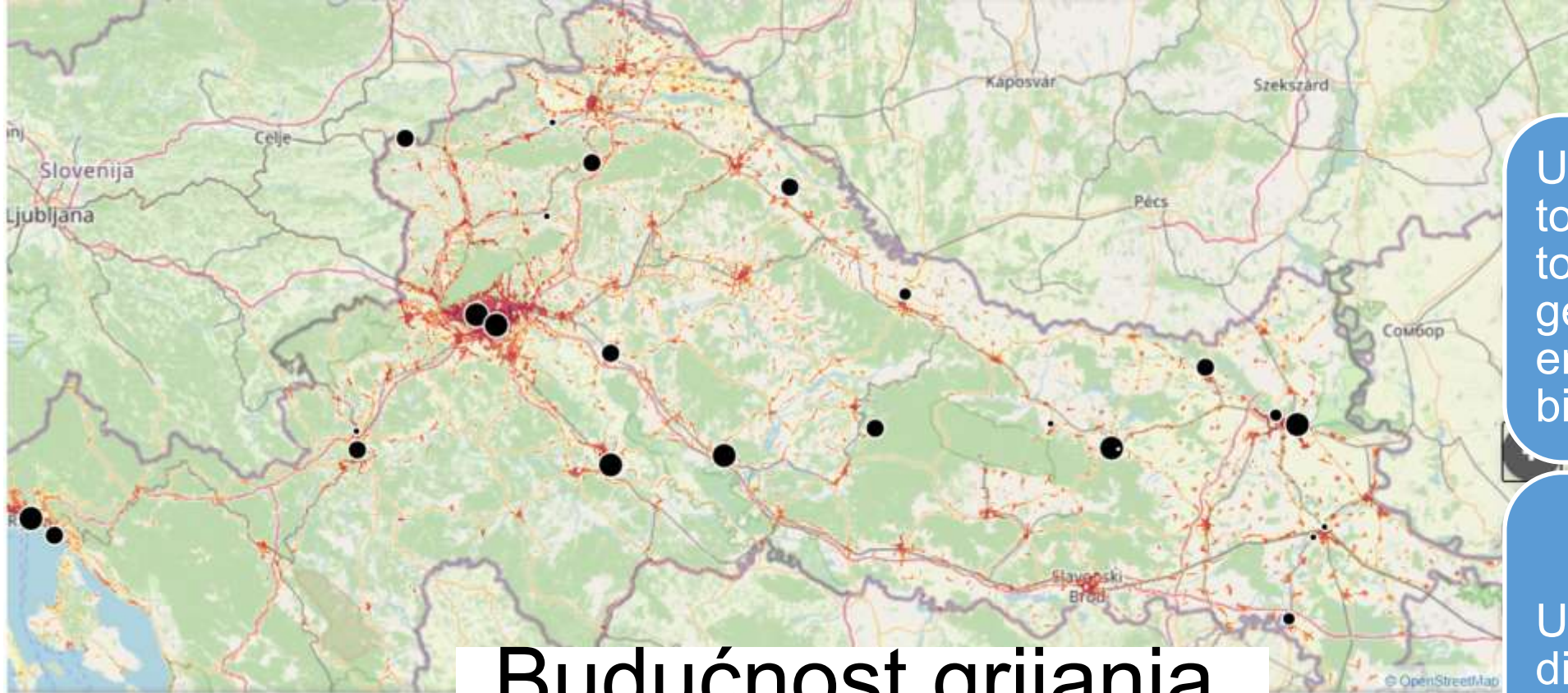
### 8. NORWAY

Ban on installation of new gas boilers since 2017.



- 8 countries already have policies in place for **banning new gas boilers** or requiring high levels of renewables in buildings
- EU has 65 million gas boilers



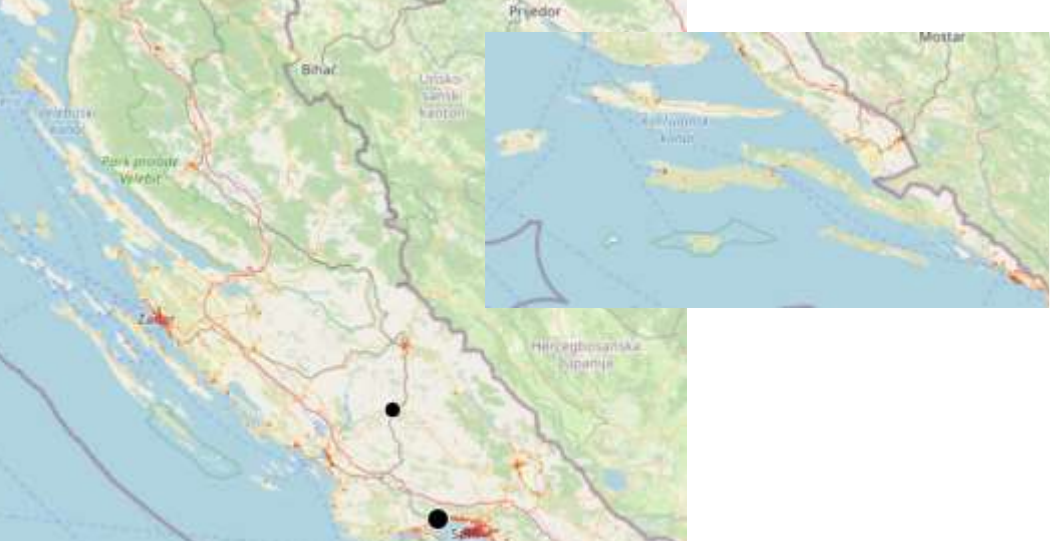


U gustim naseljima toplane na otpadnu toplinu, dizalice topline, geotermalnu, solarnu energiju, otpadnu biomasu itd.

U rjeđim naseljima dizalice topline

# Budućnost grijanja

<http://het.hr/gis-karta/>



Izvan naselja peleti od otpadne biomase



# Gradnja novih elektrana

Vjetroelektrane:

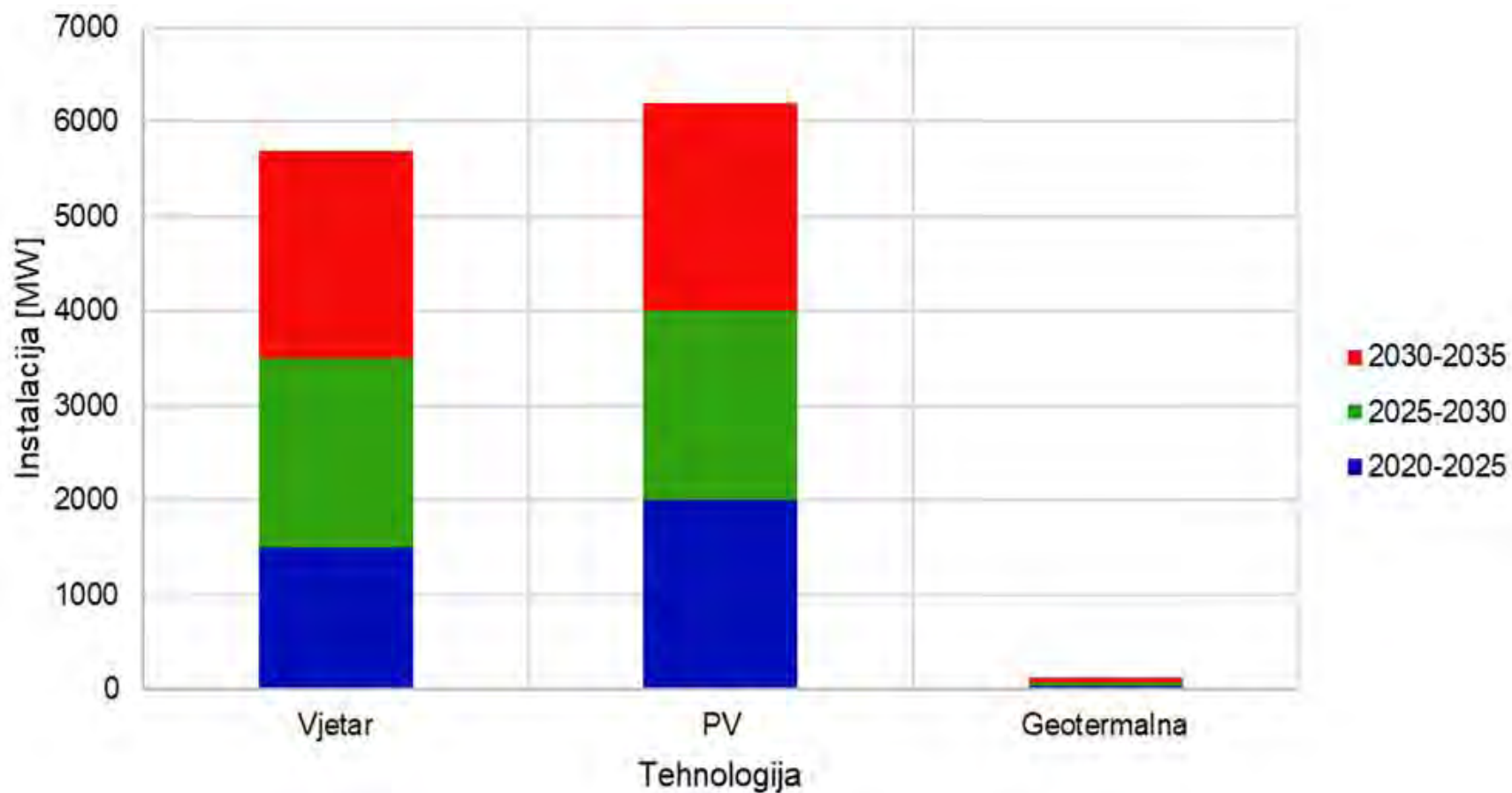
Do 2025 1500 MW, do  
2030 2000 MW te do  
2035 2195 MW

Fotonaponske elektrane:

Do 2025 2000 MW, do  
2030 2000 MW te do  
2035 2187 MW

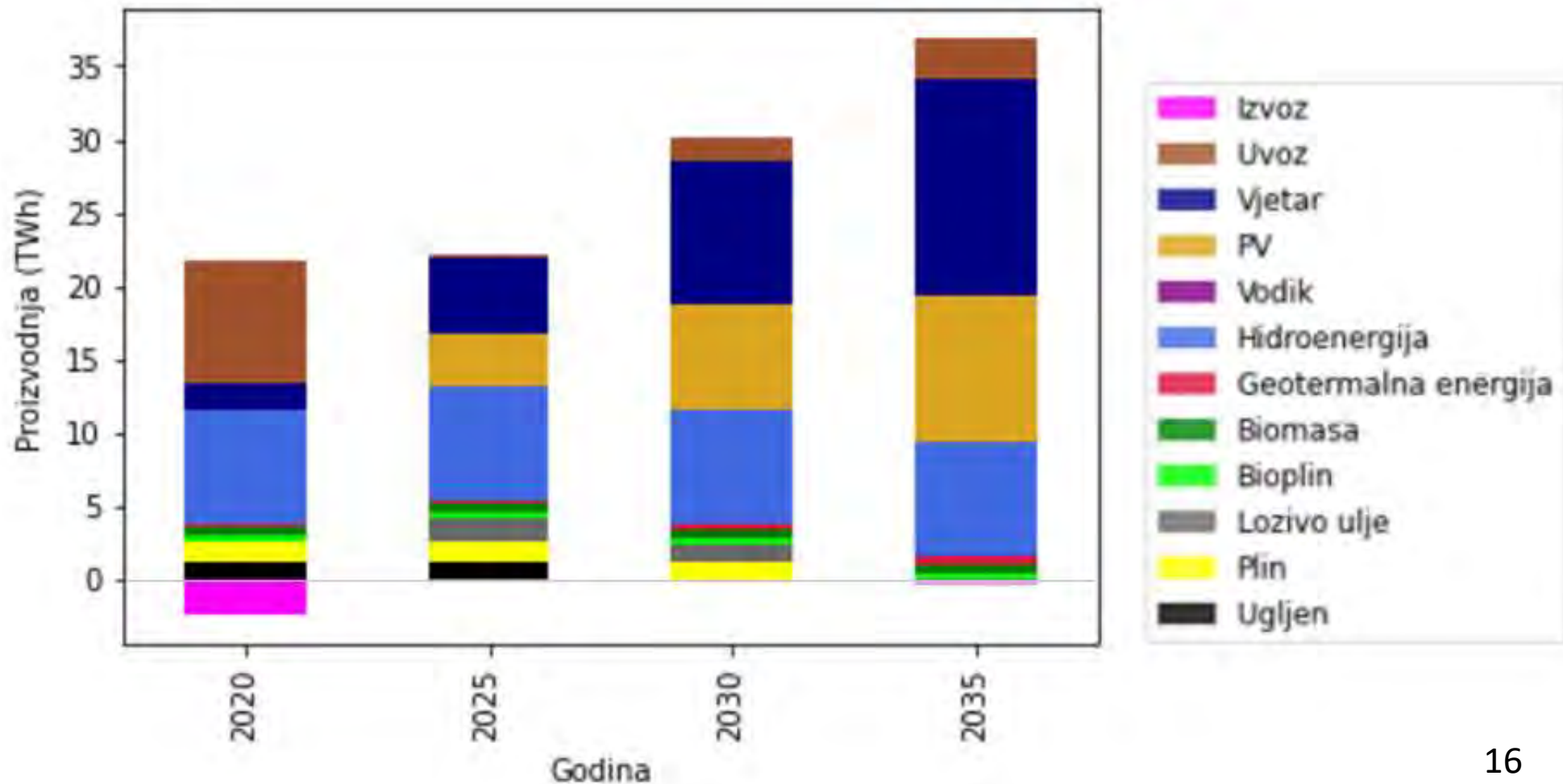
Geotermalne elektrane:

Do 2025 30 MW, do  
2030 40 MW te do 2035  
50 MW

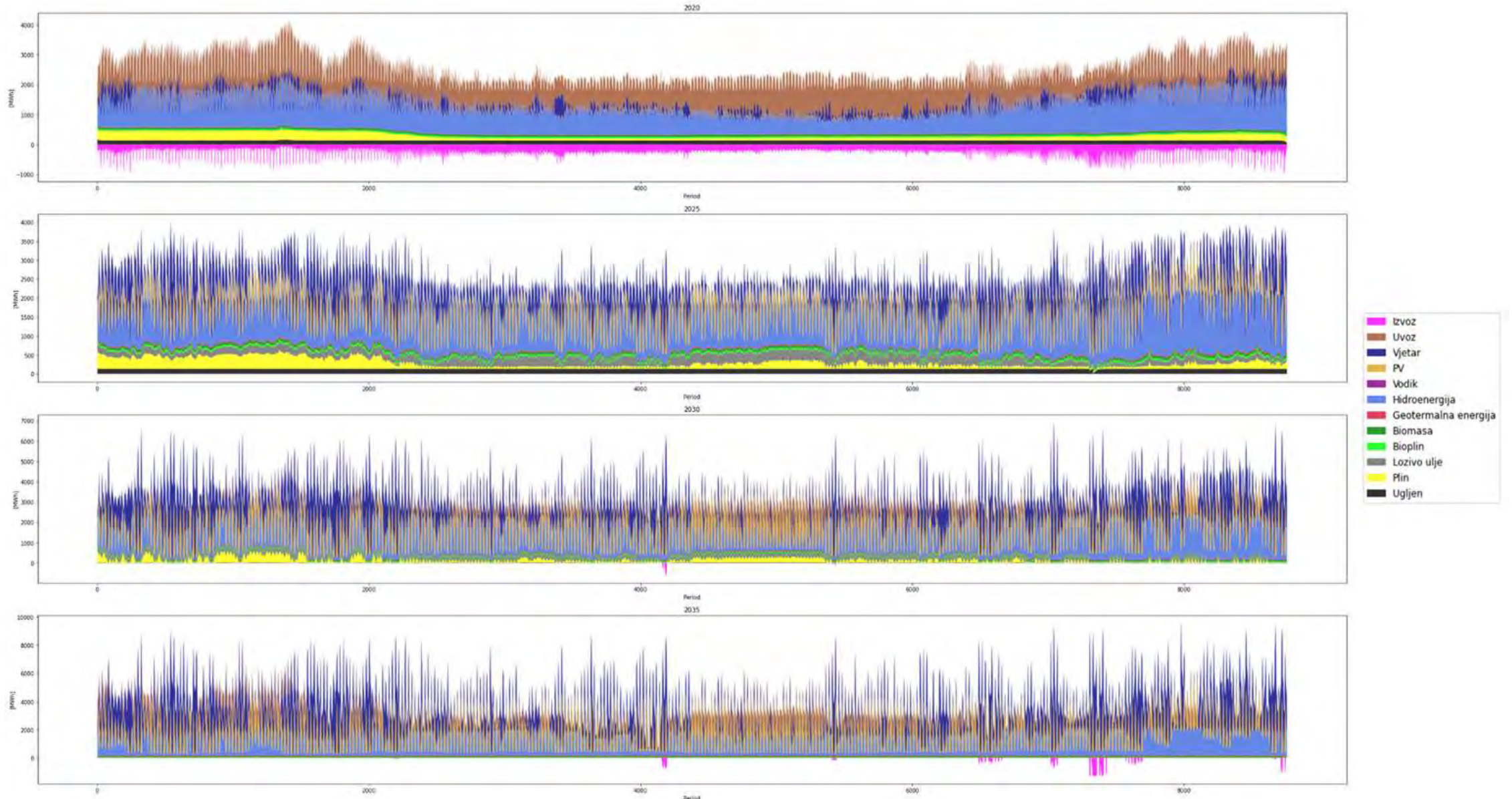


# Proizvodnja električne energije

- Izlazak ugljena do 2030. godine
- Izlazak plina i naftnih derivata do 2035. godine
- Visoke cijene na tržištu -> smanjenje uvoza uslijed visokih cijena na tržištu
- Povećanje potrošnje unutar sustava -> smanjenje izvoza



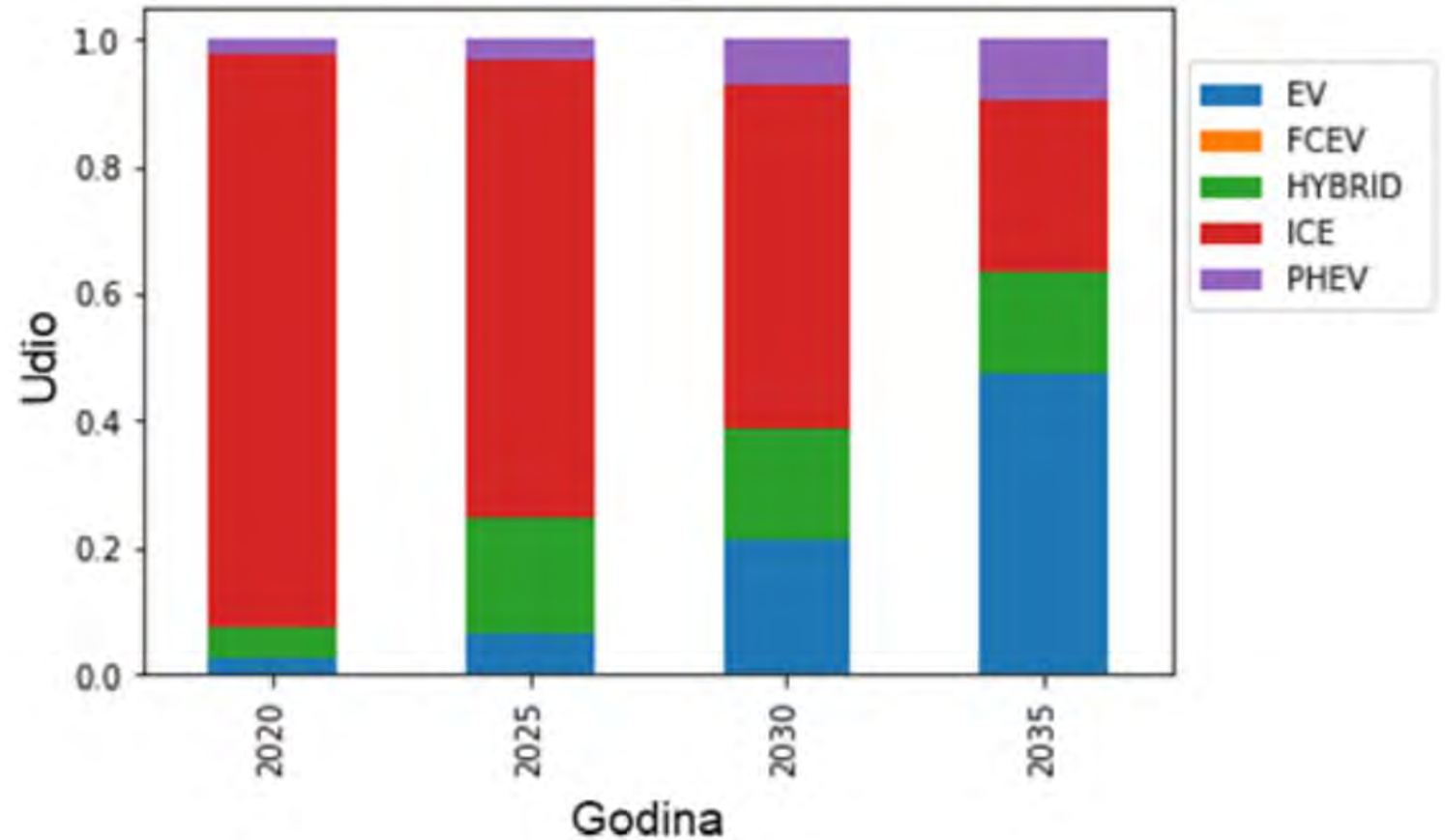
# Proizvodnja električne energije – satne distribucije



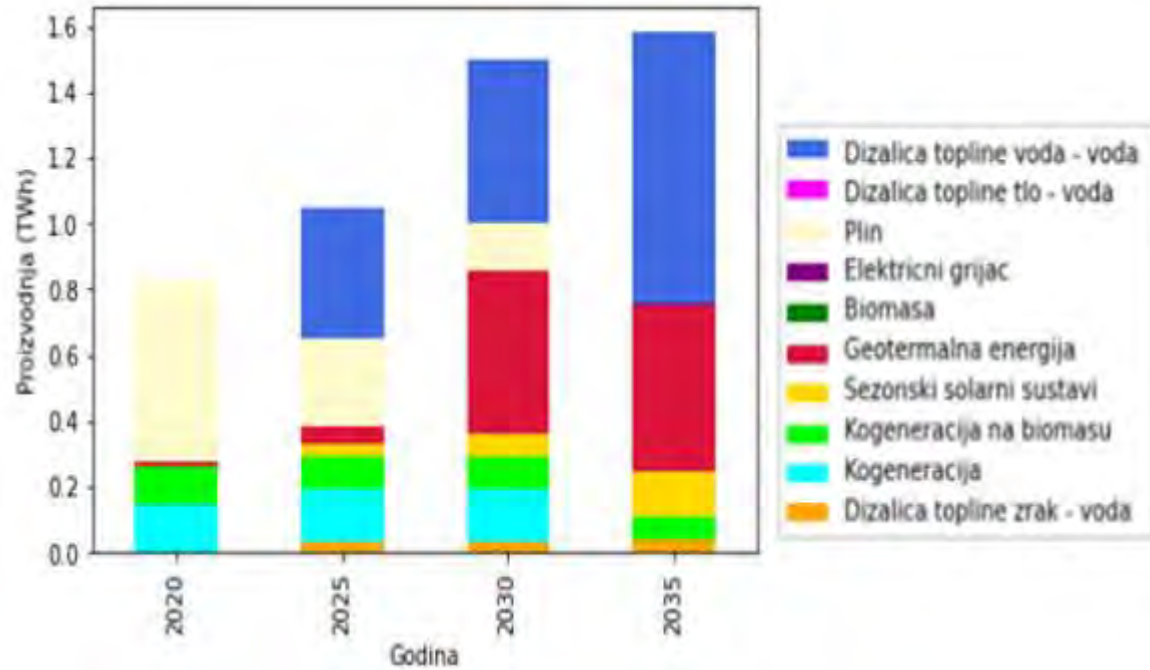


# Sektor transporta

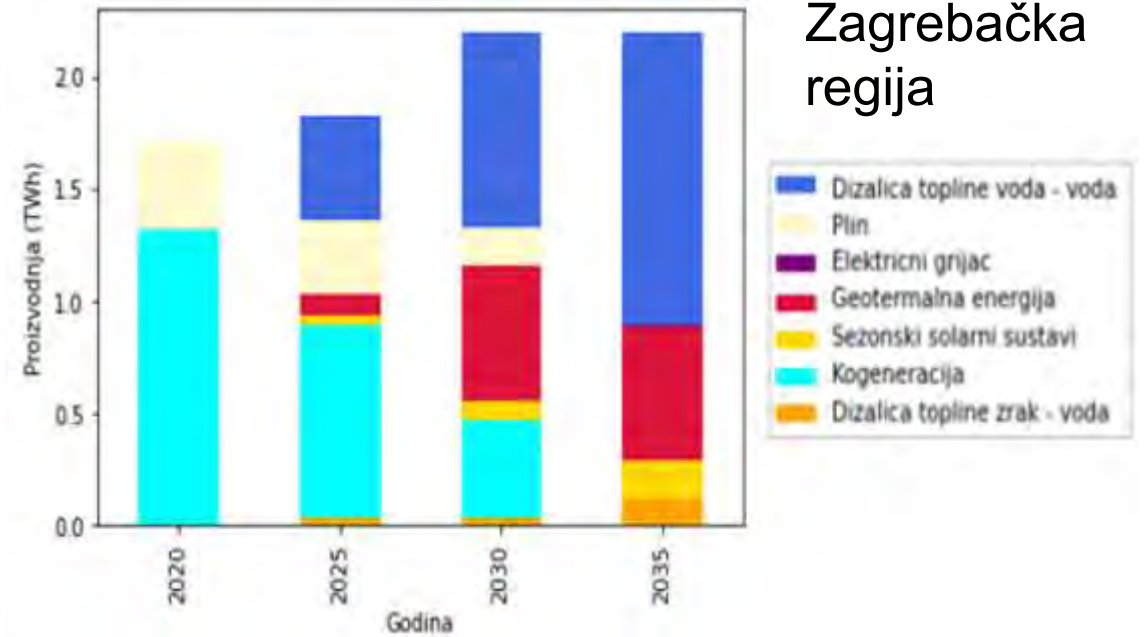
- Do 2025. – ulaganje u hibridna vozila
- Nakon 2025. – uzlet električnih vozila
- Udio klasičnih ICE vozila 2035 od 27 %
- Dekarbonizacija do 2050. godine



# Centralizirani toplinski sustavi

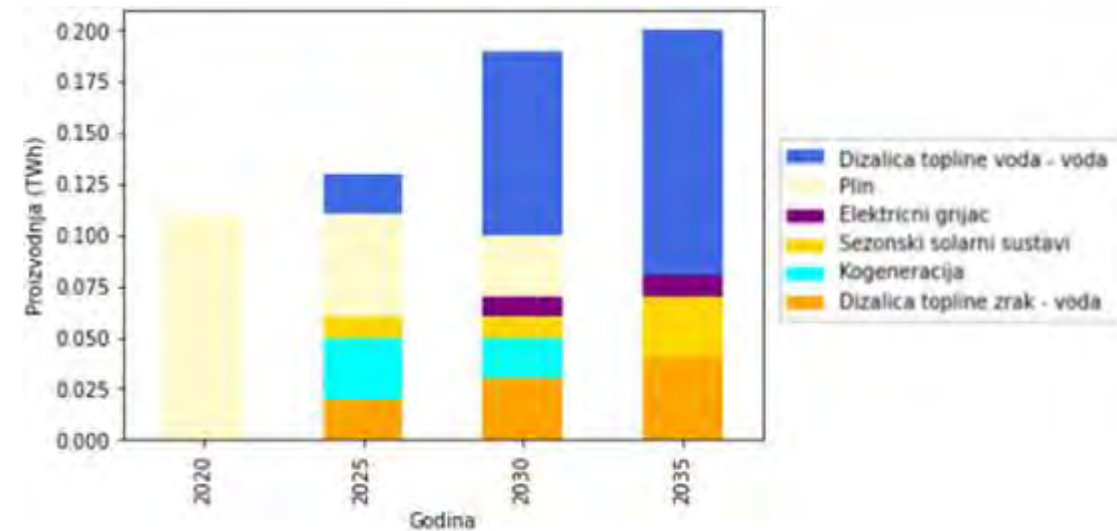


Kontinentalna Hrvatska  
izuzev zagrebačke regije

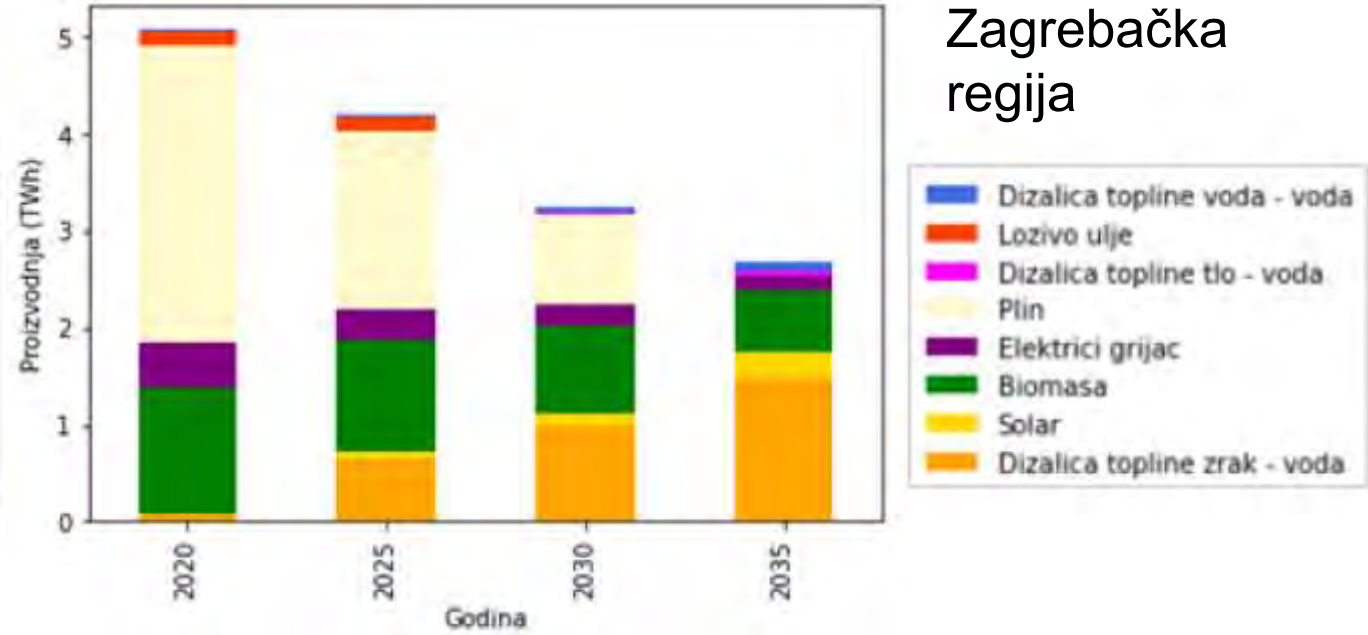
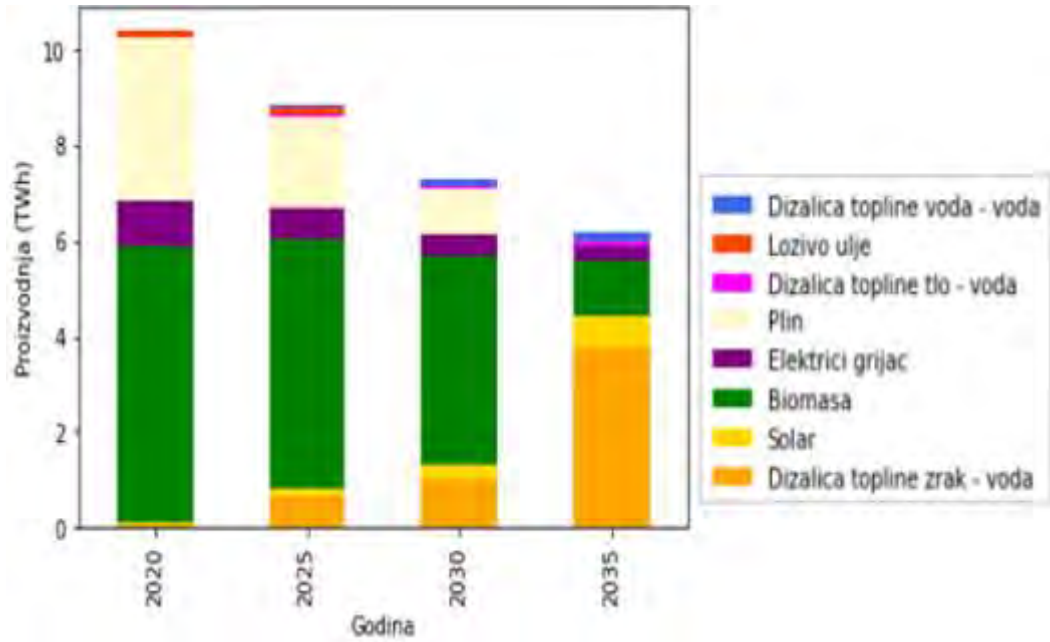


Zagrebačka  
regija

Primorska  
Hrvatska

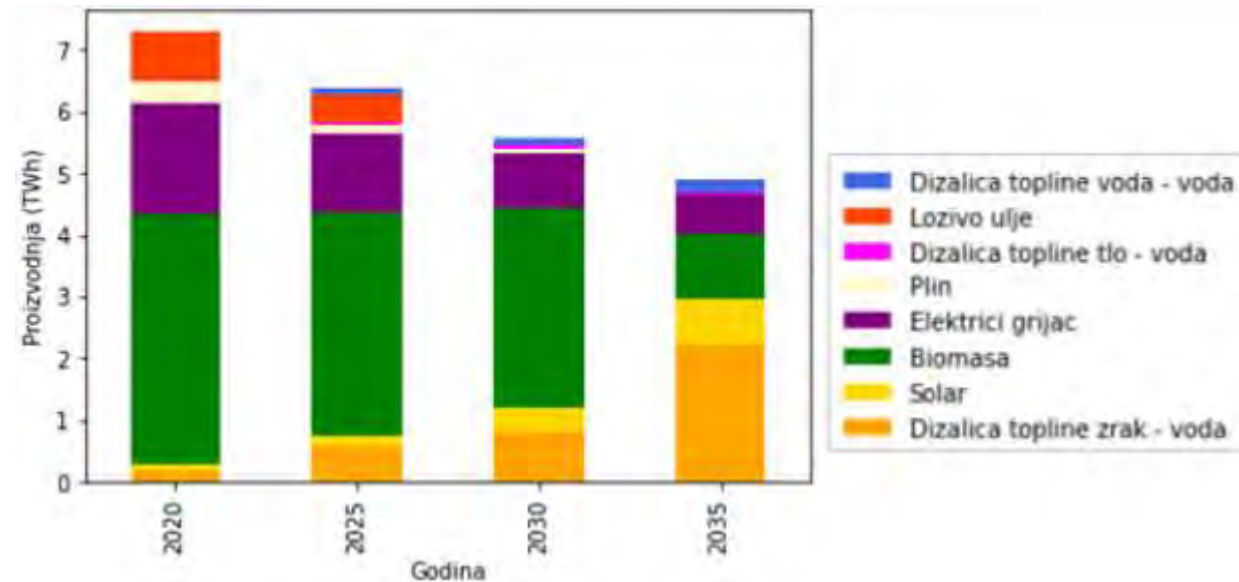


# Individualni sustavi



Kontinentalna Hrvatska  
izuzev zagrebačke regije

Primorska  
Hrvatska





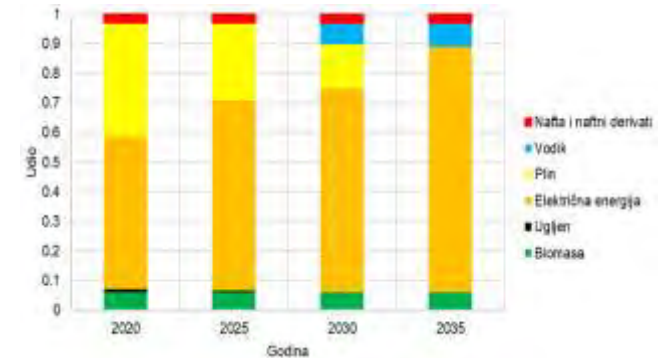
# Sektor industrije

- Podjela na nekoliko podsektora
  - Petrokemija
  - Rafinerije
  - Cementare
  - Ostatak industrije
- Različite specifičnosti pojedinih grana industrije – ograničenja na primjeni tehnologija
- Neenergetska potrošnja goriva
- Dekarbonizacija industrije:
  - ☐ Vodik
  - ☐ Električna energija

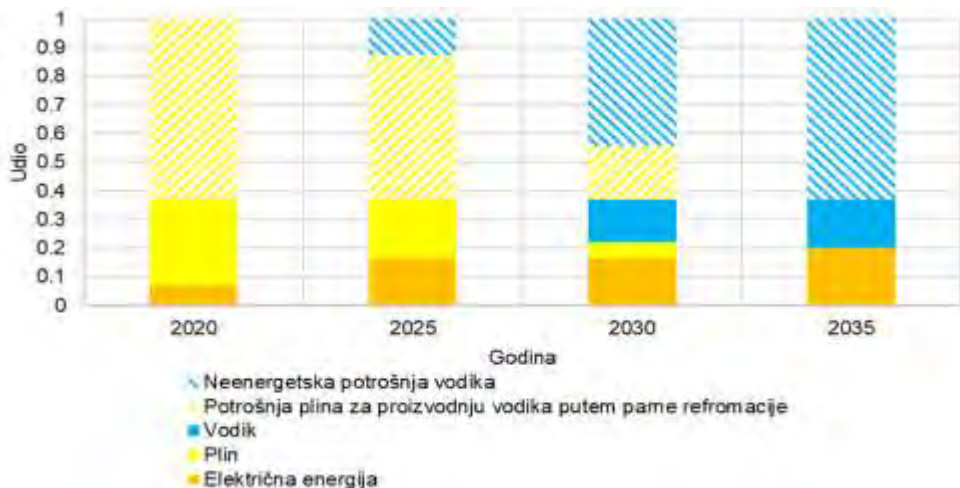
# Sektor industrije

- Energija i neenergetska potrošnja goriva
- Dekarbonizacija industrije:
  - > Vodik
  - > Električna energija

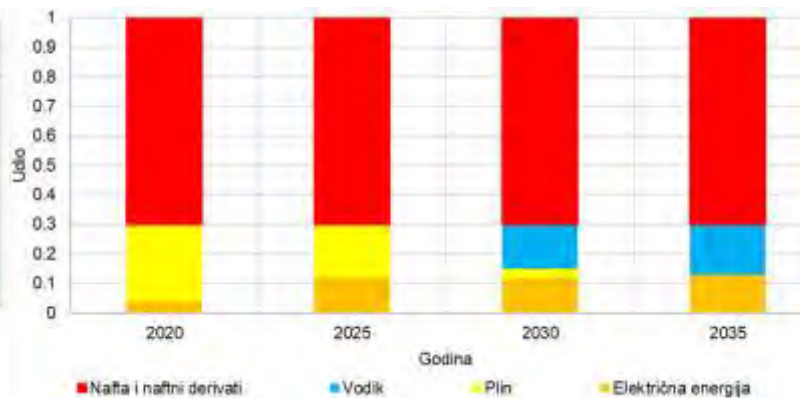
## Ostatak industrije



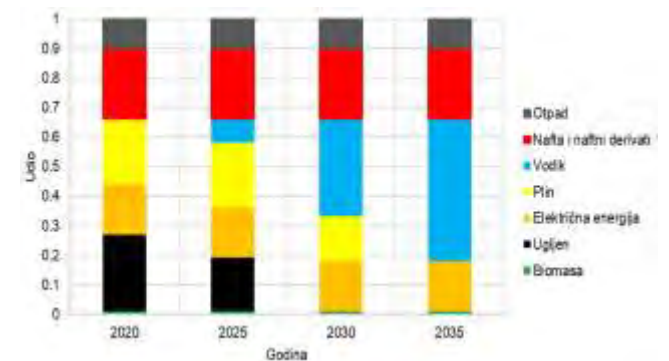
## Petrokemija



## Rafinerije

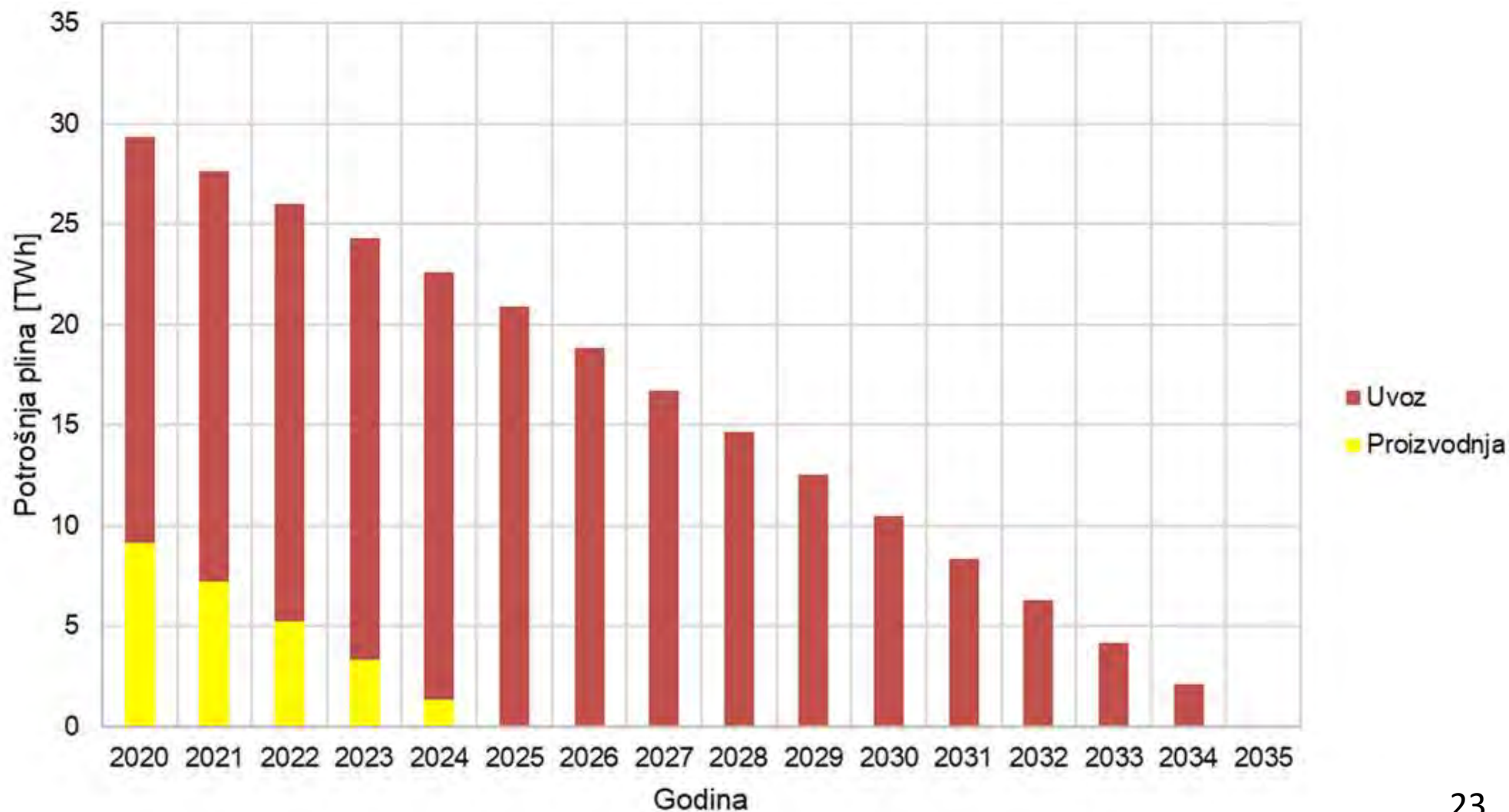


## Cementare



# Potrošnja plina

Očekivan pad  
domaće  
proizvodnje  
-> potreba za  
uvozom LNG-a

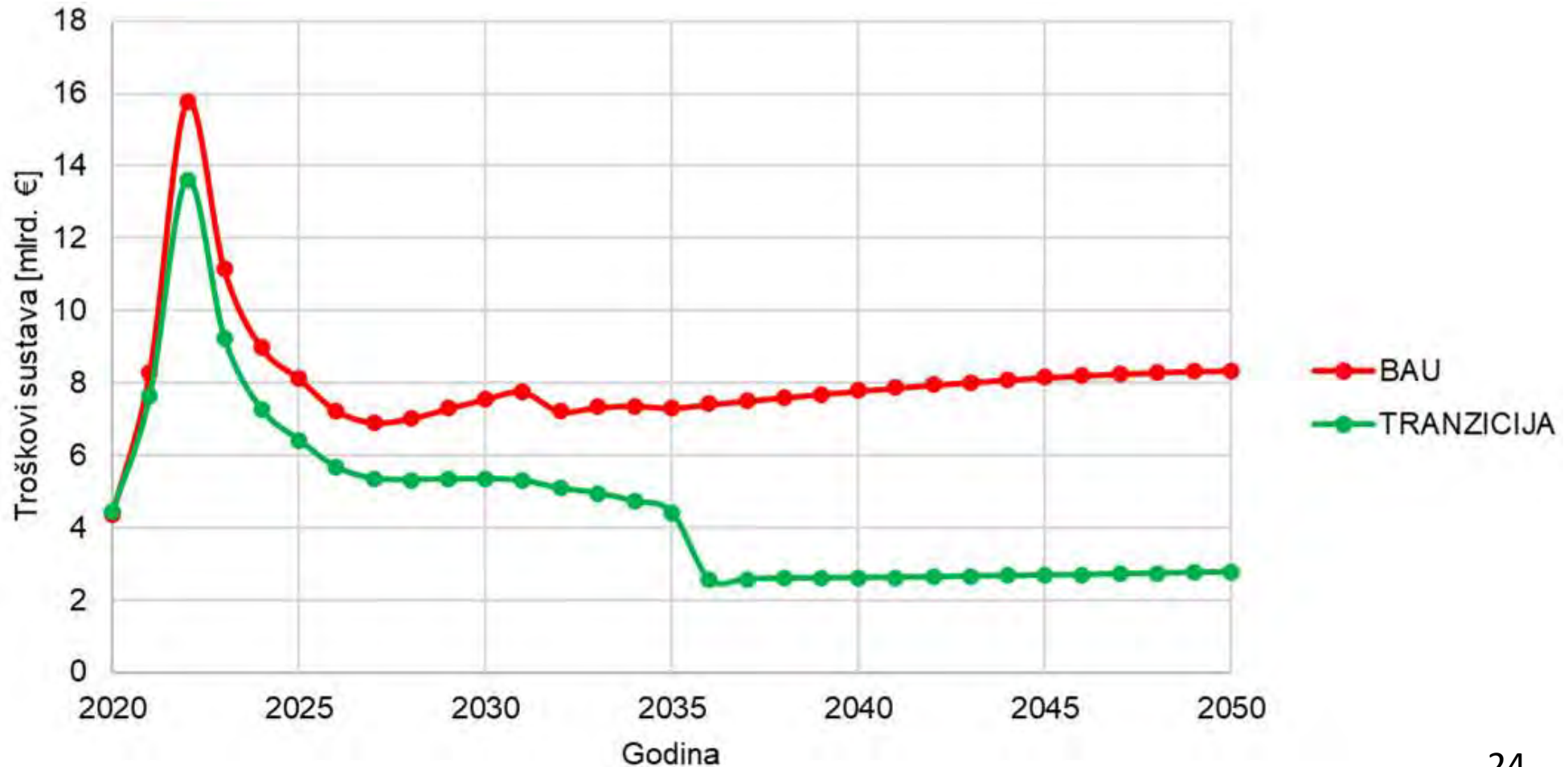




# Ukupni troškovi scenarija tranzicije i BAU scenarija

- Ukupni investicijski trošak do 2035. – 39 milijarda eura

- BAU – zadržavanje postojećih tehnologija
- TRANZICIJA – scenarij predstavljen u studiji
- Diskontna stopa = 5 %



# Koje politike i strategije je potrebno provesti kako bi se Republika Hrvatska deplinificirala?

- **Prestati subvencionirati plin**
- **Poticanje širenja toplinskih mreža i izgradnju novih**
- **Subvencionirati zamjenu plinskih kotlova dizalicama topline u kućama**
- **Ubrzati izgradnju obnovljivih izvora energije**
- **Poticati izgradnju elektrolizatora u industriji**

## Što i koliko treba graditi?

- **380 MW** vjetroelektrana godišnje
- **410 MW** fotonaponskih elektrana godišnje
- **60 MW** elektrolizatora godišnje
- **30 MWh** pohrane vodika godišnje
- **400 MW** dizalica topline godišnje