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International Renewable Energy Agency

REmap 2030
A Renewable Energy Roadmap

# REmap 2030: Renewables for manufacturing industry

Paris, 11 May, 2015

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# REmap 2030

# REmap 2030 - A roadmap for doubling the RE share

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- In 2011, UN Secretary-General initiated the global Sustainable Energy for All (SE4ALL) initiative
- Three objectives, all to be achieved by 2030:
  - Universal energy access (rural electrification, modern forms of renewables
  - Doubling the rate of energy intensity improvements
  - **Doubling the share of renewables in the global energy mix (compared to 2010 level)**
- Each objective has its own hub; IRENA is the thematic hub for renewables
- 2014-2024: UN decade of Sustainable Energy for All

# REmap 2030 - A roadmap for doubling the RE share

- REmap explores the **potential**, **cost** and **benefits** of doubling the renewables share in the global energy mix
- **Technology options**
  - No target setting; options characterised by their cost and potentials
  - Technology options can be combined into scenarios and translated into policy action
- Focuses on power, district heat and end-use sectors
- Coverage: **40 countries;** 80% of the global energy use
- Developed together with & validated by country experts

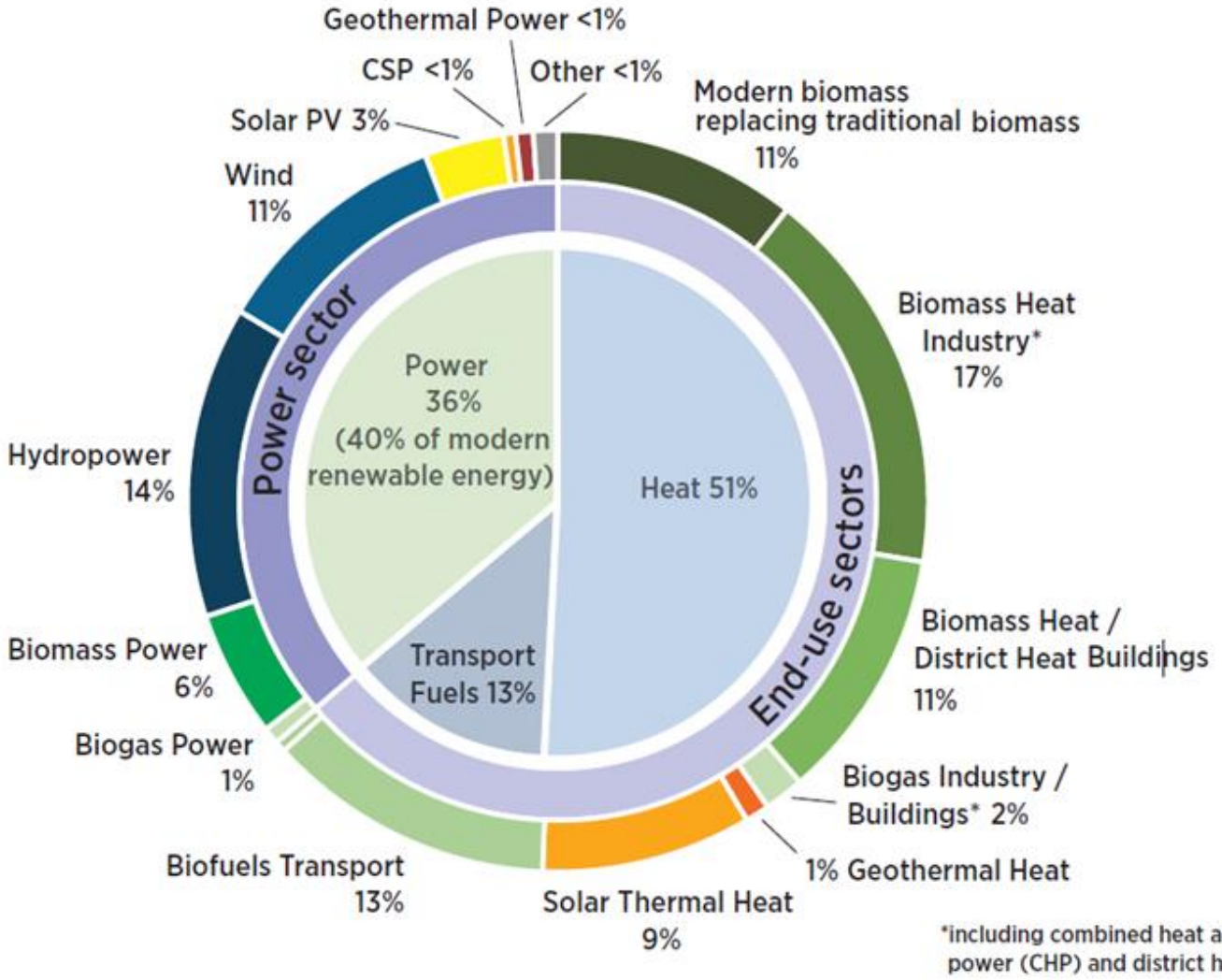
# REmap 2030 key findings

- **Doubling the RE share to 36% in 2030 is technically achievable with existing technologies**
  - Higher shares in power generation
  - More attention needed for heating and transportation fuels (biomass)
- **Doubling is affordable when externalities are accounted for**
  - However externalities are not reflected in todays prices. Many markets are distorted because of energy subsidies
  - Macro-economic benefits include more jobs; economic activity; health benefits; a cleaner environment; improved energy security
- **Potential exists in all countries**

# Global RE Use in 2030 including REmap Options

**REmap 2030 – 132 EJ (final energy)**

**60% of total is biomass; and 20% is industry (18% biomass & 2% solar thermal)**



# Progress per End-Use Sector

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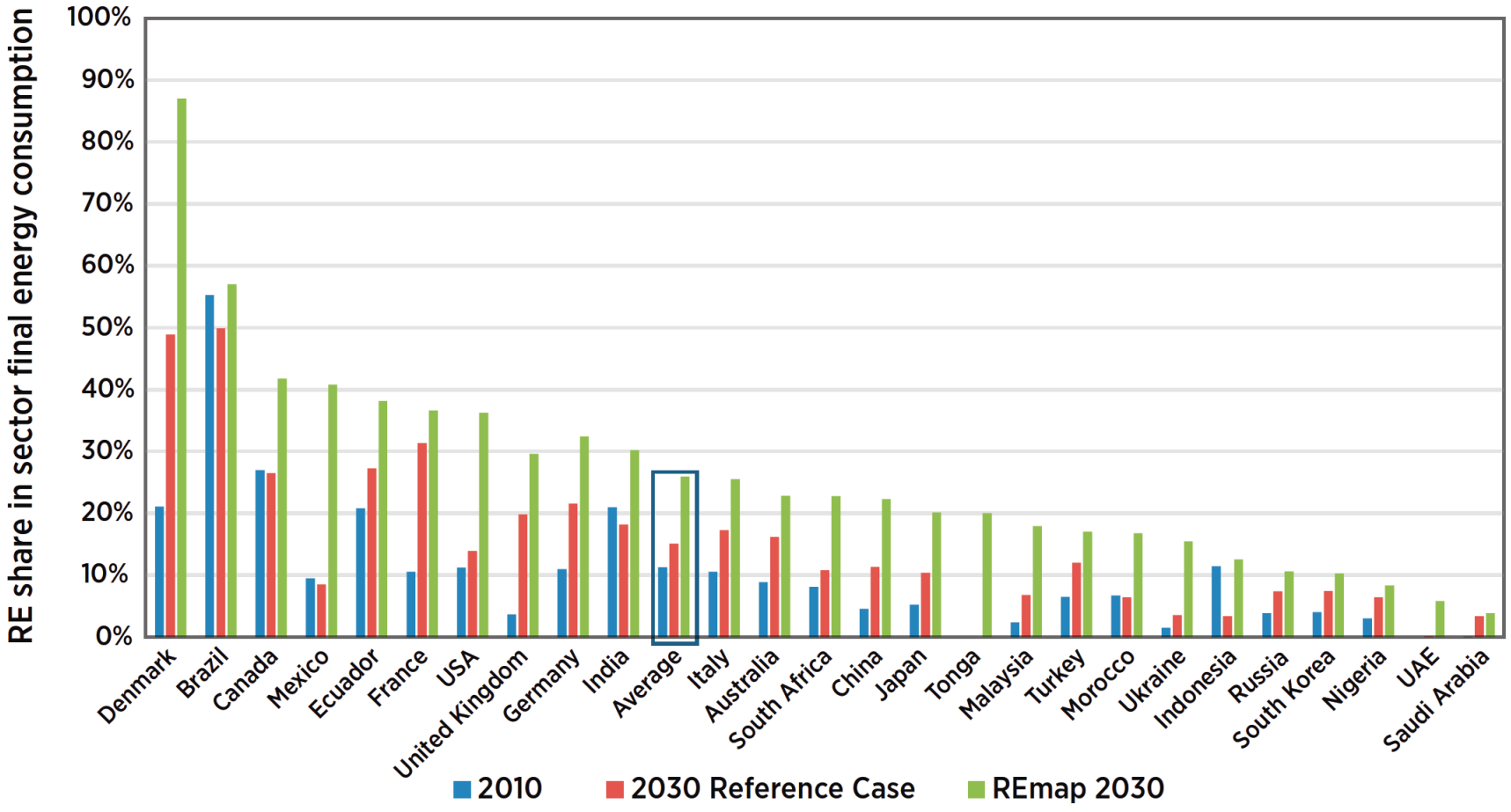
| | Renewable Share of: | as % of: | 2010 | 2030 Refer-ence | REmap 2030 | RE use REmap 2030 (EJ/yr) |
|---|---|---|---|---|---|---|
| Industry | Heat[1] | Heat consumption | 8% | 9% | 19% | 25 |
| | Heat & Electricity & DH[2] | Sector TFEC | 11% | 15% | 26% | 51 |
| Buildings (excluding traditional biomass) | Heat[1] | Heat consumption | 12% | 16% | 35% | 25 |
| | Heat & Electricity & DH[2] | Sector TFEC | 14% | 20% | 38% | 50 |
| Transport | Fuels[1] | Fuel TFEC | 3% | 5% | 15% | 16 |
| | Fuels & Electricity[2] | Sector TFEC | 3% | 6% | 17% | 18 |
| Power[3] | | Generation | 18% | 26% | 44% | 62 |
| District heat (DH)[3] | | Generation | 4% | 14% | 27% | 5 |
| Total (as % of TFEC) | Modern RE (excl. traditional biomass) (see Figure 6 for the cost-supply curve which plots the development of the modern RE share) | | 9% | 14% | 27% | 119 |
| | Modern + Access | | 18% | 21% | 30% | 132 |
| | Modern + Access + EE (assumes the implementation of all the 3 SE4ALL objectives) | | | | 34% | |
| | Modern + Access + EE + "RE+" | | | | >34% | |

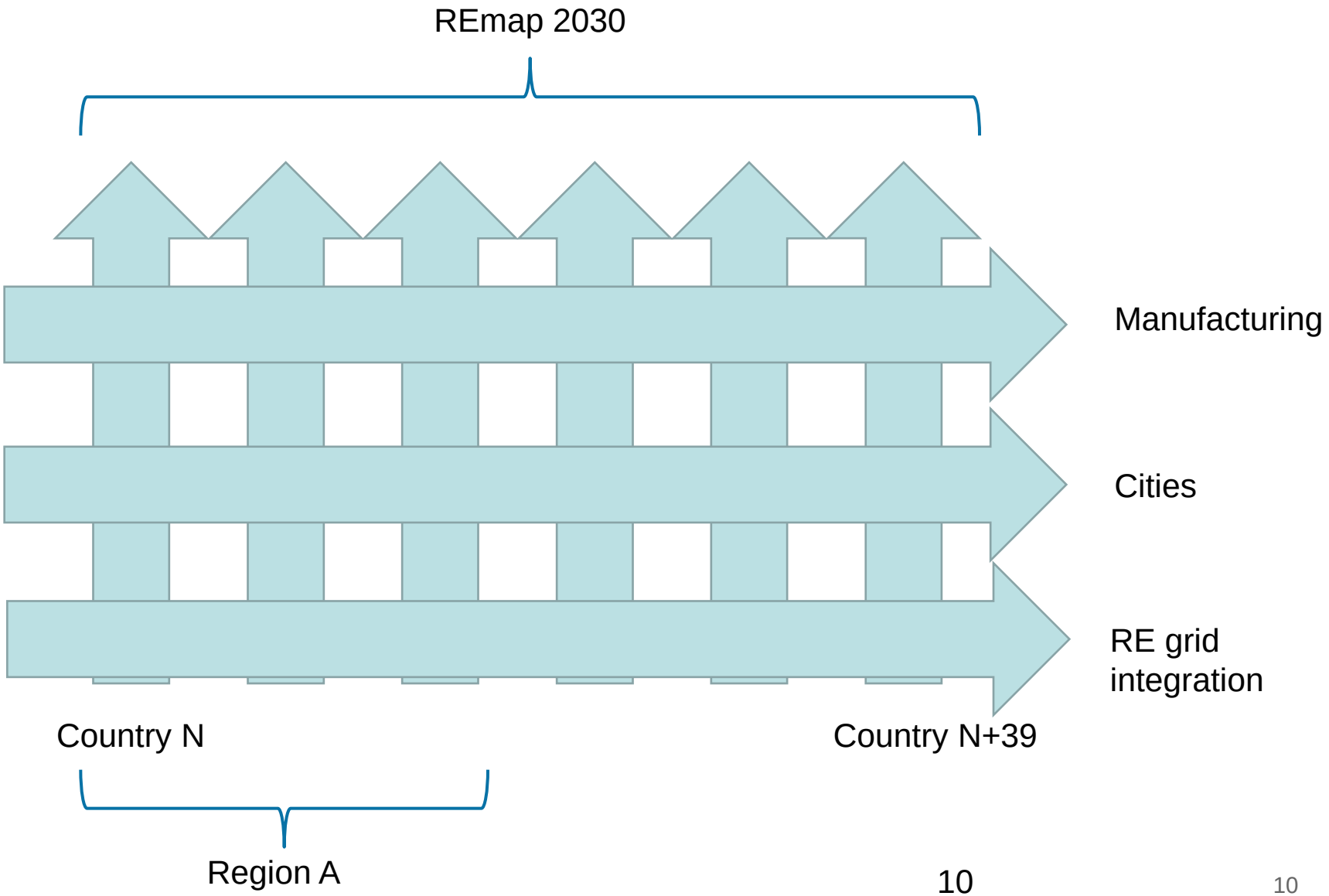
# Options in the Manufacturing Sector




With the right policies, the renewable energy share of the manufacturing sector could more than double to 26%

# 2 Renewables in Manufacturing

# REmap 2030 and technology roadmaps



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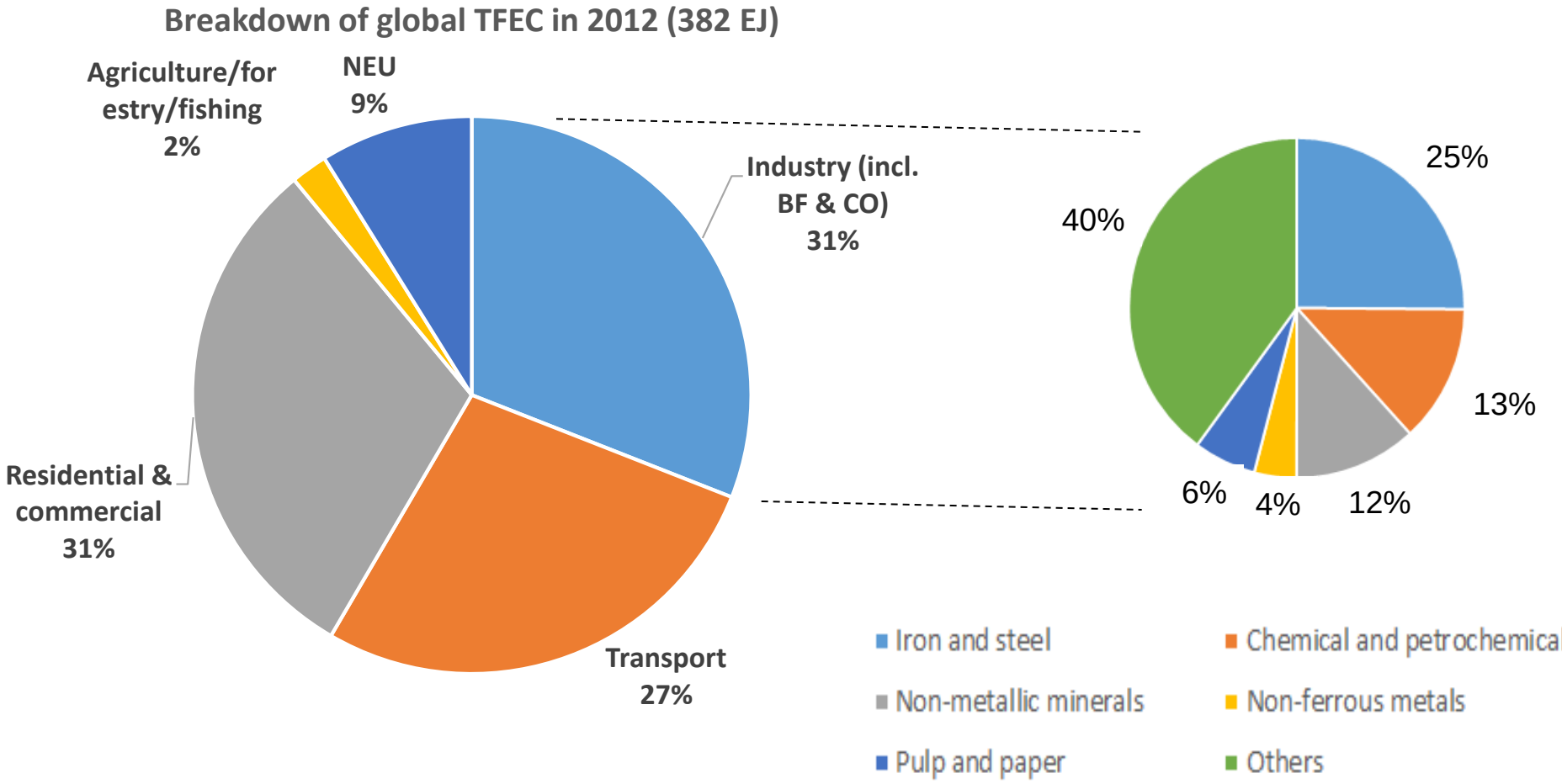
# Manufacturing sector energy






Source: IEA (2015)

# Methodology

1) **Projections of industrial energy use: 2010 – 2030** (ten world regions)
2) **Production costs of process heat generation: 2030**
3) **Potential of renewables** (bioenergy, solar thermal, geothermal, heat pumps)

**1) Technical potentials**, capital stock and temperature level,

→ two scenarios: **Optimistic** and **Realistic**

**2) Economic potentials,** comparison of process heat generation costs,

→ two scenarios: **Moderate climate policy** and **Ambitious climate policy**

**3) Economically realisable potentials,** comparison of economic potentials with resource supply (notably for biomass)

**4) Allocation of realisable potentials** to different temperature levels

# Key findings (1/6)
# Growth and costs

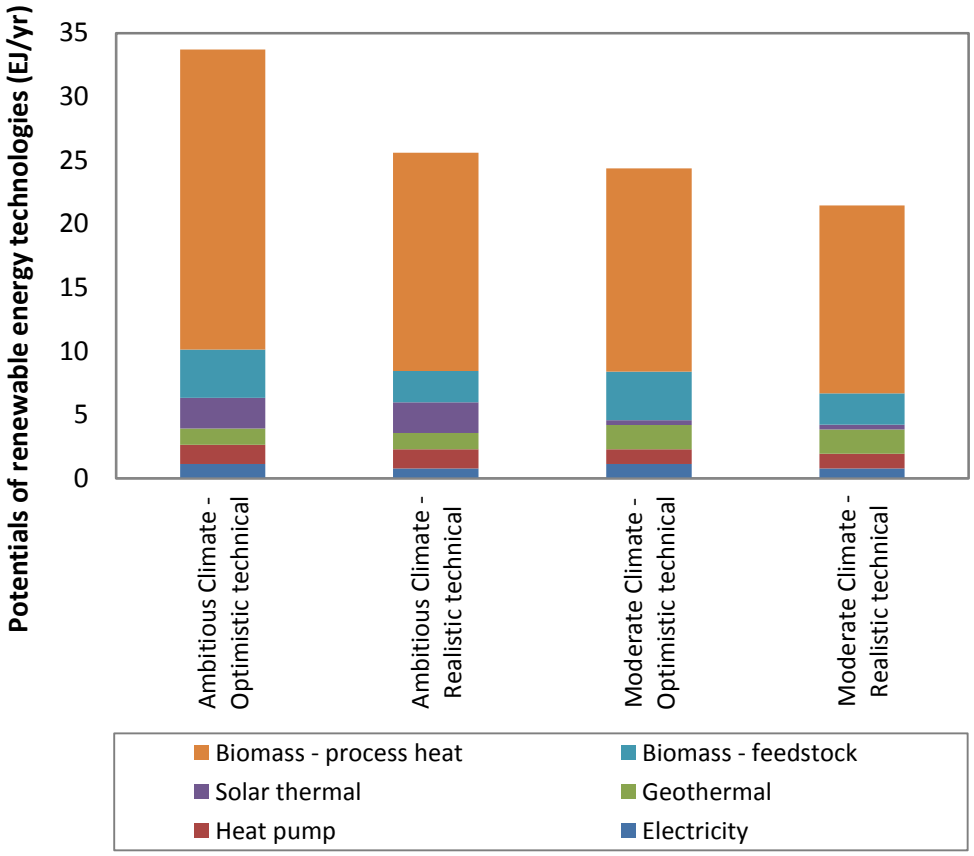
## Industrial energy use growth

- Total final industrial energy use grows to >120 EJ by 2030 (excl. NEU)
- >85 EJ **fossil fuels**, 10 EJ combustible renewables and waste, >25 EJ electricity
- 50-60% from **existing capacity**, accounting for 45-50 EJ of fossil fuel use
- About half **high temperature** (>400 $^{o}$C) process heat, the remainder roughly halved between **low** and **medium** temperature heat applications

## Process heat generation costs

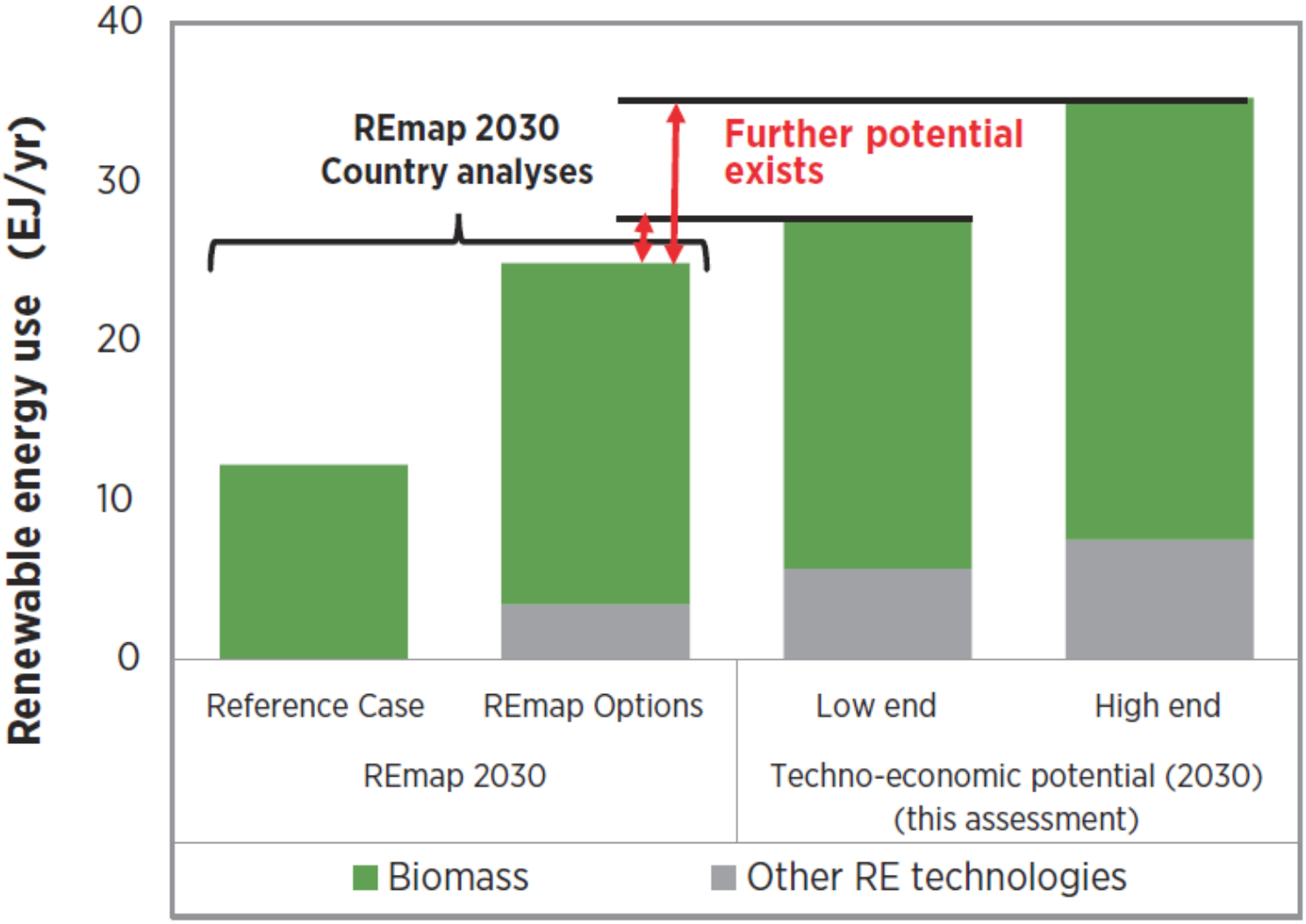
- Fossil fuels by 2030: 15-20 USD/$GJ_{th}$ (varies across countries: 10-35 USD/$GJ_{th}$, depending on temperature, energy price, fuel type, technology)
- Carbon pricing (based on WEO) adds another 4-9 USD/$GJ_{th}$
- Biomass residues **cost-competitive** worldwide 8-15 USD/$GJ_{th}$, energy crops **only in few regions** 20-35 USD/$GJ_{th}$
- Solar thermal **cost-competitive** 20-30 USD/$GJ_{th}$ India, LAC, parts of OECD
- Geothermal and heat pumps **cost-competitive** 10-25 USD/$GJ_{th}$ in most regions

# Key findings (2/6) Scenarios

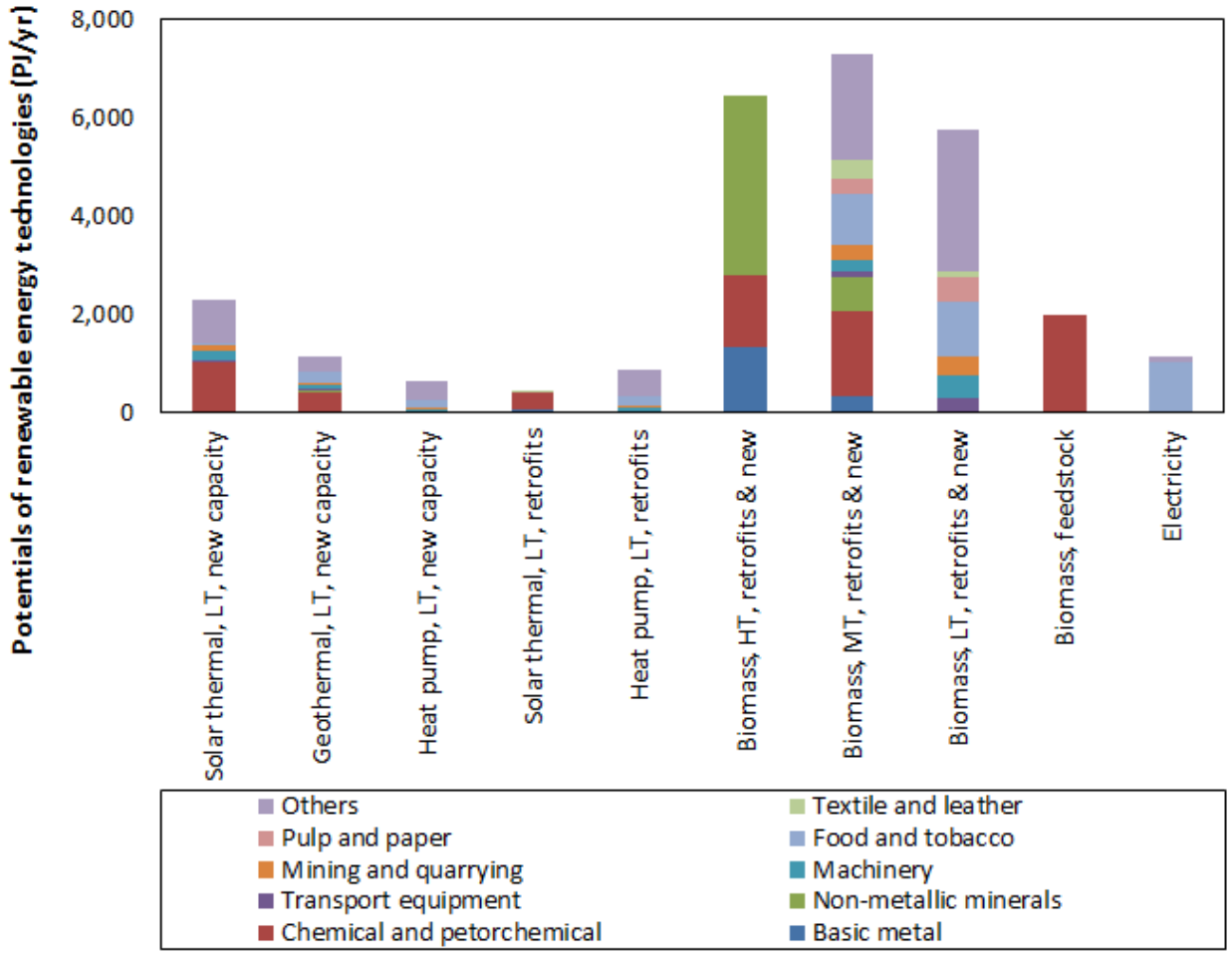



- Additional RE use **19-28 EJ** for the global industry by 2030,
- Low-cost biomass basis for process heat generation: **14-20 EJ** (both existing & new capacity)
- Solar thermal for LT heat contributes **0.7-2.8 EJ** (new cap.)
- Geothermal and heat pumps for LT heat **3 EJ** (new capacity)
- Biomass as feedstock **1-2 EJ**

# Key findings (3/6)
# Techno-economic potentials

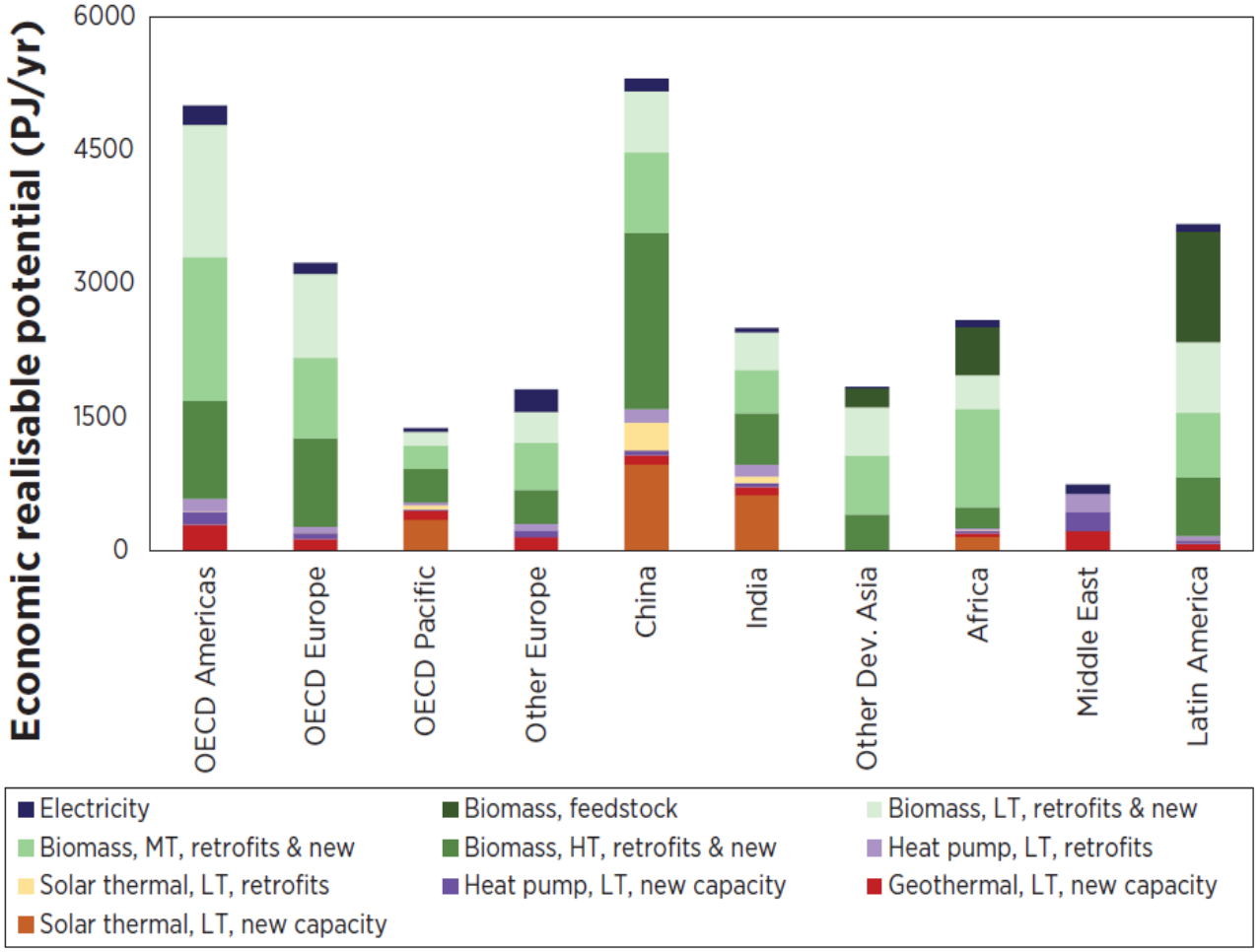


# Key findings (4/6)
# By technology



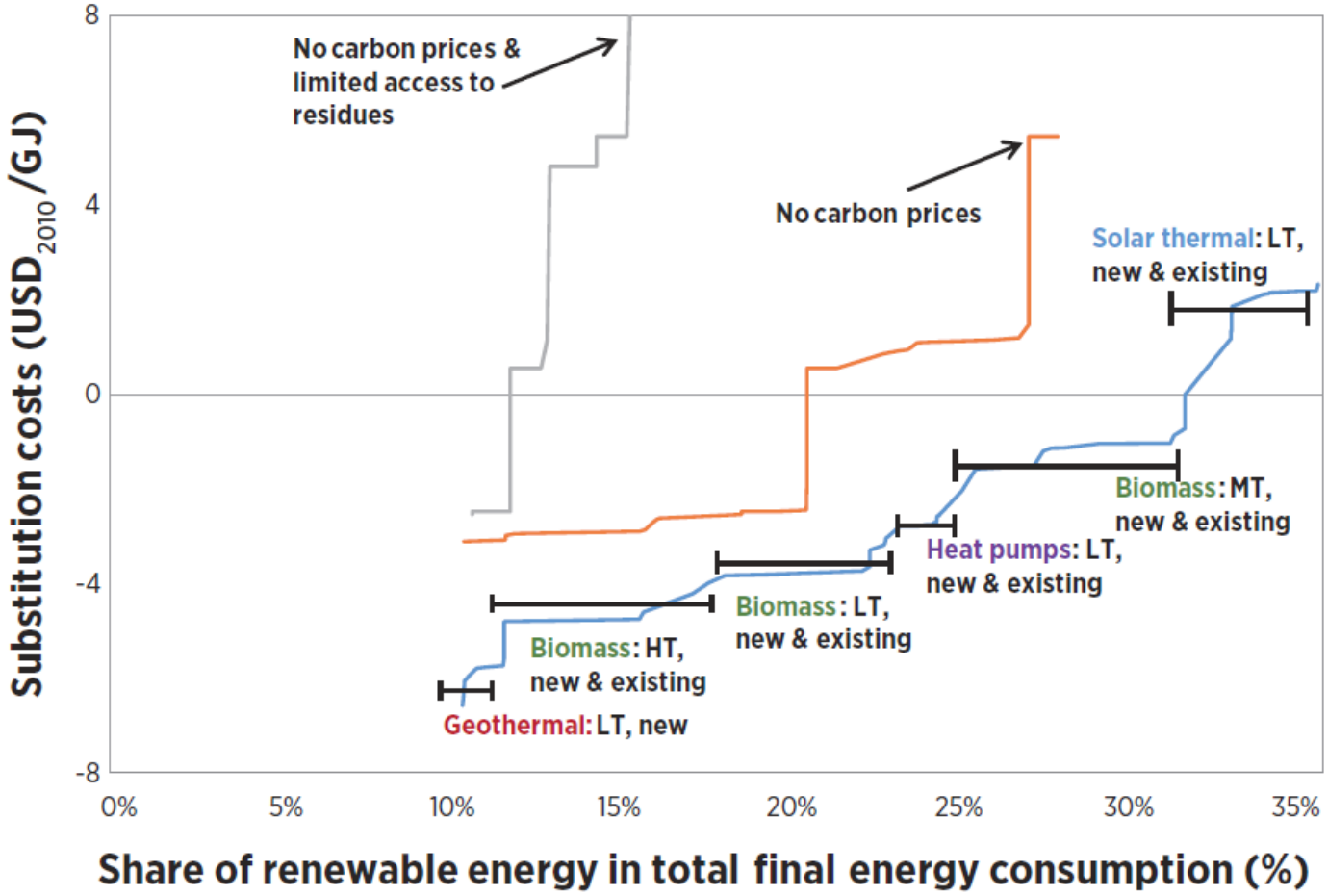

Biomass use for various applications is three-quarters of the total potential

# Key findings (5/6)
# By region




OECD and Asian countries account for majority of the global potential

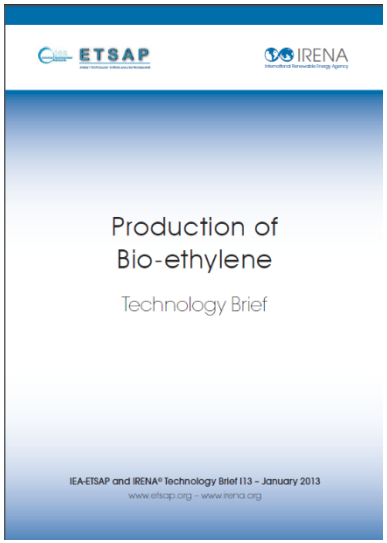
# Key findings (6/6)
# Cost-competitiveness

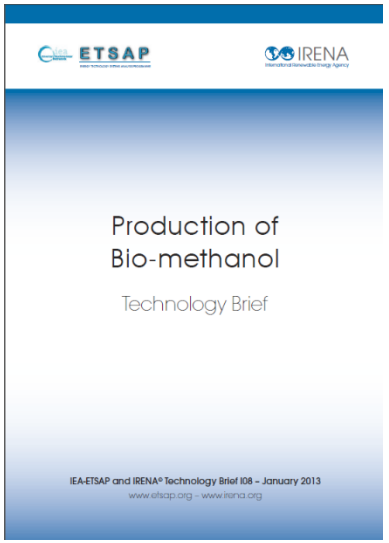



Techno-economic potentials can raise RE share from 10% to 34%
Without low-cost biomass feedstock, RE share is limited

# Bio-based materials

| | Bio-based ethylene (USD/t) | Fossil fuel-based ethylene (USD/t) | Bio-based methanol (EUR/t) | Fossil fuel-based methanol (EUR/t) |
|---|---|---|---|---|
| **China** | 1 340-2 180 | 600-1 300 | 160-900 | 100-300 |
| **India** | 1 000-1 670 | | | |
| **Latin America** | 970-1 630 | | | |
| **OECD and rest of the world** | 1 700-3 380 | | | |



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# Next Steps

# Supporting country analysis

- Study closes an important gap about RE use in industry sector, and creates awareness of potential
- This techno-economic potential assessment study helps **country dialogue** with the REmap national experts
- Deploying further potentials based on assumptions with uncertainty:
  - Biomass supply potential and availability for industry sector
  - Biomass price developments (e.g. higher prices with more demand),
  - Access of industry plants to resources (large volumes biomass transport and supply, storage requirements, geothermal),
  - Process modifications (e.g. solar thermal),
  - Upfront costs (mainly for solar thermal),
  - Synergy / trade-offs with energy efficiency

# Prioritisation areas

- **Energy intensive sectors:** largest potential
- **Small and medium enterprises:** >90% of all industrial plants, low absolute energy demand per plant
- **Biomass:** >75% of the potential for different applications, but many issues remain to be resolved
- **Solar thermal systems:** potentials exist, but more deployment needed
- **Electrification:** fuel switching and increased RE share in the power sector
- **Regional aspects:** energy pricing and climate policies, growth of industry versus availability of resources

# Guiding international cooperation

| Stakeholders / Activities | Sustainability of biomass resources | Agriculture and forestry sectors | Trade barriers for biomass | Cascading use of biomass | Niche markets for bio-based feedstocks |
|---|---|---|---|---|---|
| Governments / policy makers | 3.5 | 2.5 | 4.0 | 2.5 | 2.0 |
| Industry / associations | 3.5 | 2.0 | 3.5 | 3.3 | 3.3 |
| Technology / equipment suppliers | 1.8 | 1.5 | 1.8 | 3.0 | 3.0 |
| Funding organisations | 3.5 | 2.0 | 2.5 | 2.0 | 2.0 |
| Research | 3.0 | 2.5 | 2.5 | 2.5 | 3.3 |
| Non-government organisations / statistics offices | 3.5 | 3.0 | 3.0 | 2.0 | 1.5 |

| | What is the role of the stakeholder? | When will the action by the stakeholder have an impact? | Where will the action by the stakeholder have an impact? |
|---|---|---|---|
| Weight | 50% | 25% | 25% |
| Score – 1 | Indirect | Long-term: >2030 | Local |
| Score – 2 | Support | Medium-term: >2020 | National |
| Score – 3 | Part of team | Short-term: > 2015 | Regional |
| Score - 4 | Lead | Continuous | Global |

# Keep updated

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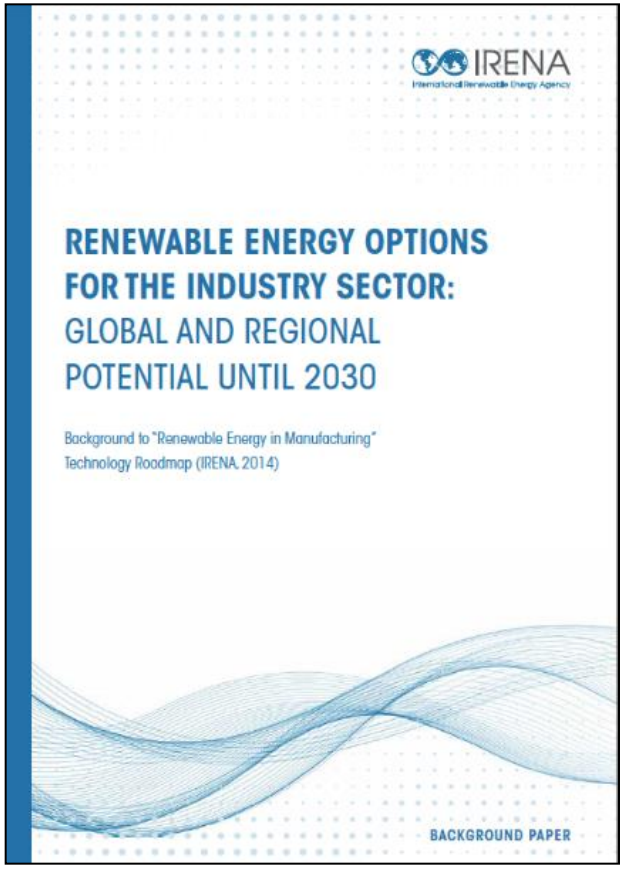


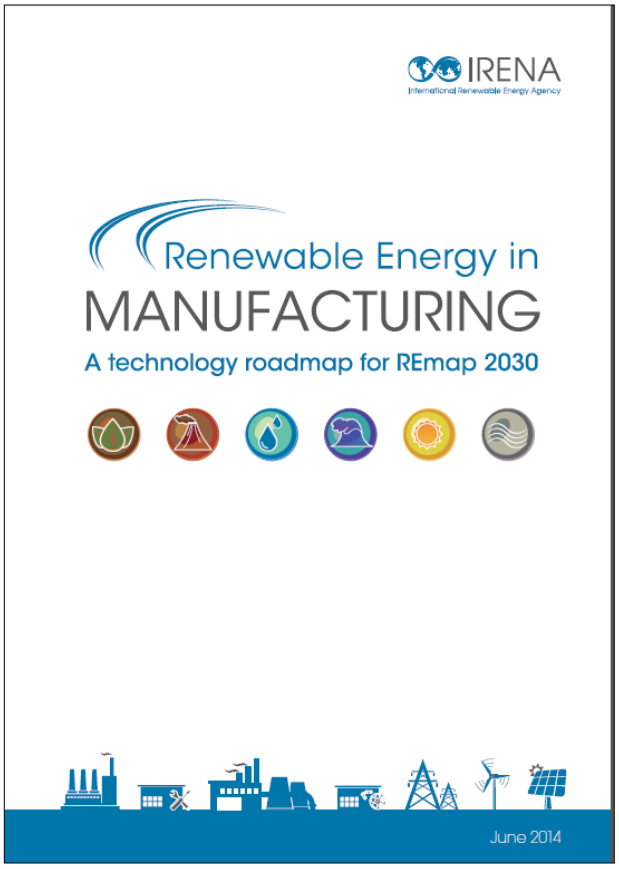


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THANK YOU

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