

ROADMAP FOR A RENEWABLE ENERGY FUTURE



13 October 2016, Moscow

The REmap approach

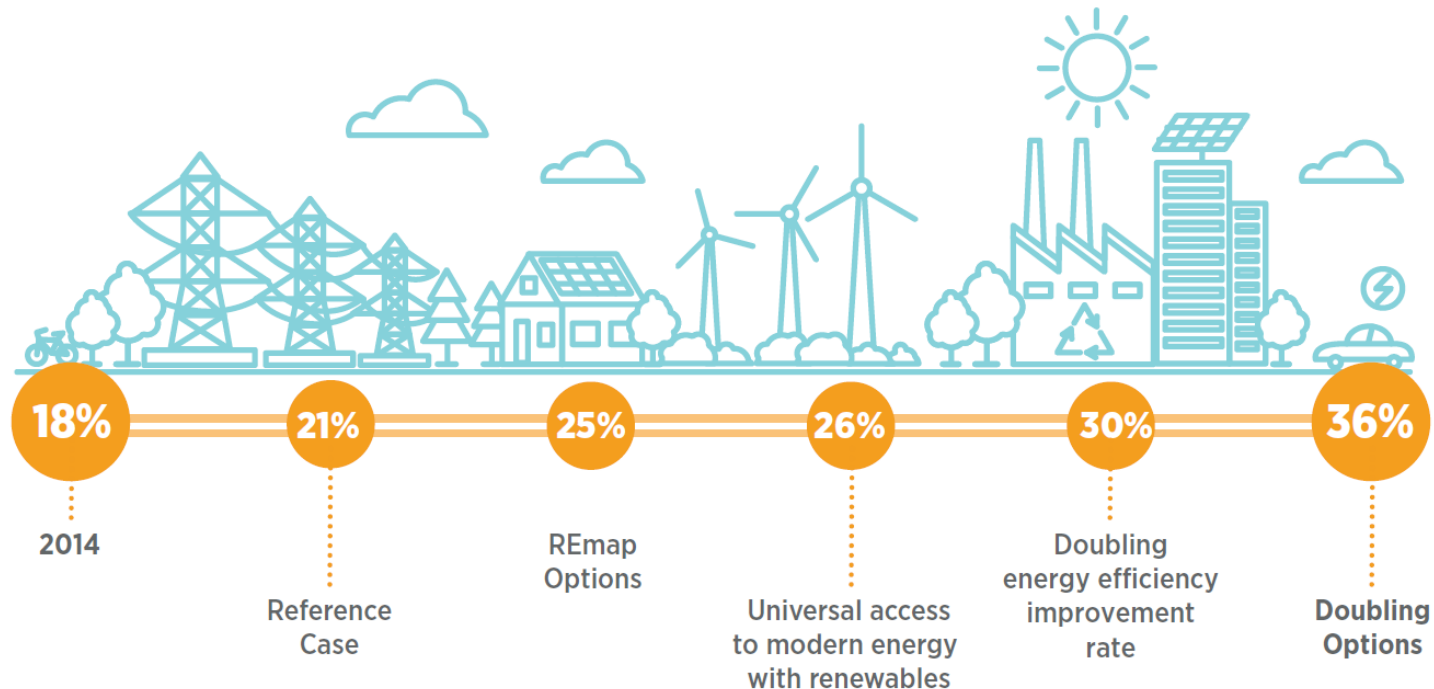
- IRENA's REmap programme explores **potential, cost and benefits** of doubling the share of renewables in global energy mix (SE4ALL objective), key to realize **SDG 7: Affordable and clean energy**
- **Technology Options:**
 - This is no a target setting exercise
 - Each technology option is characterized by its cost and potentials
 - Technology options can be combined into roadmaps or plans and translated into policy action
- Includes power, district heat, end-uses (industry, transport, buildings)
 - Including sector coupling and power systems aspects
- Developed **together with** and **validated by country experts**

REmap 2030 highlights

- Sustainable energy and climate change objectives can be reached by **doubling the share of renewable energy by 2030**
- Doubling renewables in the world's energy mix by 2030 will lead to **savings exceeding costs up to 15 times**
- Savings related to air pollution alone are **up to 10 times more than costs**
- The transition to renewables, with greater energy efficiency, can **limit the global temperature increase to below 2 degrees**
- Doubling the share of renewable energy by 2030 is feasible, but only with **immediate, concerted action in transport, buildings and industry**

Doubling the share of renewables

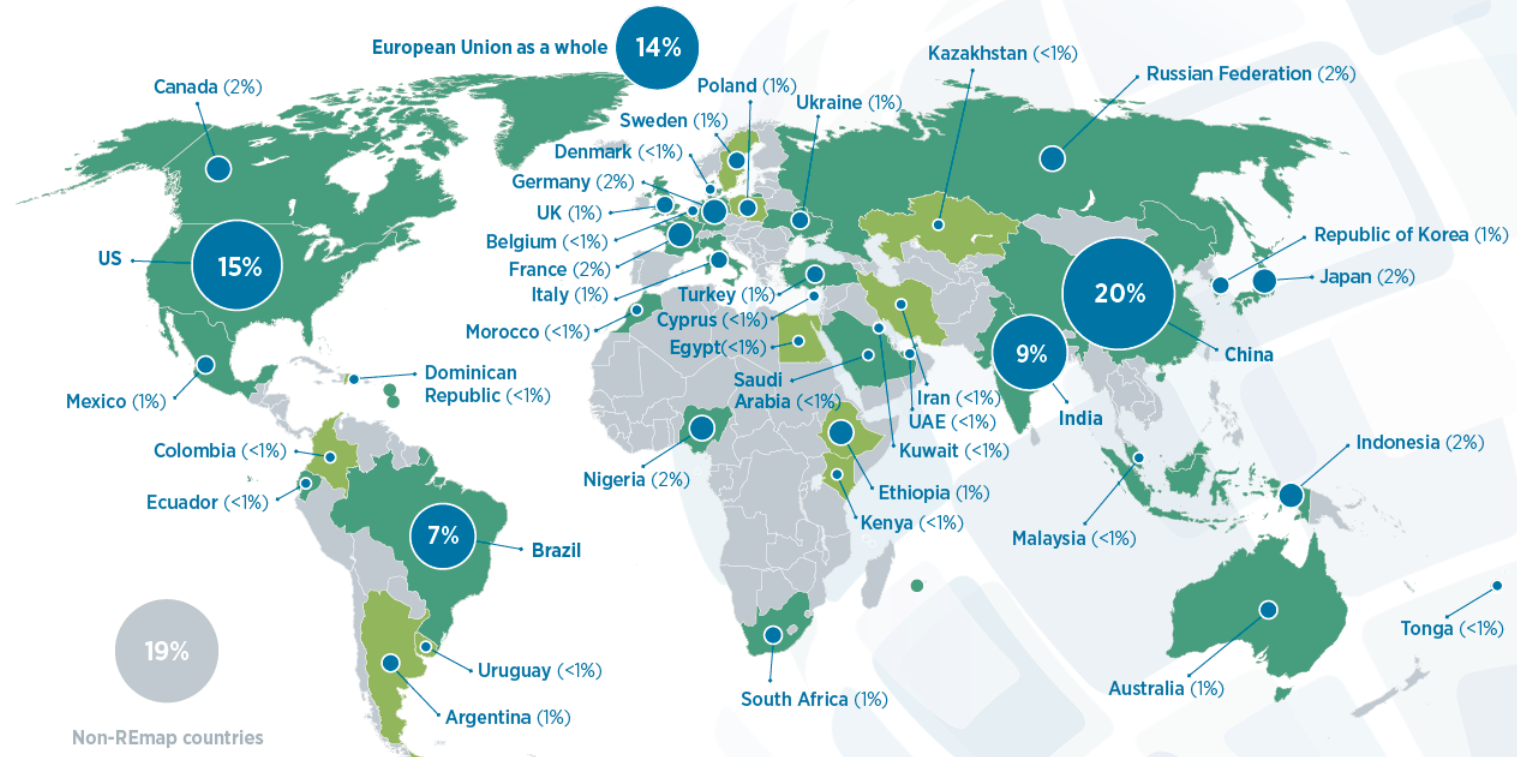
Roadmap to doubling the global share of renewable energy by 2030



Doubling the world's renewable energy share requires concerted action, reinforcing growth in renewables with energy efficiency and universal access – the three pillars of SDG 7

Contribution of countries to the doubling

FIGURE 22 Contribution of 40 REmap countries to total global renewable energy use in 2030, if REmap Options are followed



Note: Percentages indicate how much renewable energy each country consumes of the global total in 2030 if the REmap Options are deployed.

REmap Russia: chronology & background

- **Since 2013, Russia participates in IRENA's REmap programme**
- **Russian Federation member of IRENA since July 2015**
- **IRENA started working with Minenergo experts on roadmap in 2015**
- **Roadmap focuses particularly on:**
 - Renewables potential beyond the Russia current RE targets
 - Cost and benefits of higher share of renewables
 - How to get there by identifying barriers and solutions
- **Roadmap has well progressed, and under expert review**

Drivers for renewable energy in Russia (DRAFT)

- **Economic activity and job creation**
 - Positive impact on job creation, trade balance, and GDP
 - Russia currently the 5th worldwide in hydro sector jobs (65 000)
- **Science and technology deployment**
 - Solar PV manufacturing capacity in operation
 - R&D around PV
- **Affordable energy supply to isolated populations**
 - More than 10 million people, across 70% of the Russian territory
 - Generation costs from diesel are significant (USD 2/kWh)
- **Climate change and environmental concerns**
 - INDC target: -25-30% below the 1990 levels by 2030 subject to the maximum possible account of absorbing capacity of forests
 - Excl. LULUCF, equivalent to -6-11% below the 1990 levels

Key renewable energy targets and policies (DRAFT)

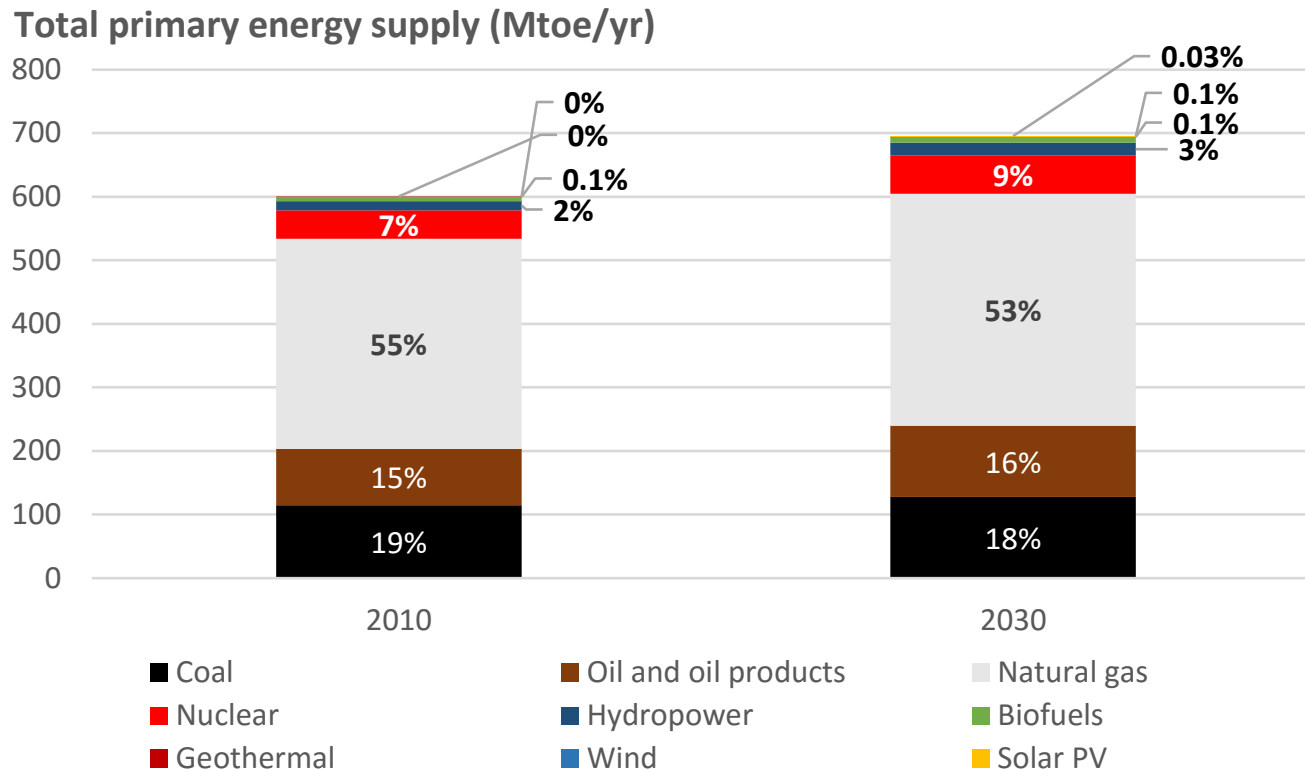
- 2.5% renewable energy share by 2020 (excl. large hydro)
- 5.9 GW RE capacity by 2024
- Auctions for RE power in wholesale and retail markets
- Several legislations for biofuels
- Reduce energy intensity by 40% in 2020 compared to 2010 level
- Modernization of the district heating sector
- Reference books for sectors, technologies and pollutants to control emissions

Summary of key REmap findings for Russia (DRAFT)

- **RE plays an important role in reducing Russia's CO₂ emissions**
 - Reference Case: CO₂ emissions decline 26% compared to 1990 levels
 - With higher RE share, CO₂ emissions decline by 30%
- **Bioenergy, hydropower and wind are key RE resources**
 - REmap identifies potential for 0.9 GW/year of wind installations (excl. capacity for export of electricity)
 - Modern bioenergy 57 Mtoe per year by 2030, 8% of TPES
- **Additional focus needed on end-use sectors and off-grid systems**
 - 1.1 GW wind & solar PV for off-grid
 - Biofuels for heating & transport
- **Annual investment need of USD 15 bln/yr, but additional cost of renewables offset by reduced externalities**
 - Renewables come with savings of up to USD 10 billion per year in 2030

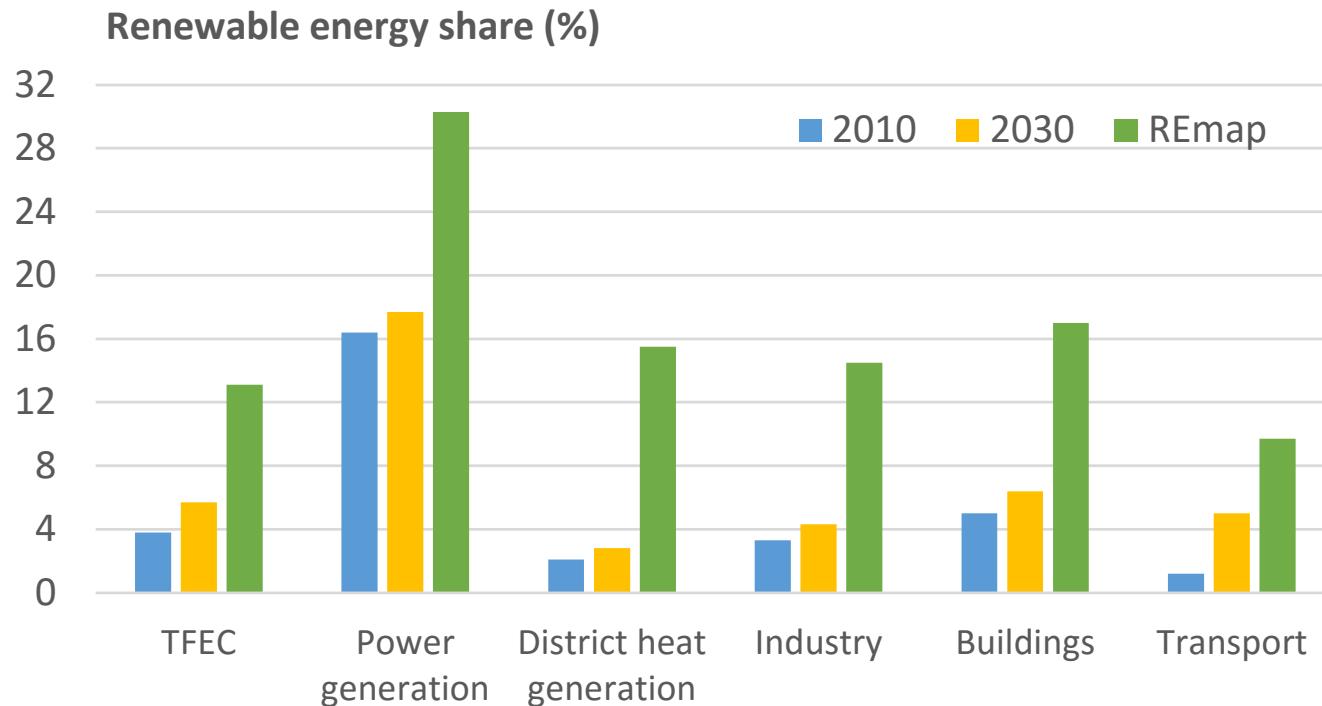
Reference Case – fuel mix similar to 2010 (DRAFT)

- Increasing role for wind and biofuels in the RE sector
- Modern renewable energy share in TFECE up to 6% by 2030



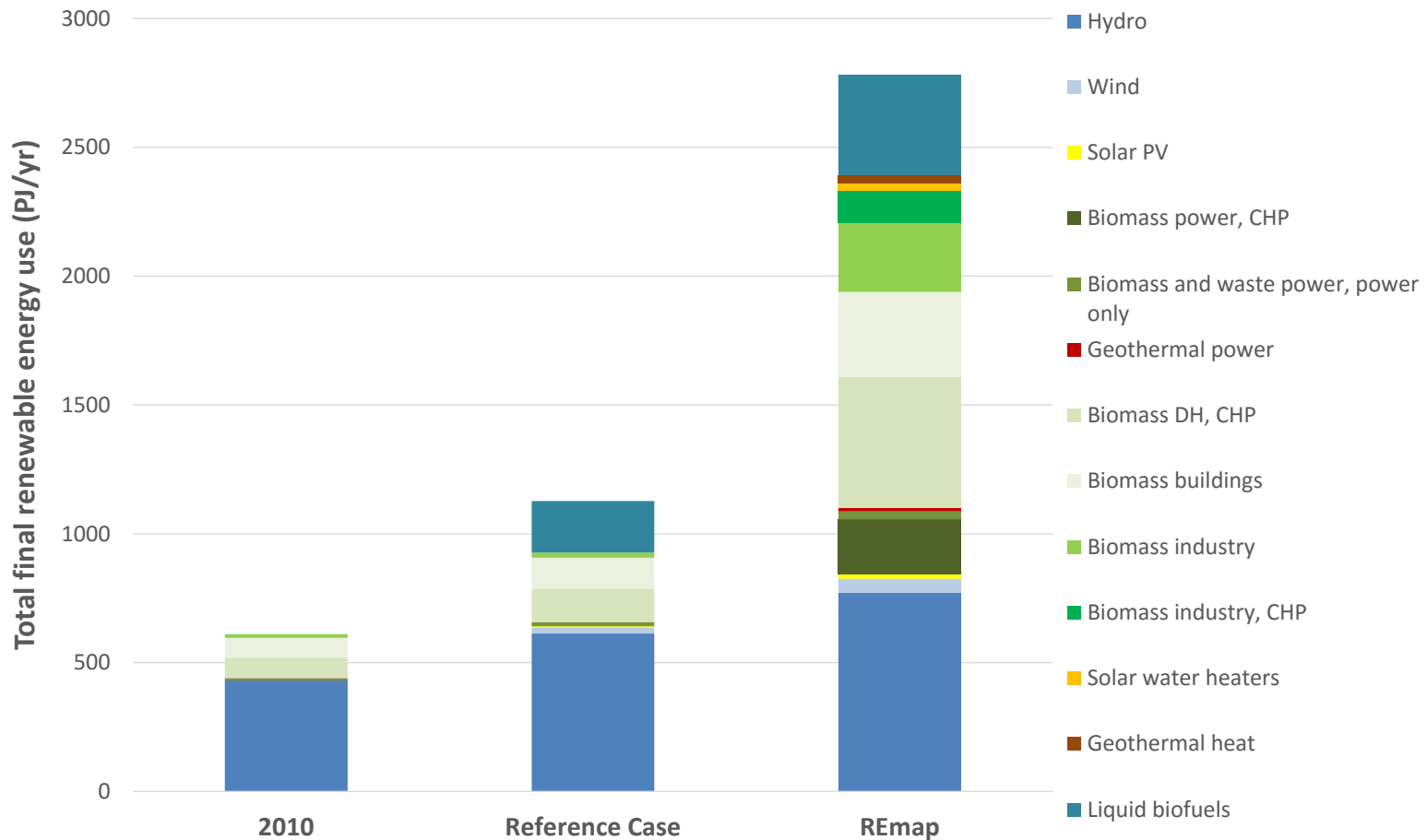
REmap - additional potential across sectors (DRAFT)

- RE shares to further increase with REmap Options
 - 13% in TFEF by 2030
- Highest RE shares in power generation and heating sectors



REmap – breakdown by technology and sector #REmap (DRAFT)

- **Total final RE use of 67 Mtoe/yr by 2030 under REmap**

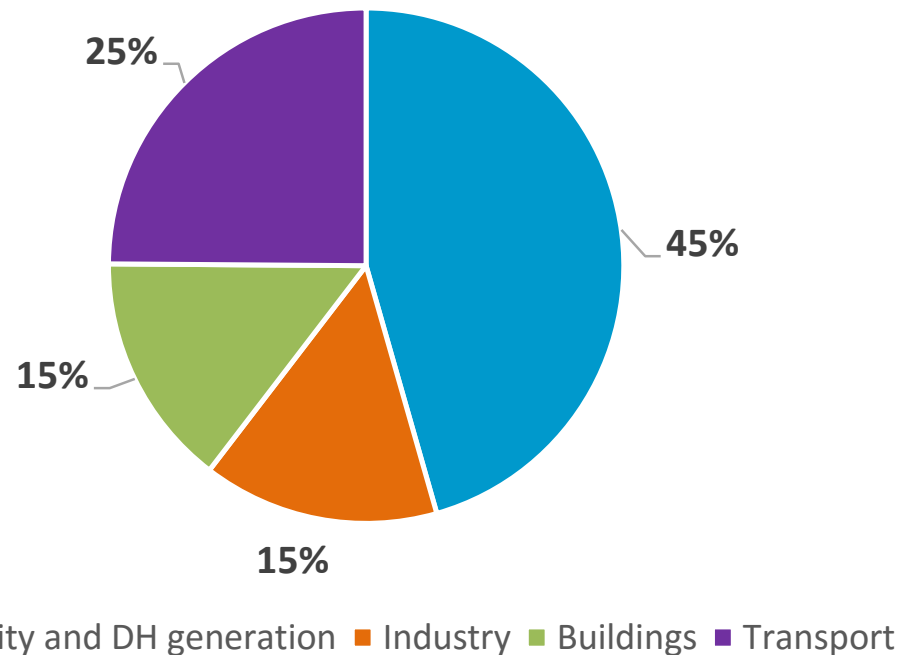


REmap – heating sector (buildings, industry, DH) (DRAFT)

- **Bioenergy main technology for all three sectors**
- **Buildings**
 - 11 kWh/m²/yr per year bioenergy use in 2030, compares with about 100 kWh/m²/yr total heating demand
 - 13.5 million m² rooftop area for solar water heating, mainly in SW (70 kW/1000cap. Today, Germany 150 kW/1000cap)
- **Industry**
 - 23 million tonnes of bioenergy for low-medium temp heat 40% CHP, 60% boilers
- **Transport**
 - About 15% blending of gasoline/diesel
 - 18.4 billion liters of biofuels (9.4 conventional ethanol, 8.5 diesel, 0.5 advanced ethanol)

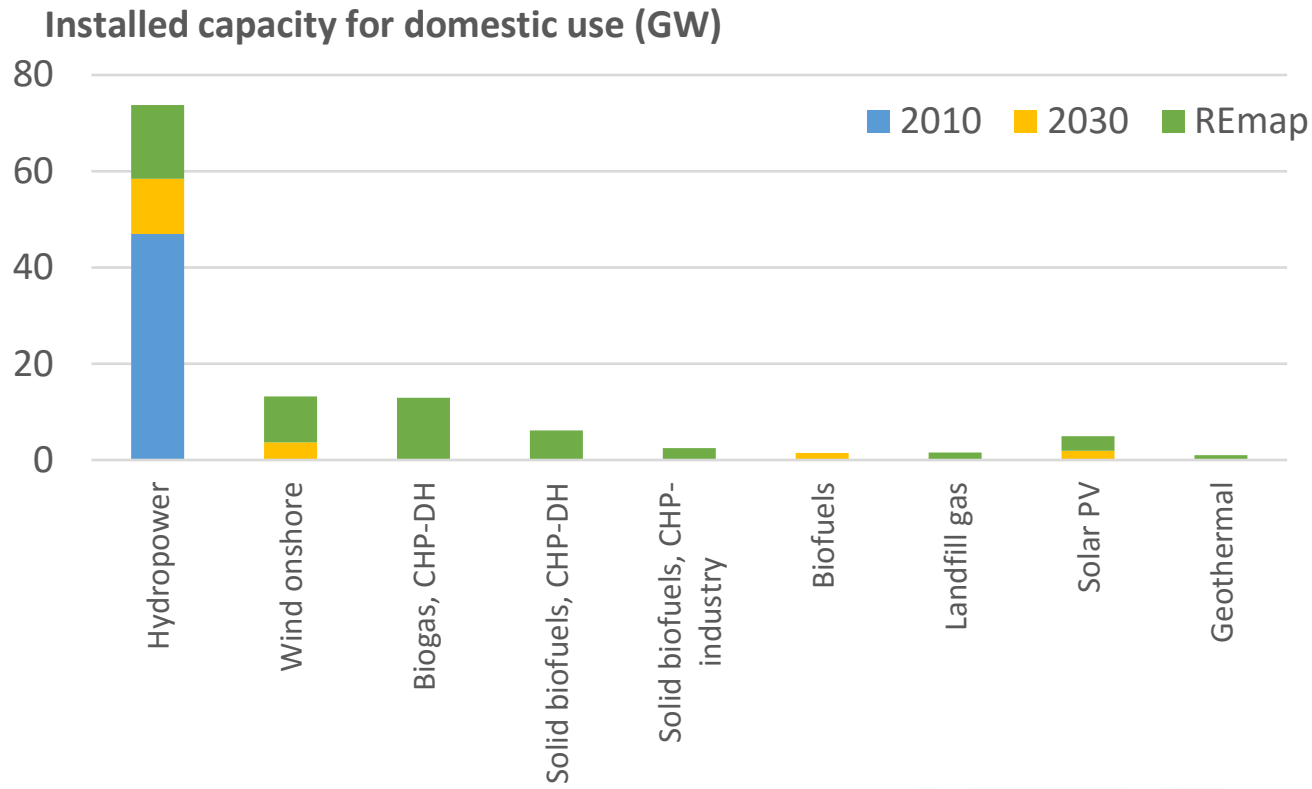
REmap – biomass feedstock supply vs demand (DRAFT)

- 57 Mtoe per year primary demand, compared to 45-335 Mtoe/yr supply potential
- >40% wood products, 25% energy crops, 17% biogas/waste, 15% agricultural residues,



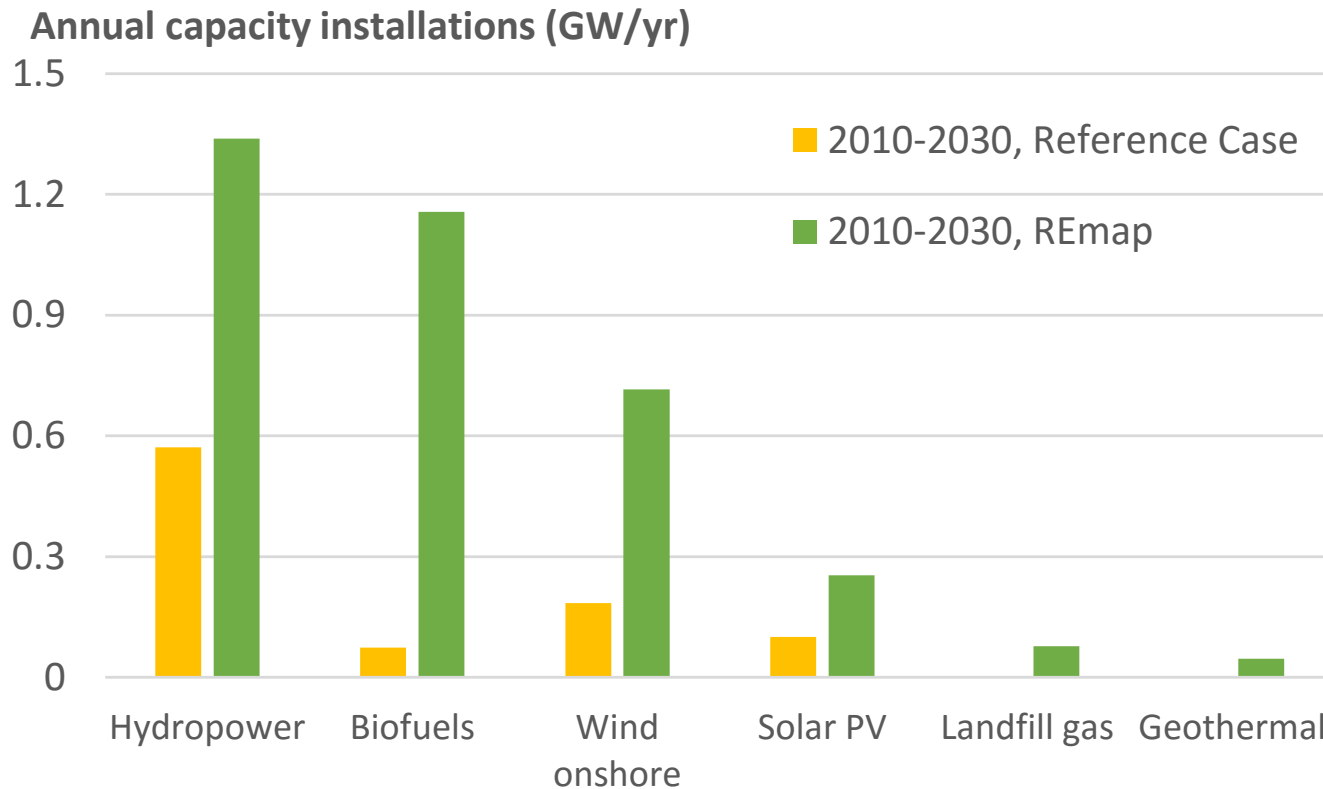
REmap - power generation (DRAFT)

- On-grid installed power capacity to increase by 50% by 2030
 - From 230 GW in 2010 to 360 GW
 - 118 GW RE for own consumption + about 40 GW export
 - 1.1 GW off-grid systems



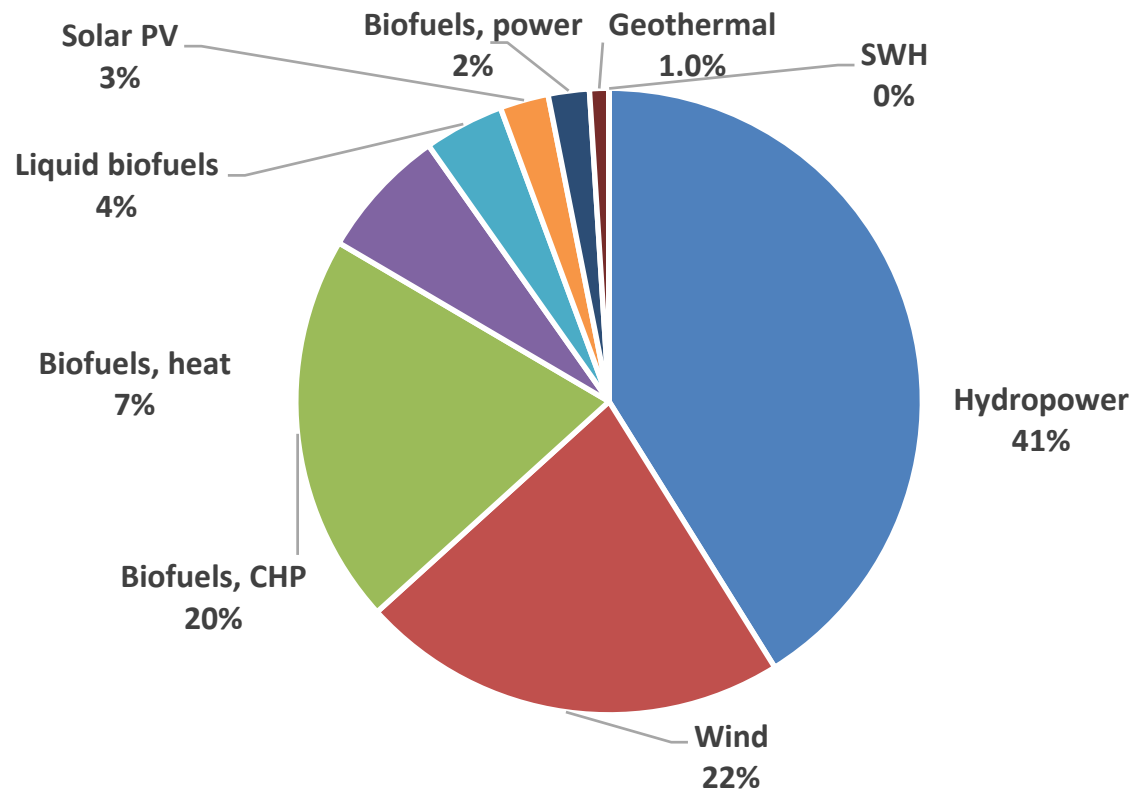
REmap - market acceleration for RE capacity (DRAFT)

- With REmap, RE capacity installations of 3.6 GW/year needed
 - Hydropower and biofuels would remain the largest markets



Investment needs - by technology (DRAFT)

- With REmap Options, investment needs for hydropower and wind account for two-thirds of the total (USD 15 bln/yr between 2010-2030)



Externality savings (DRAFT)

- **Savings from reduced externalities consist of:**
 - Outdoor air pollution: **USD 0.4 - 4.0** billion per year
 - Includes PM_{2.5}, NO_x, SO₂, VOCs, and ammonia (NH₃)
 - Climate change: **USD 2.3 - 11.1** billion per year
 - Based on USD 17-80 per tonne of CO₂
- **Export benefits: USD 31 - 57 billion per year**
 - Wind and hydropower, mainly to China
 - Biofuels, mainly to Europe (USD 20-46 billion per year)
- **System costs with externalities USD -11.1 to 1.3 bln/year**

Areas that require further attention (DRAFT)

- Long-term planning, considering benefits of renewable energy
- Wind power and solar PV development
- Power sector, grid transmission infrastructure, flexibility of the power system
- Creating bioenergy markets



REmap



ROADMAP FOR
**A RENEWABLE
ENERGY FUTURE**