



# **General overview of RES, focusing on the geothermal energy**

Perspectives of Renewable Energy in the Danube Region  
International Conference

**Made by: Klára Szita Tóth**

**Anna Vizkeleti**

**University of Miskolc**

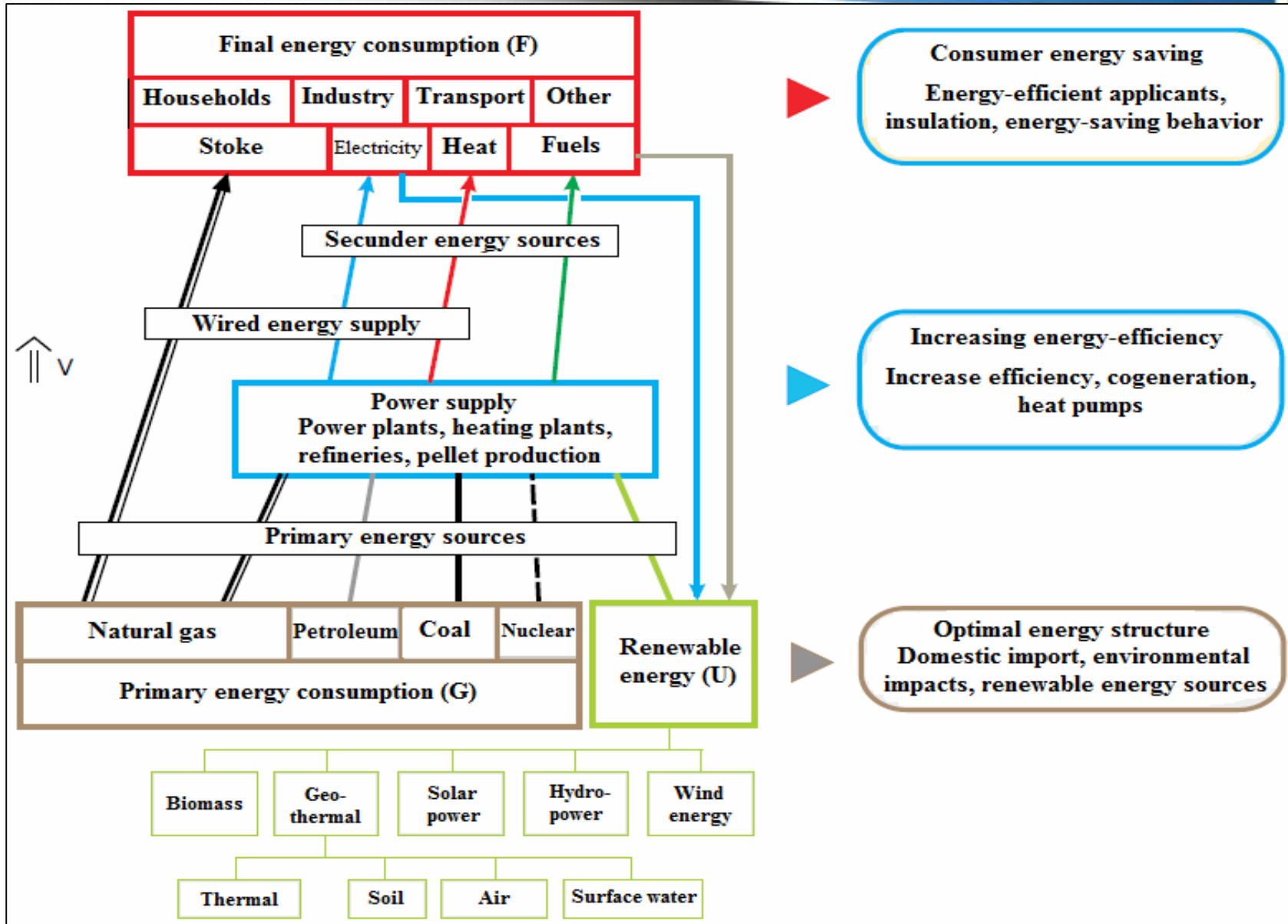
**Pécs, 2015. 03. 27.**



## Concerned topics

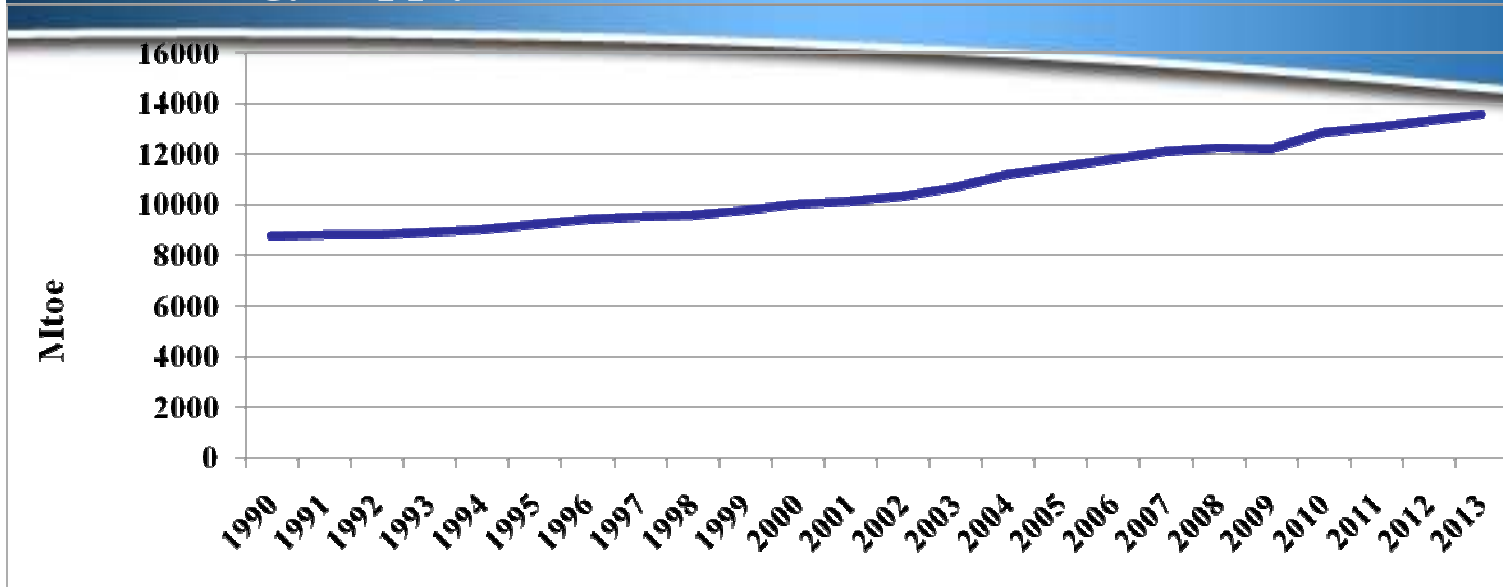
- Introduction of the renewable resources
- Trends in the world
- RES in Hungary
- Biomass in Hungary
- Geothermal energy and its environmental impacts
- Conclusions

# Renewable resources

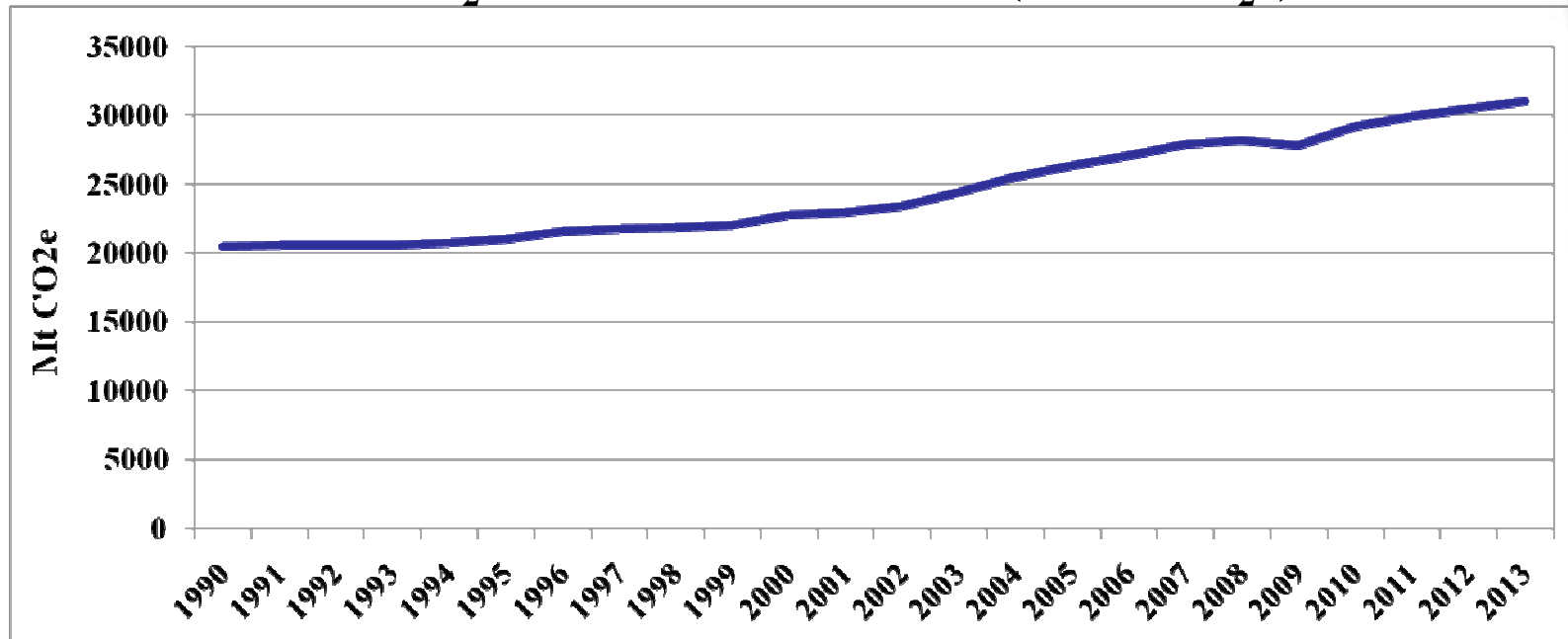


Source: own compilation based on MTA 2010

## Total energy supply (Mtoe) between 1990 and 2013



## The CO<sub>2</sub> emissions in the world (in Mt CO<sub>2</sub>e)

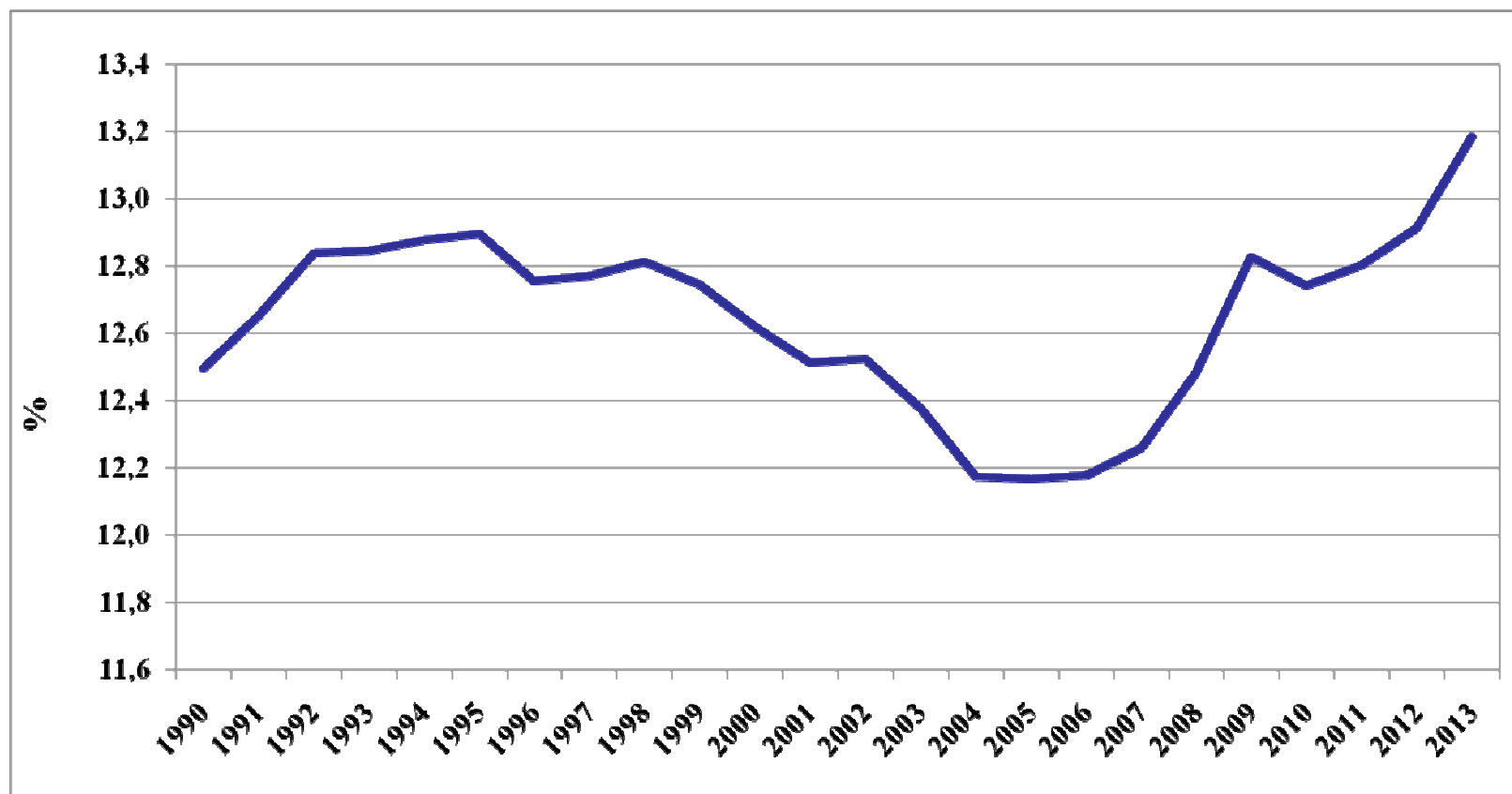


Source: own compilation based on EurObserv'ER





## The rate of the Res % in the world

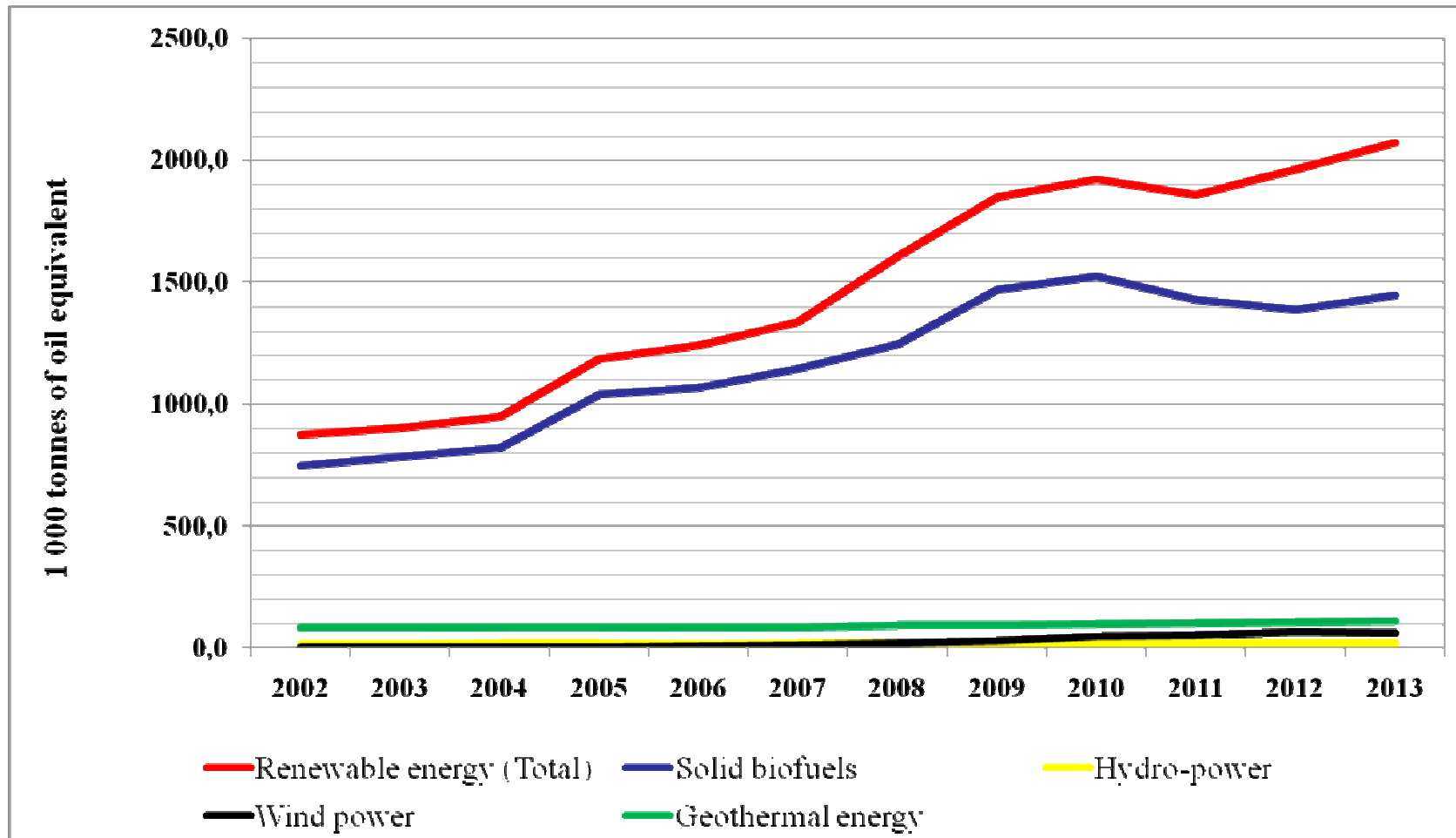


Source: own compilation based on EurObserv'ER

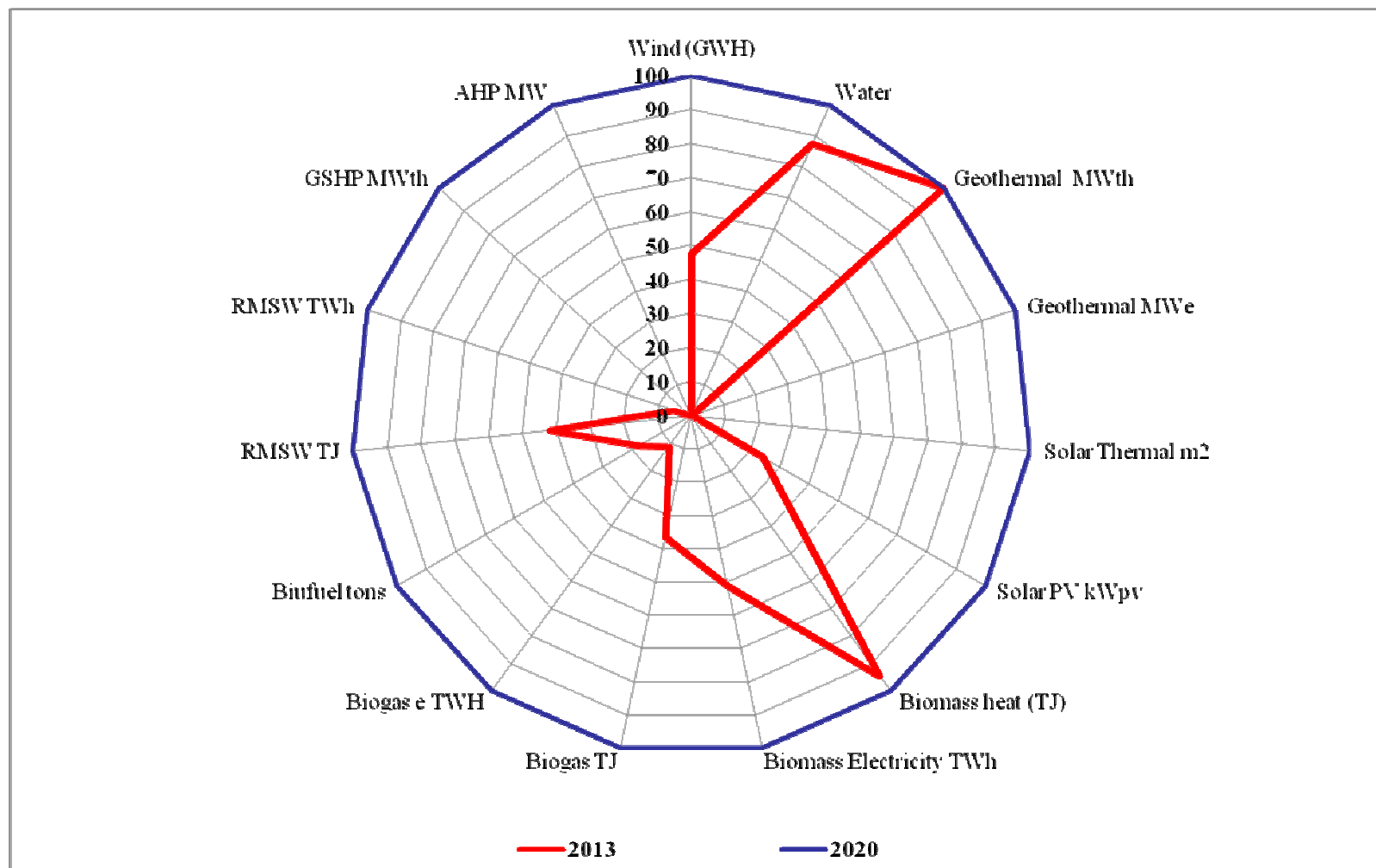
# RES in Hungary



## Primary production of renewable energy by type in Hungary between 2002 and 2013

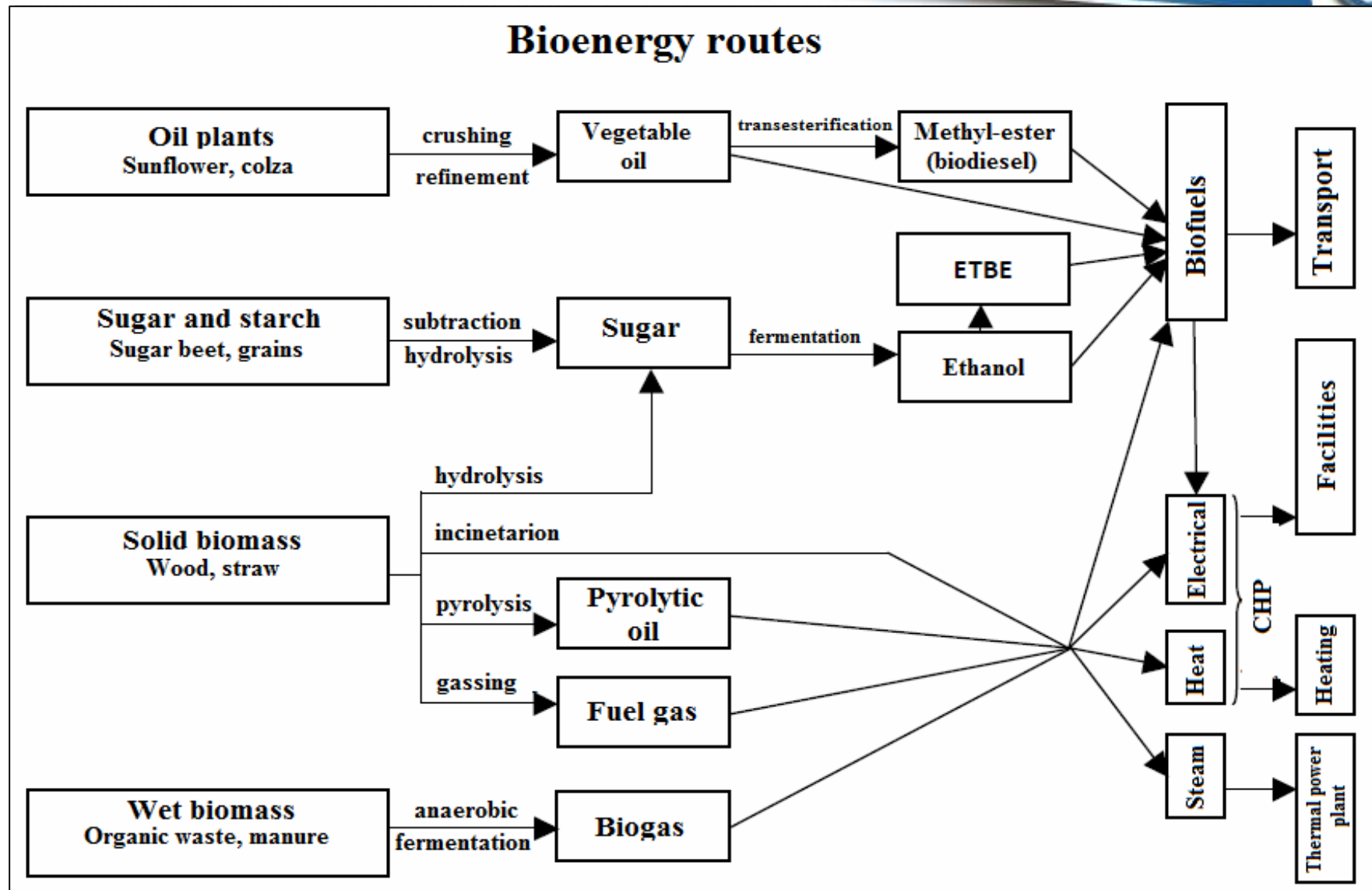


## Comparison between the current utilization of the RES and the objectives for 2020 in Hungary



Source: own compilation based on EurObserv'ER

# Biomass in Hungary



Source: own compilation based on *Megújuló energiaforrások kézikönyve* pp30



# Geothermal energy in Hungary



**Geothermal heat utilization in Hungary (2014)**

<b>Geothermal heat utilization</b>	<b>Electricity production GWh/year</b>	<b>Direct heat utilization GWh/year</b>	<b>%</b>
World	67 246	121 696	100
Hungary	-	3750	3

1GWh=3,6\*10<sup>12</sup>J

Source: own compilation based on Livo 2014

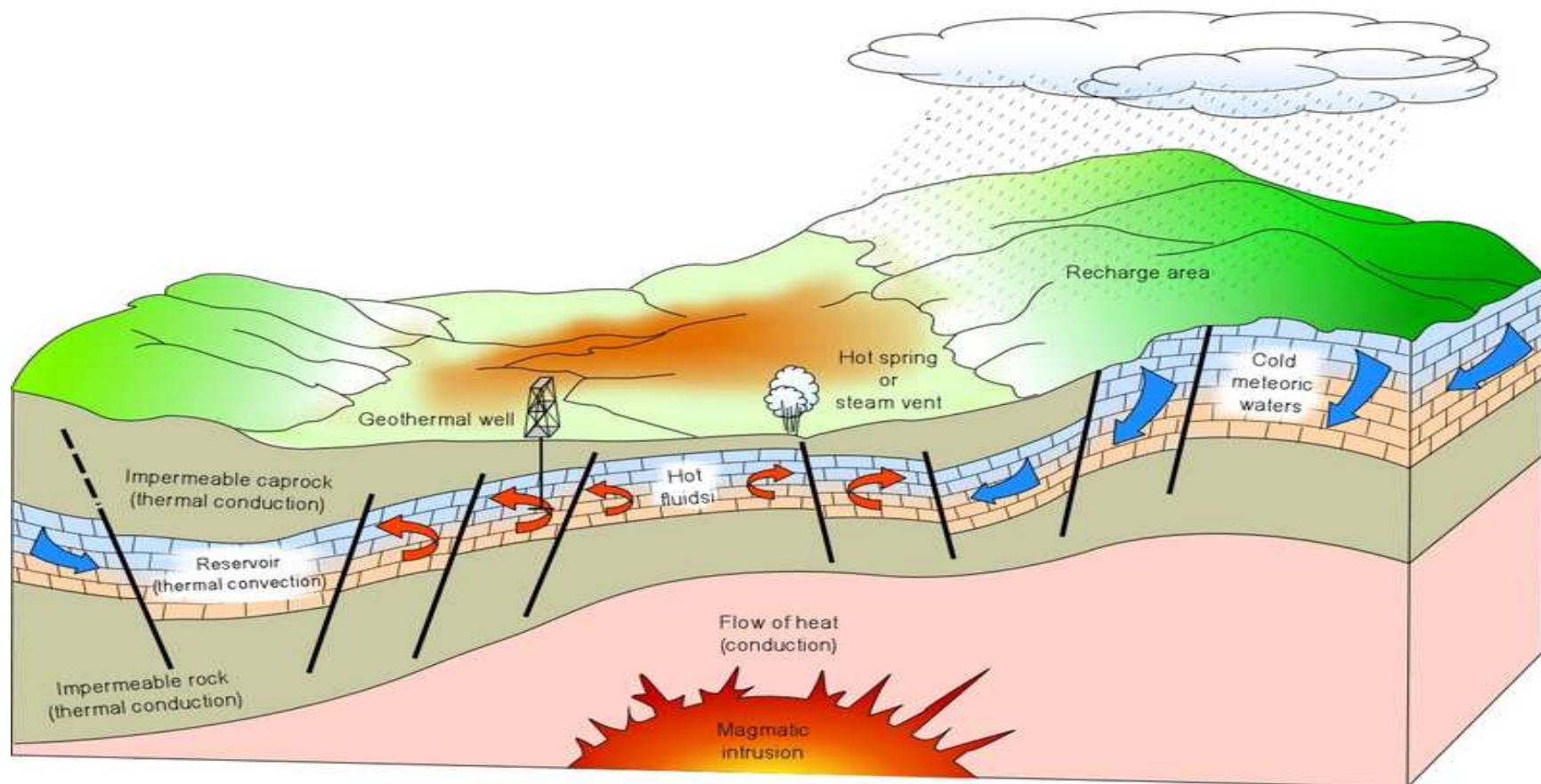
- Comparison with other resources
  - permanently available,
  - independent from the weather conditions,
  - using flexibility,
  - reduce the dependence from import,
  - geothermal energy is available in the extraction site, so it can be used in a decentralized way
  - the research, deployment and the maintenance create jobs and retain them.

# EGS (Enhanced Geothermal System) in Hungary



- Projects
- Geothermal energy potential

## A schematic diagram of an ideal geothermal system





- Project place: Battonya
- The finish of the project: 2017. december 31.

### Main elements of the reservoir

<b>Fluid production rate</b>	75 kg/s
<b>Fluid temperature at wellhead</b>	200 °C
<b>Total effective heat exchange surface</b>	10×106 m <sup>2</sup>
<b>Rock volume</b>	3×108 m <sup>3</sup>
<b>Flow impedance</b>	<0,1 MPa (kg/s)
<b>Thermal drawdown</b>	10%
<b>Water loss</b>	<10%
<b>Capital interest rate</b>	5%

*Source: own compilation based on EGEC 2012*



## *Heat pumps*

High percentage of using heat pumps

### **The total geothermal heat pump capacity in Hungary**

<b>Geothermal heat pump (include Hydrothermal heat pump)</b>	<b>Total units in operation 2012</b>	<b>Total units in operation 2013</b>	<b>Cumulated in 2012 (kW)</b>	<b>Cumulated in 2013 (kW)</b>
<b>Brine/water</b>	312	375	5742	6876
<b>Direct expansion/Water and Direct expansion/air</b>			3800	3800
<b>Water/Water and Water/air</b>	13	18	4200	6700
<b>Total</b>	325	393	13742	17376

*Source: own compilation based on collected and data of EurObserv'ER*



# Environmental impacts

- Depletion of resources
  - Reduce the pressure
  - Caused the land to sink (?)
- Polluting waterways and air
  - Arsenic pollution
  - Contain dissolved gases
  - Closed-loop water systems
  - Open-loop water systems
- The difficulties of LCA analysis



## Conclusions

- Reduce the energy dependence from other countries
- Contribute the implementation of green economy
- It has also economic effects (e.g. create new jobs)
- Contribute to rich our 2020 goals
- Reduce the CO<sub>2</sub> emissions
- It is also hard to adapt the legislation in this field
- The geothermal energy need further research because of the high risk



# Thank you for your attention!

**Contact information:**

Klára Szita Tóth: [regszita@uni-miskolc.hu](mailto:regszita@uni-miskolc.hu)

Anna Vizkeleti: [vizkeletianna@gmail.com](mailto:vizkeletianna@gmail.com)