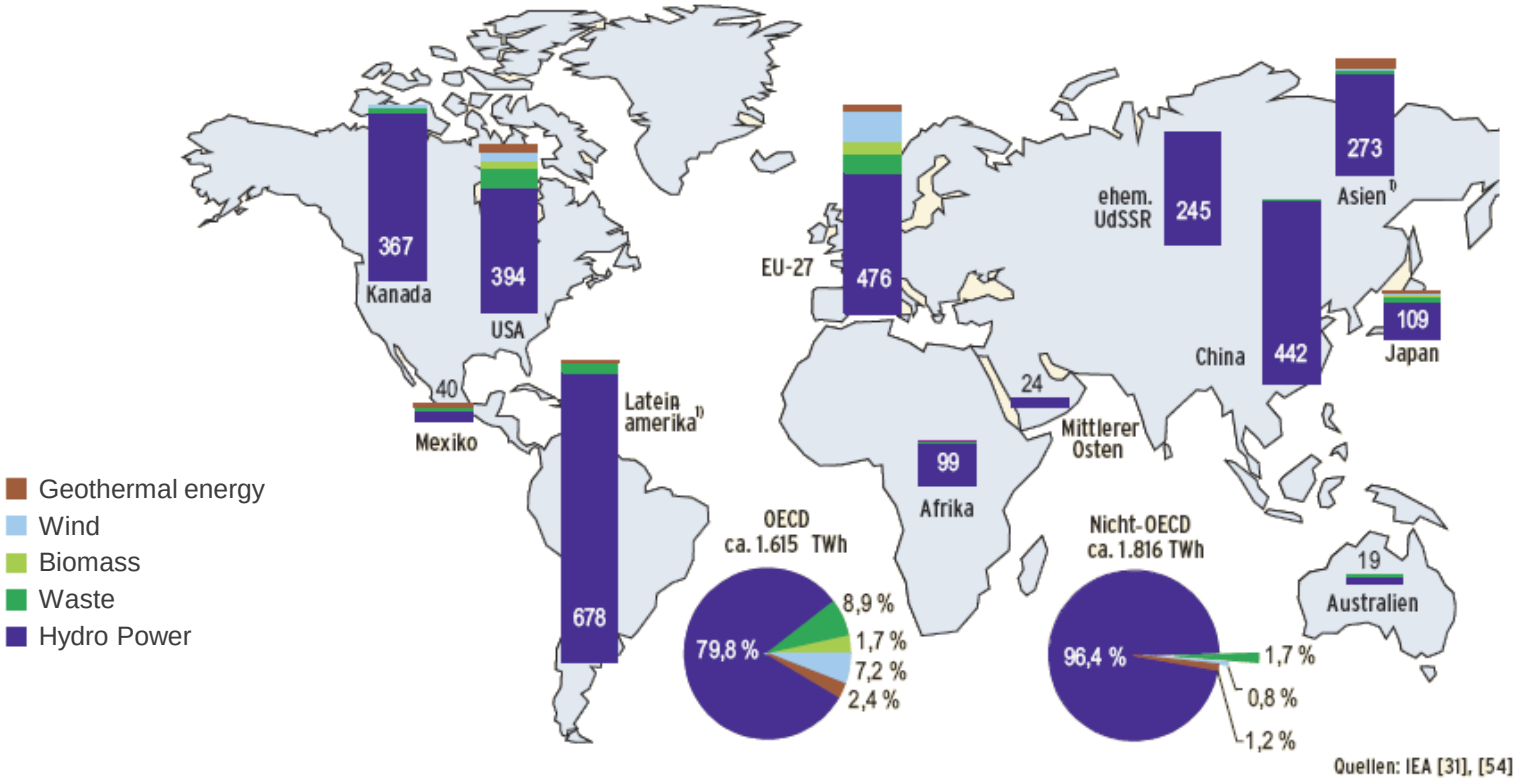
Renewable Energy from Small Hydro Power

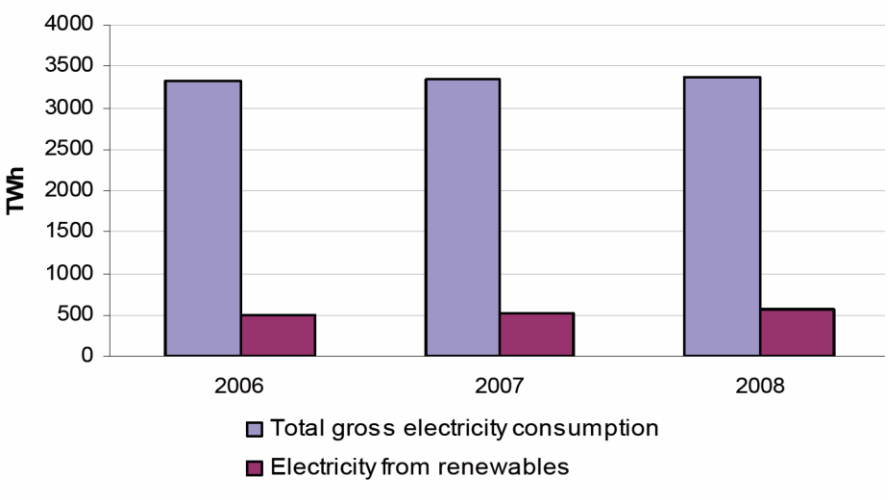
Vienna, 2011-11-03

Worldwide overview of renewable energy production



Source: IEA 2006

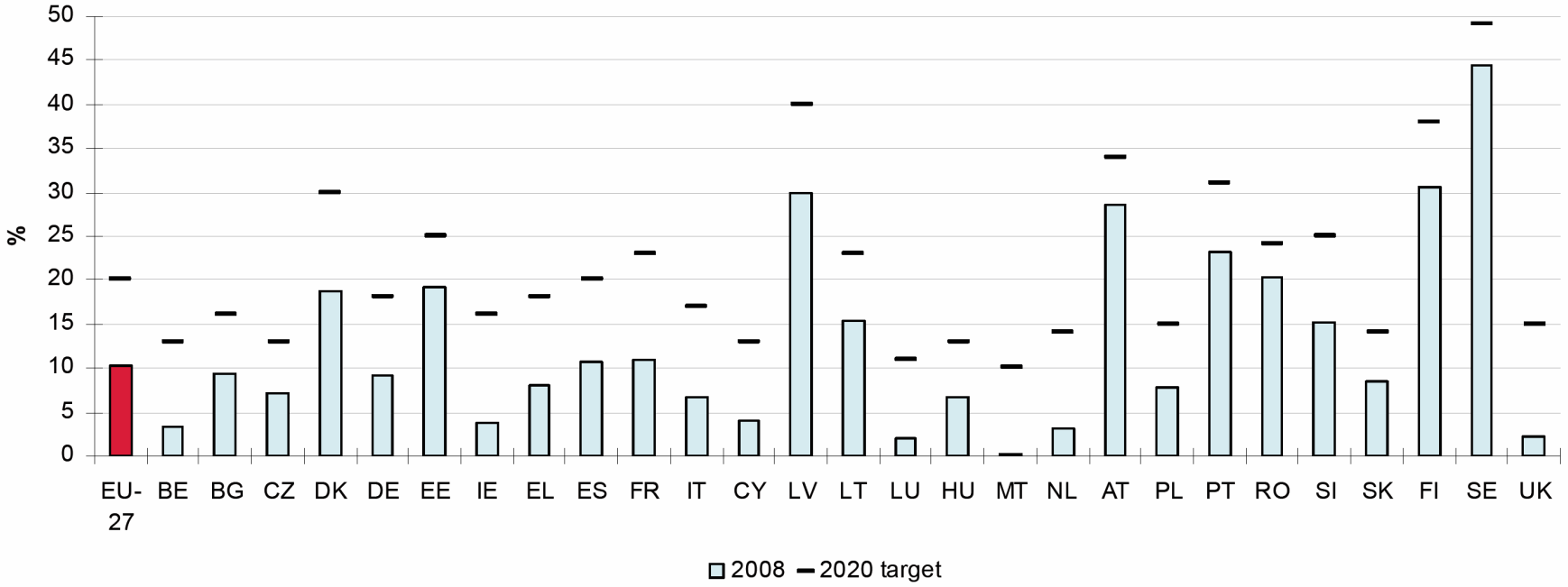
Electrical energy consumption and production from renewable energy sources



Source: Eurostat Statistics in focus 56/2010

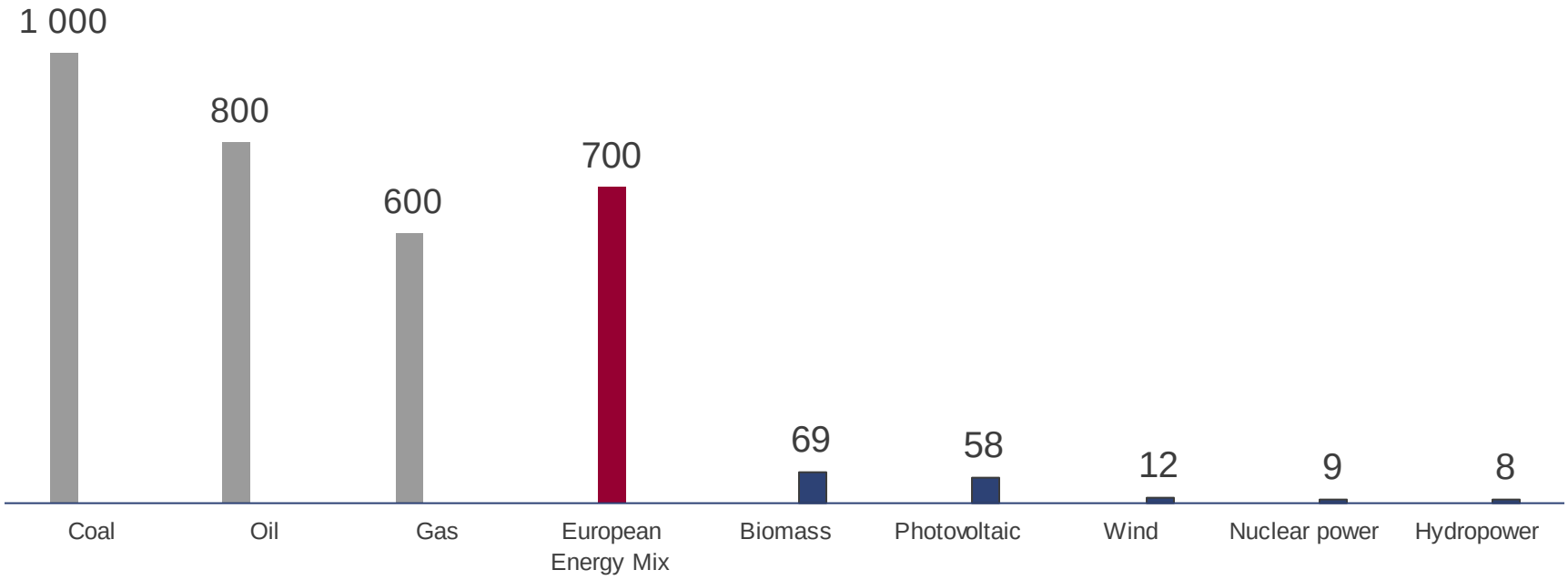
- approximately 17 % of electrical energy consumption produced by renewables
- 60 % Hydropower
  - ~ 12 % from Small Hydro
- 21 % Wind
- 17 % Biomass
- 1 % Photovoltaic
- 1 % Geothermal

20-20-20 targets of EU status 2008



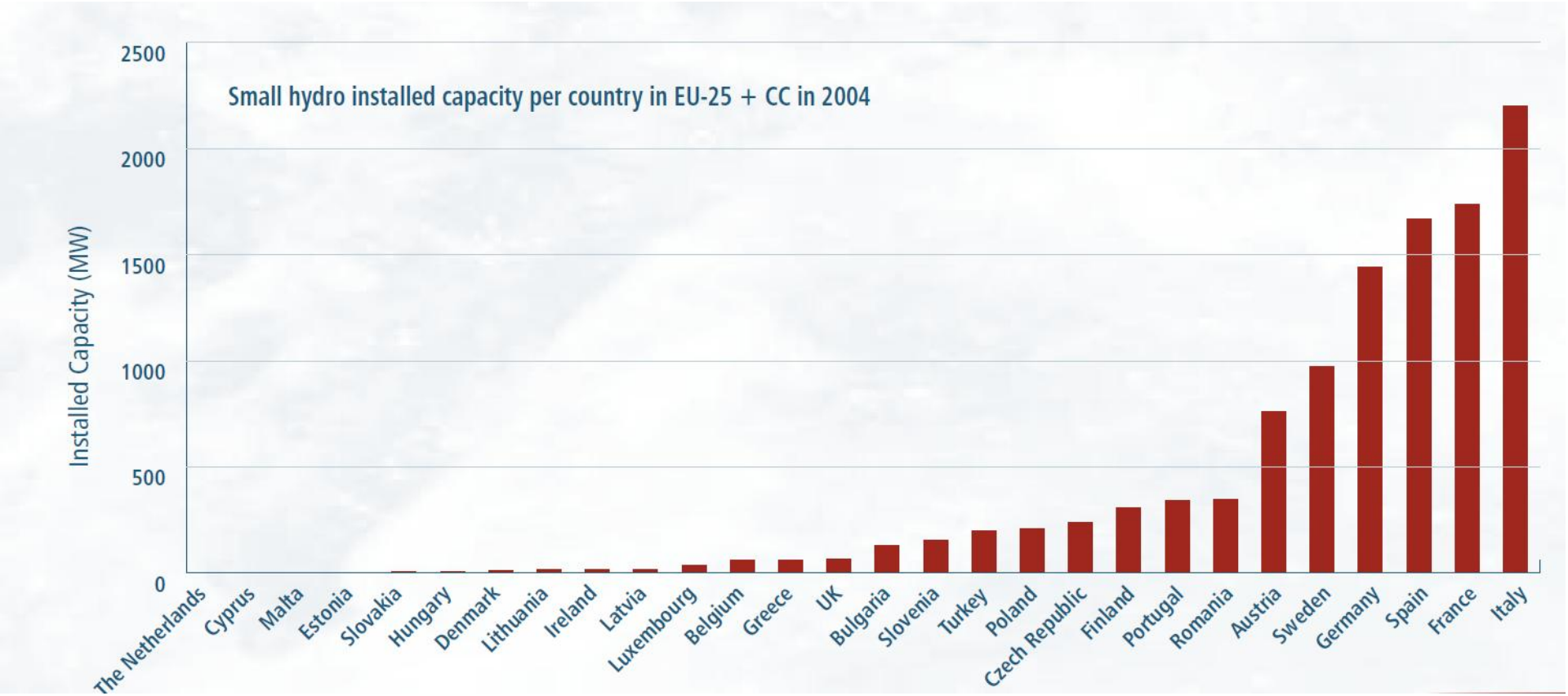
Source: Eurostat Statistics in focus 56/2010

g CO_2 emission per produced kWh over whole lifecycle of different energy sources



Source: Weisser, D. (2007). A guide to life-cycle greenhouse gas (GHG) emissions from electric supply technologies. Energy 32 (9), 1543-1559 (modified). 10

Installed Small Hydro capacities in EU



Source: ESHA State of the art of Small Hydropower in EU

EU Small Hydro potential economically feasible and ecologically acceptable

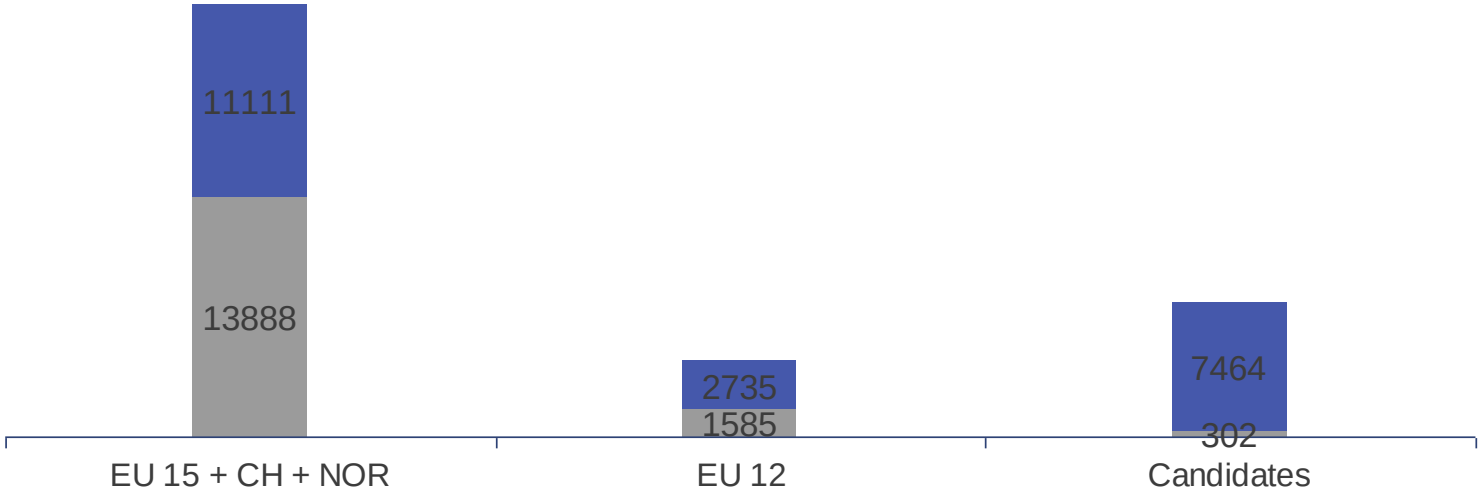
Installed output: ~ 15.800 MW

Potential: ~ 21.300 MW

Potential of energy production: ~ 110 TWh / a

CO_2 equivalent: ~ 77 Mio T / a

CO_2 certificate cost equivalent : ~ 1,15 Mrd. € / a



Source: ESHA

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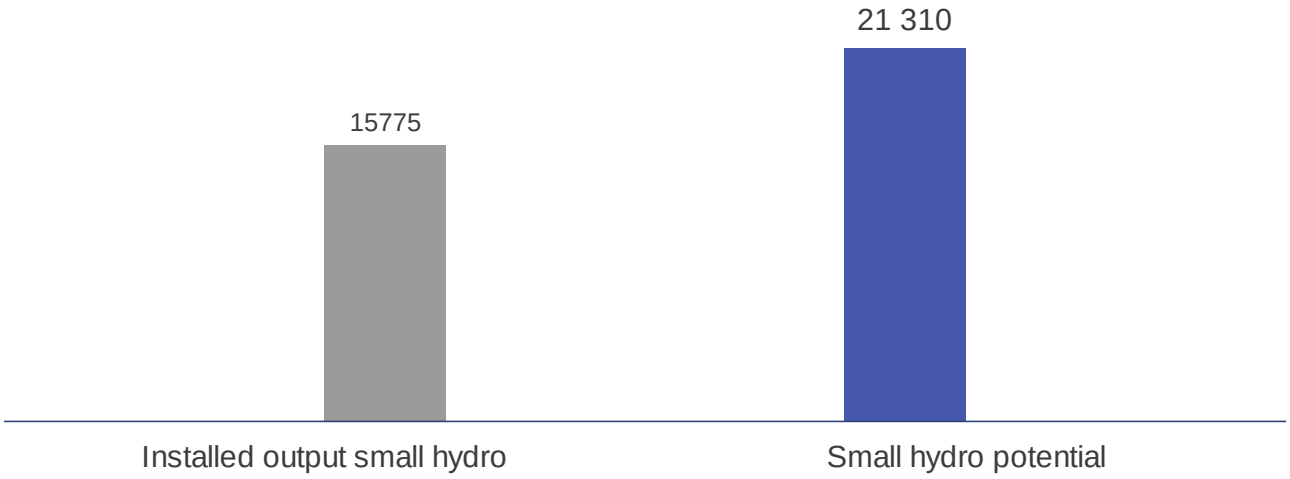
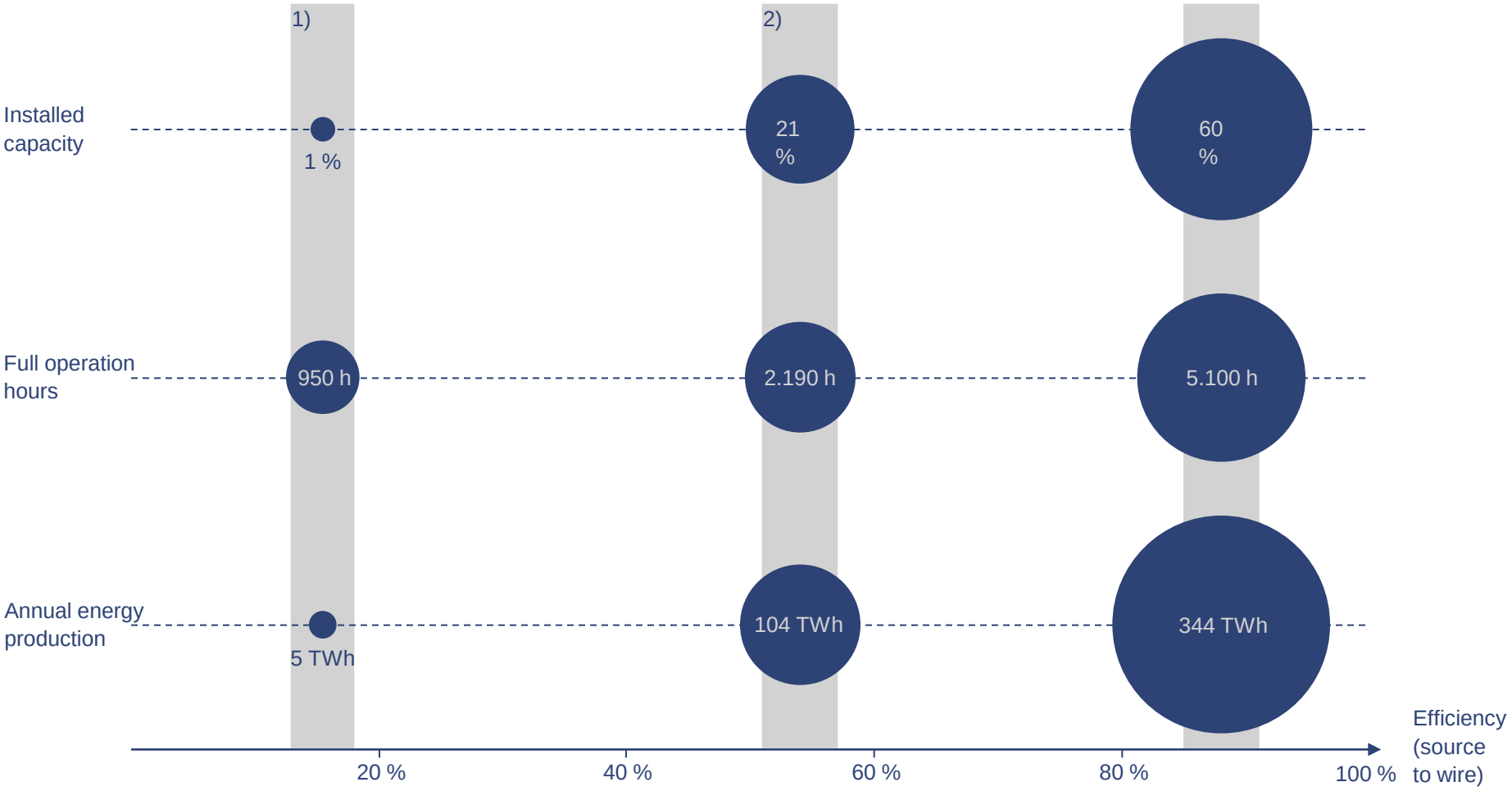


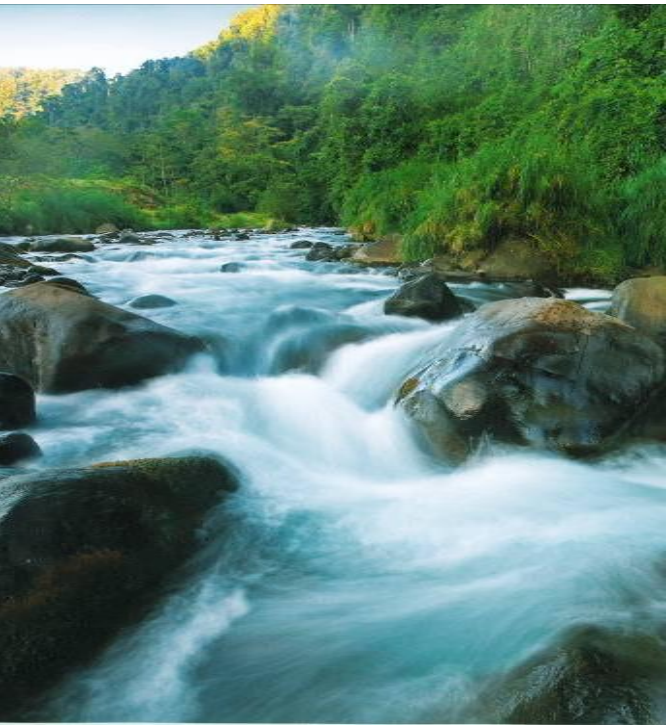
Source: ESHA

Comparison of different renewable energy sources within EU 27



Source: [1] Photovoltaik Austria, [2] Energie CH AG

Installed Small Hydro Power in Austria



Number of installed power plants: 4.000 – 5.000

Total capacity: 1.161 MW

Energy production: 5,5 TWh (≡ 10 % of Hydropower production)

CO2 reduction equivalent: 3,8 Mio. t

Potential new: 1,5 TWh

Potential MOD: 1,0 TWh

(Remark: all figures approximately)

Typical operation range Francis turbines

Head: 3 m – 200 m

Flow: 1 m^3/s – 50 m^3/s

Operation range: 50 % - 100 % nominal flow

Best efficiencies: 91 % - 94 %

(Run of rivers, channels, reservoirs, penstocks, closed circuits, drinking water, isolated net)

Typical operation range Pelton turbines

Head: 80 m – 1500 m

Flow: 0,5 m^3/s – 5 m^3/s

Operation range: 15 % - 100 % nominal flow

Best efficiencies: 89 % - 91 %

(Reservoirs, high head, penstocks, drinking water, isolated net)

Typical operation range Kaplan turbines

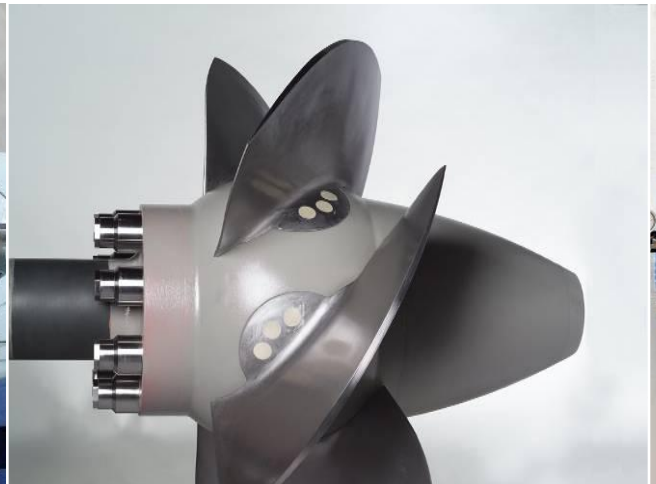
Head: 2,0 m – 30 m

Flow: 5 m^3/s – 100 m^3/s

Flow operation range: 25 % - 100 %

Best efficiencies: 90 % - 93 %

(Run of rivers, channels, residual water dotation, environmental units, irrigation purposes)



Sustainable solutions: Praterkraftwerk – Munich

- Located in the heart of the city
- Completely submerged power plant
- Generator integrated in bulb
- Owner: Green City Energy
- Small hydro power plant is part of Munich’s green energy initiative

Sustainable solutions: Praterkraftwerk – Munich

Year of construction: 2010

Annual energy production: 11 GWh

H = 8,07 m

n = 210 min^{-1}

P = 2502 kW

Sustainable solutions: Alpbach – Switzerland

- Located in world heritage Swiss Alps
- Power house fits perfectly in the surrounding
- Very low noise emission because of special nozzle design and water cooled generator
- Sophisticated engineering could reduce power house area by 20 %

Sustainable solutions: Alpbach – Switzerland

Year of construction: 2009

Annual energy production: 11 GWh

H = 304,8 m

n = 1000 min^{-1}

P = 2573 kW

Sustainable solutions: Hollersbach

Source: Salzburg AG

- Removed from the center of Hollersbach to an uninhabited area
- Power output increased from 1.320 kW to 5.200 kW
- Annual energy production increased from 7,5 Mio. kWh to 19 Mio. kWh
- Ecological balancing measures
- One of the first power plants built after the Second World War

Sustainable solutions: Hollersbach

Year of construction: 2010

Annual energy production: 19 GWh

H = 78,07 m

n = 600 min^{-1}

P = 5309 kW

Who is Kössler?

- More than 80 years of experience in Small Hydro
- Over 550 MW or 2.400 power plants equipped with Kössler turbines worldwide
- Full line supplier of turbine, turn key solutions, after sales service and maintenance works
- Market leader in EU
- Competence Center for Small Hydro Europe within Voith Hydro
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