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Perspectives for the Energy Transition

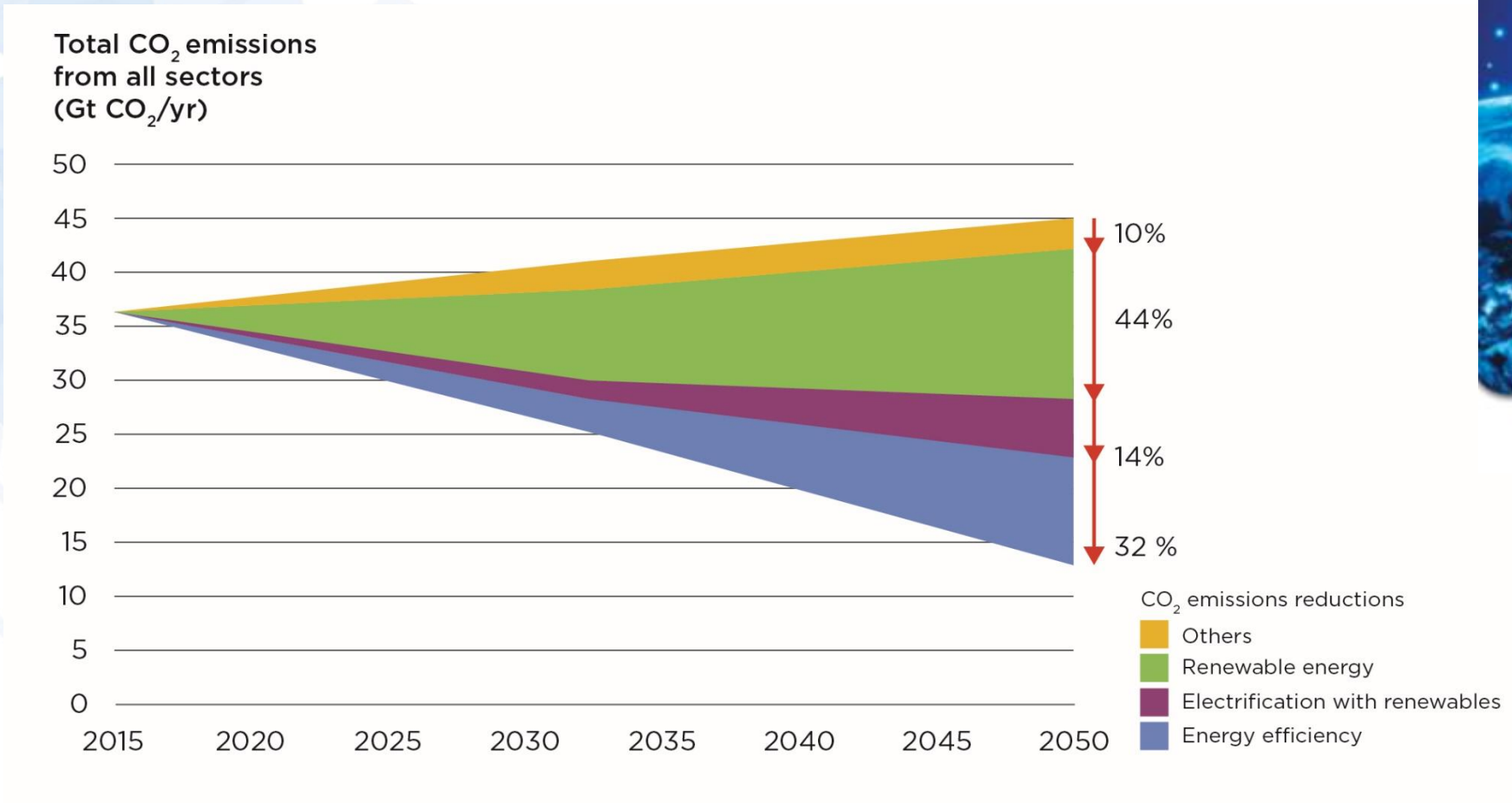
End-use Sectors & Heat Pumps

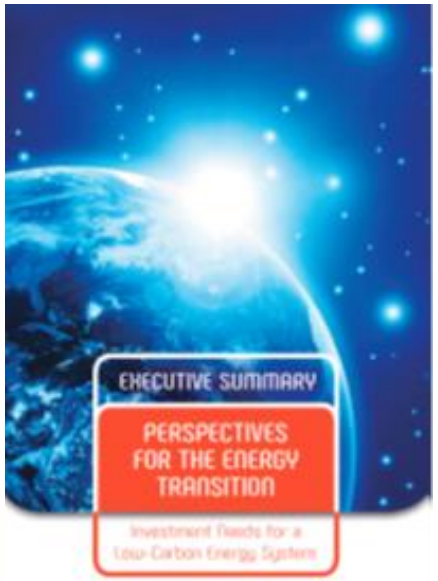
Michael Taylor, 16 May 2017
Rotterdam

Business-as-Usual is not an option

- Climate change effects will be huge
  - Impacts on food supply, migration
  - The world has agreed at COP21 to fix the problem “well below 2 degrees climate change”
- Rising air pollution problems in China, India etc. caused by fossil fuel combustion
- Nuclear uncompetitive in most countries, renewables competitiveness is rapidly improving. CCS development is lagging
- Rising energy demand in emerging economies, that will seek to max. independence, manage import bills
- Rapid technological change is driving energy transition
- Increasing attention for national economic activity, jobs, social and development aspects of renewables

REmap high-level projections: Global Results

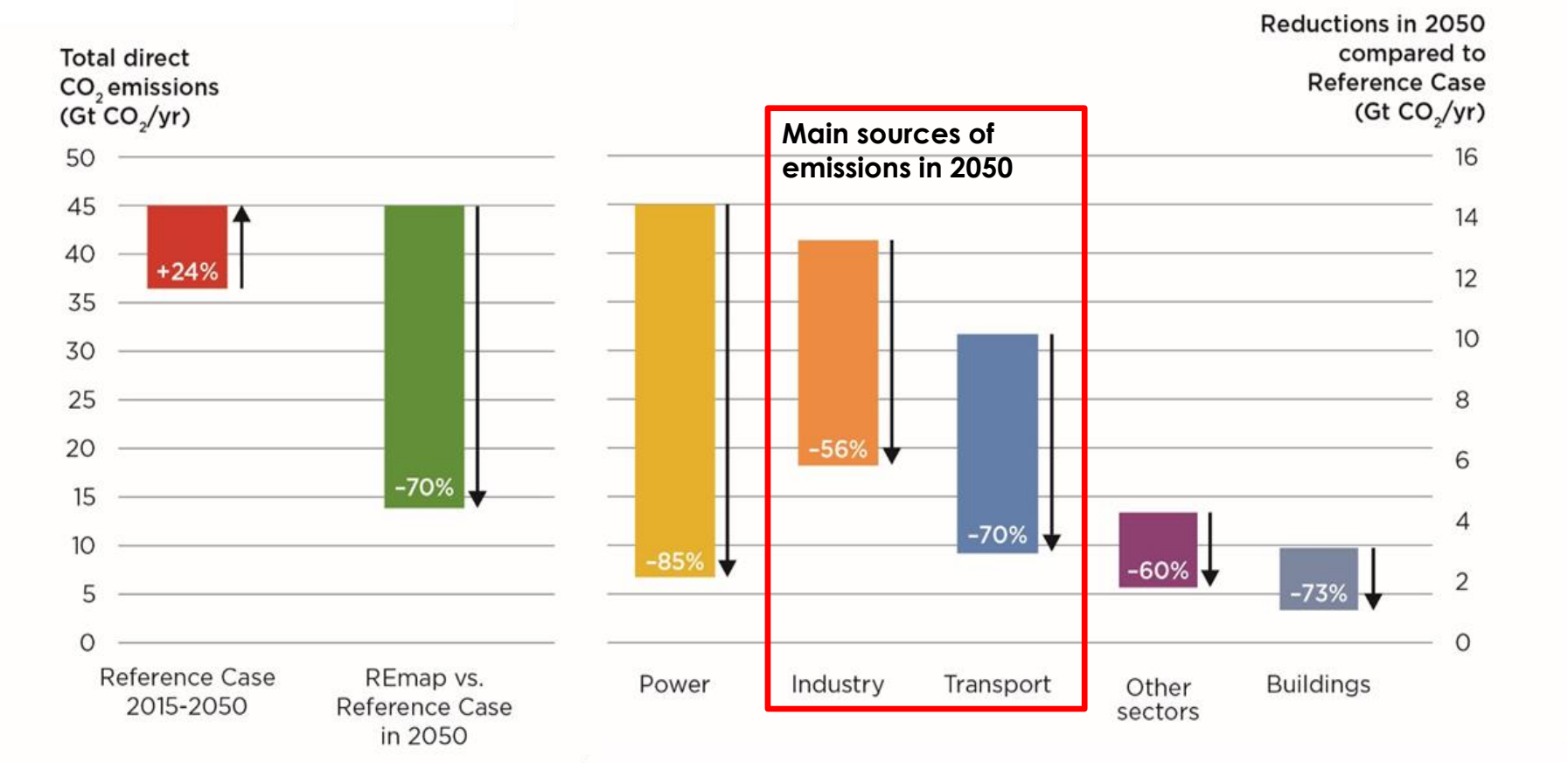




March 2017

Renewables and energy efficiency account for 90% of emission reduction potential

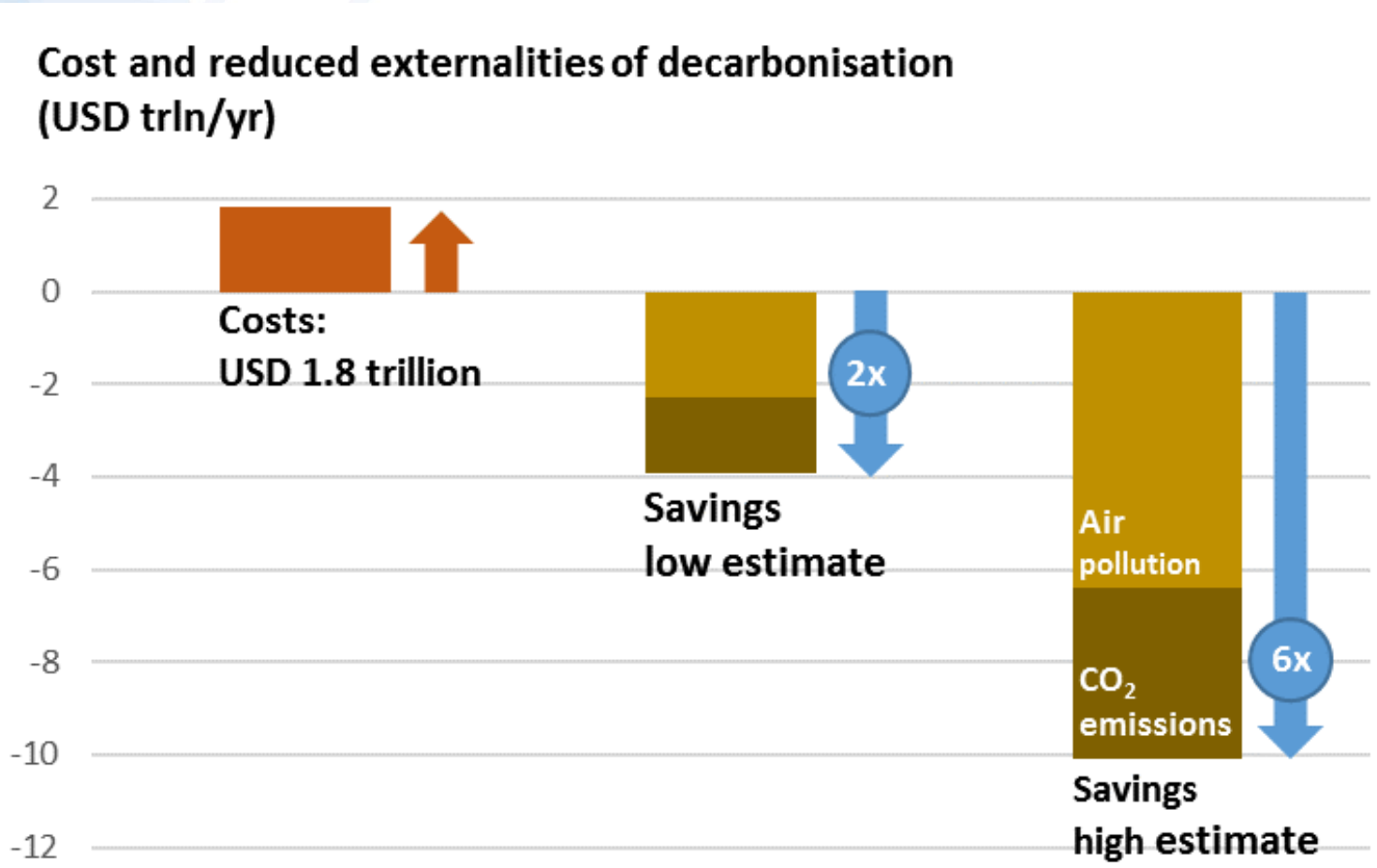
The end-use sectors transformation is lagging



By 2050, total energy-related CO_2 emissions will need to decrease to below 10 Gt/yr

CO_2 emissions from the power and buildings sectors will be almost eliminated

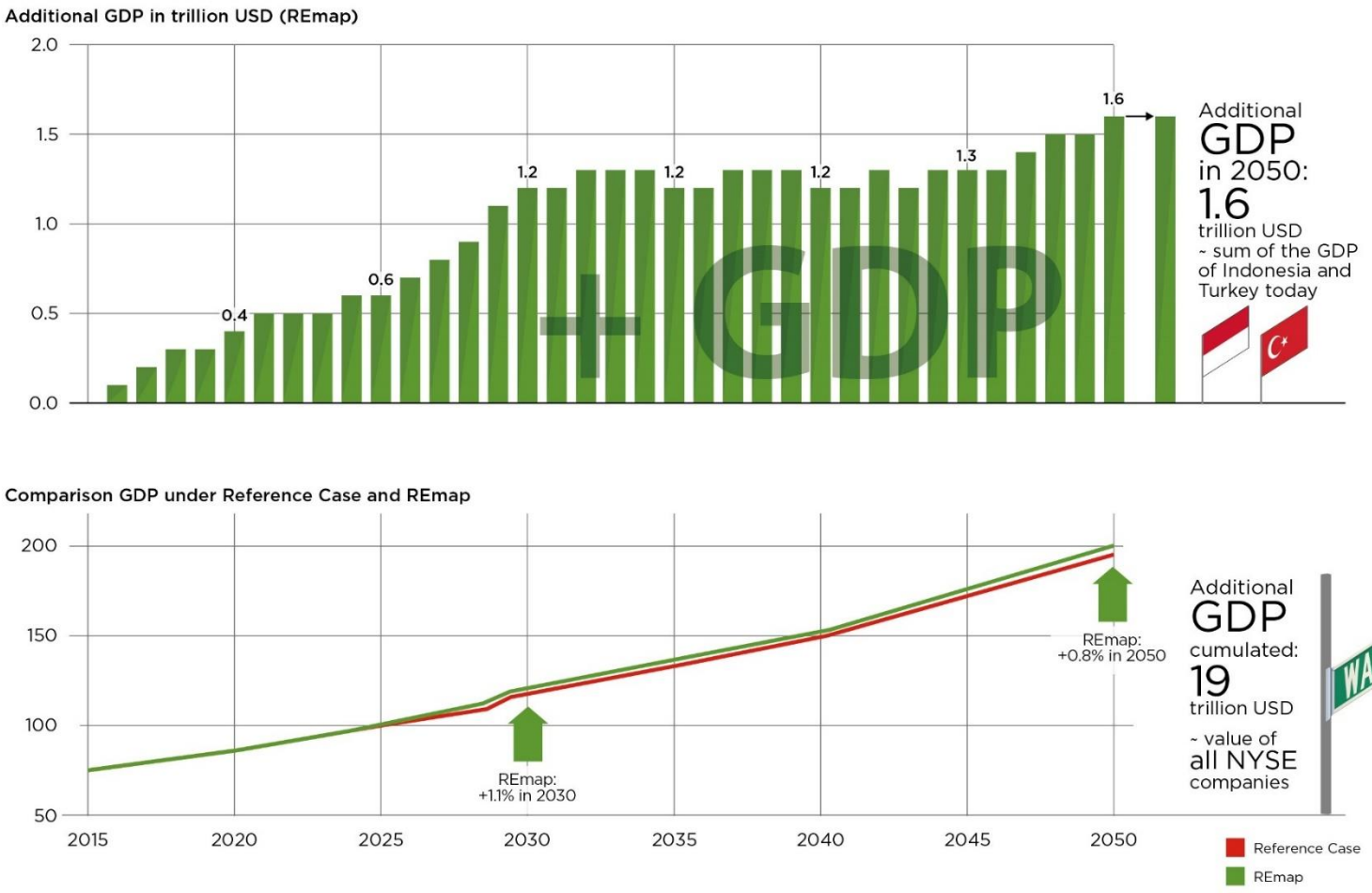
Improved health, reduced climate change



Savings due to reduced externalities exceed the costs by a factor between two and six in 2050.

Outdoor air pollution health benefits alone exceed the costs.

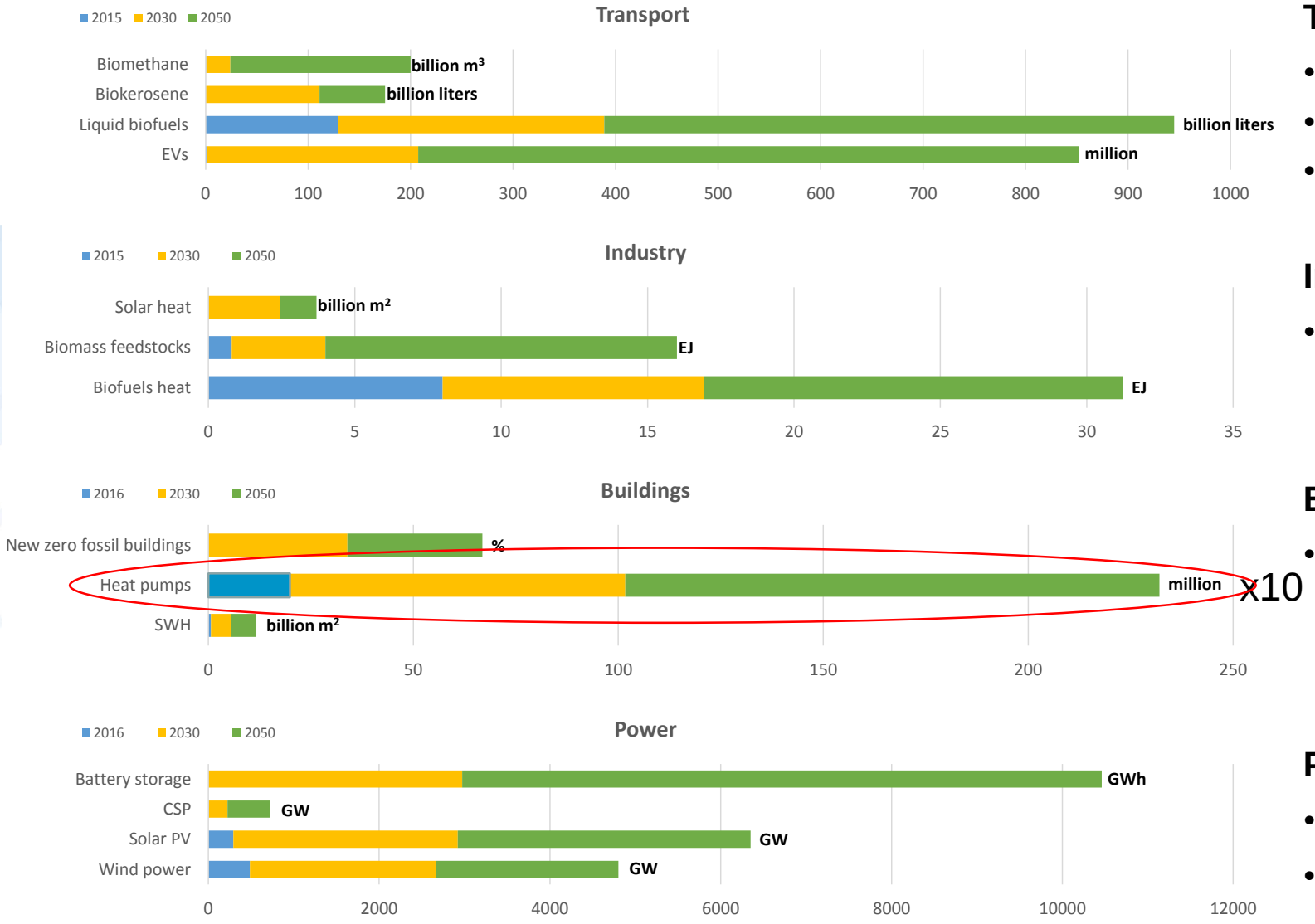
Increase in global GDP



Decarbonising the energy sector in line with REmap increases global GDP by around 0.8% by 2050 compared to the Reference Case

That is the equivalent of almost 19 trillion USD in increased economic activity between today and 2050.

The end-use sectors transition: untapped area



Transport

- Will traditional car makers able to catch up?
- Significant biofuel trade
- Materials needs (e.g. rare earth for EVs)

Industry

- Industry is the most challenging sector

Buildings

- Significant acceleration of buildings renovation

Power

- Growing equipment industries
- Materials needs (e.g. for batteries, inverters)

HEAT PUMPS IN EUROPE

REmap EU – developments in total RE use to 2030 DRAFT findings

- **Reference Case**
  - In 2015, 16.7% RE share
  - **25%** RE share in GFEC by 2030, lower than the 27% target

- **REmap case** and the **assessment of "cost-effective options"**
  - Different cost saving pathways identified to close the gap from **25% to 27%**
    - All cost-effective options in buildings and transport
    - Only wind power and solar PV power

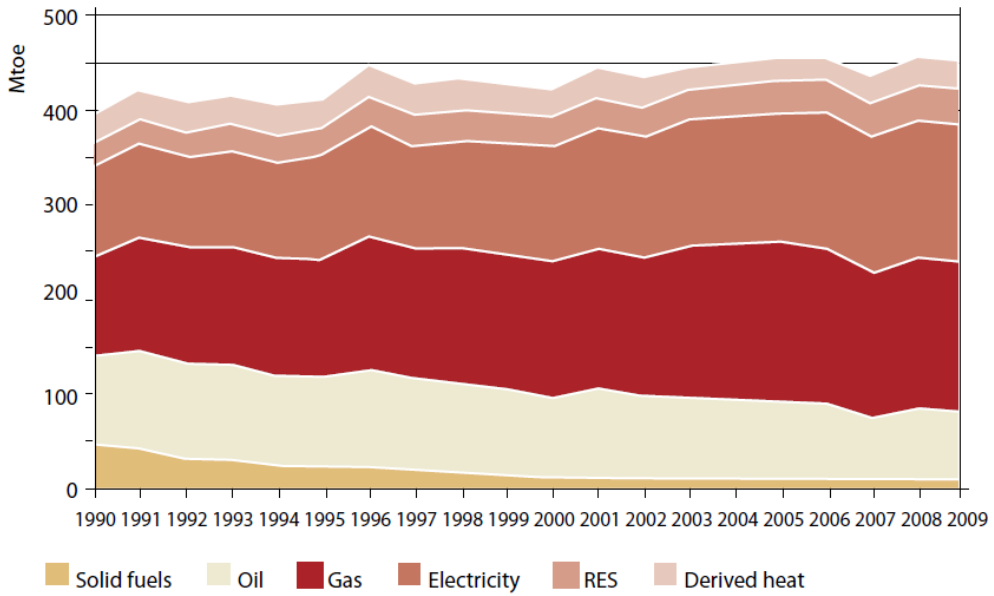
  - Considering cost effective options, up to **31%** makes economic sense based on "levelised cost of energy"
    - Requires deployment of cost-effective options in **all** sectors
    - Breakdown of RE use: 65% RE power consumption, 20% heating/cooling, 15% transport biofuels

  - More expensive RE options in the industry and DH sectors allow for **33%** RE share in GFEC

EU building energy consumption and stock

Figure 1C1– Historical final energy consumption in the building sector since 1990s for the EU27 Switzerland and Norway

Source: Eurostat database



Source: BPIE survey

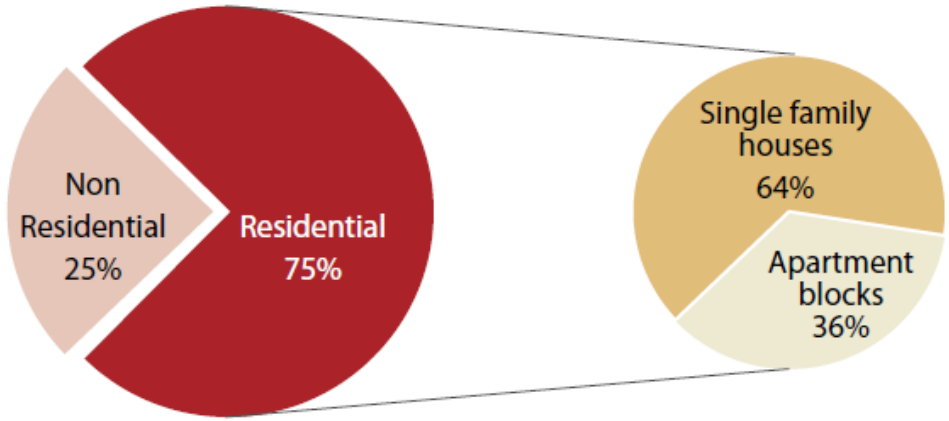
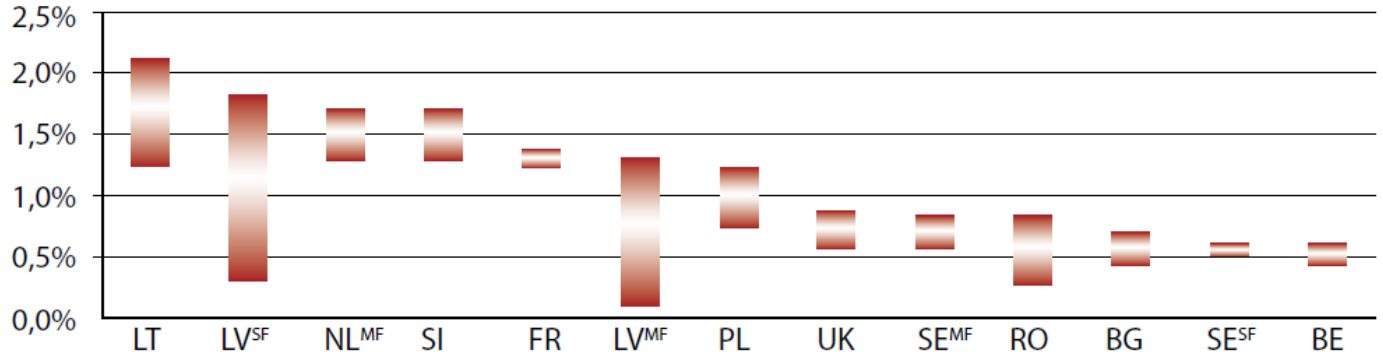


Figure 1A7 – Range of new build rates in the residential sector (2005-2010) where SF and MF denote single family and multi-family houses, respectively.

Source: BPIE survey



Limited stock turnover

Relatively low renovation rates

The role and benefits of heat pumps in the Energy Transition

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Attention shifting to end-use sectors

Heat pumps are one of just four major supply side decarbonisation options for heat in buildings (HP, DH, SWH, biomass)

- **18% EU market volume share heat pumps + solar thermal (2015)**
- **2.66 mln units sold (2015) incl. 2.33 mln ASHP**
- **8% of EU heating systems installed/sold (2015), 30% of water heating market (2015)**

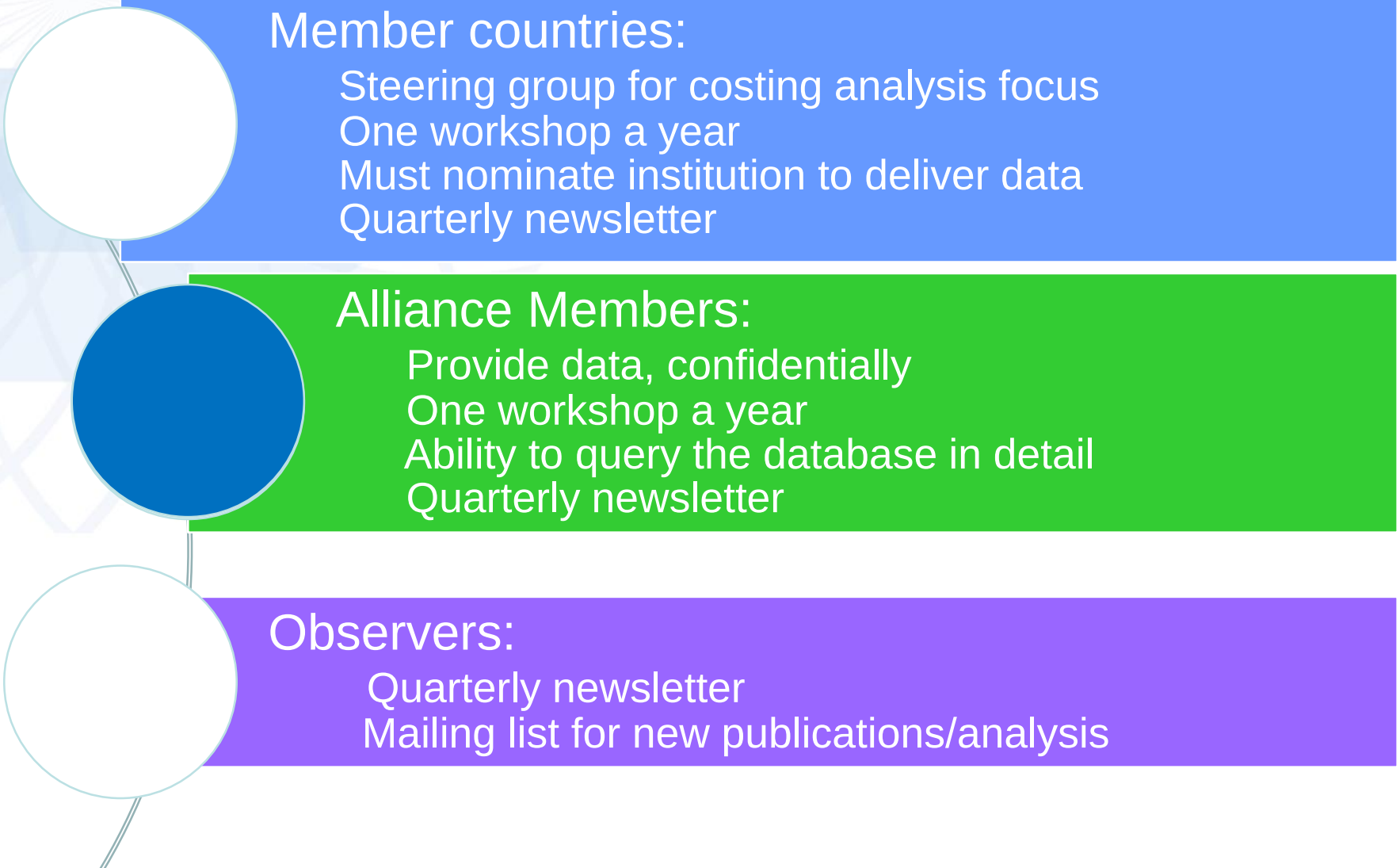
Heat pumps and low-cost thermal energy storage, integrated into grid, could provide system flexibility to increase share of VRE

Challenges remain in retrofits and scale of transition required for sustainable energy future

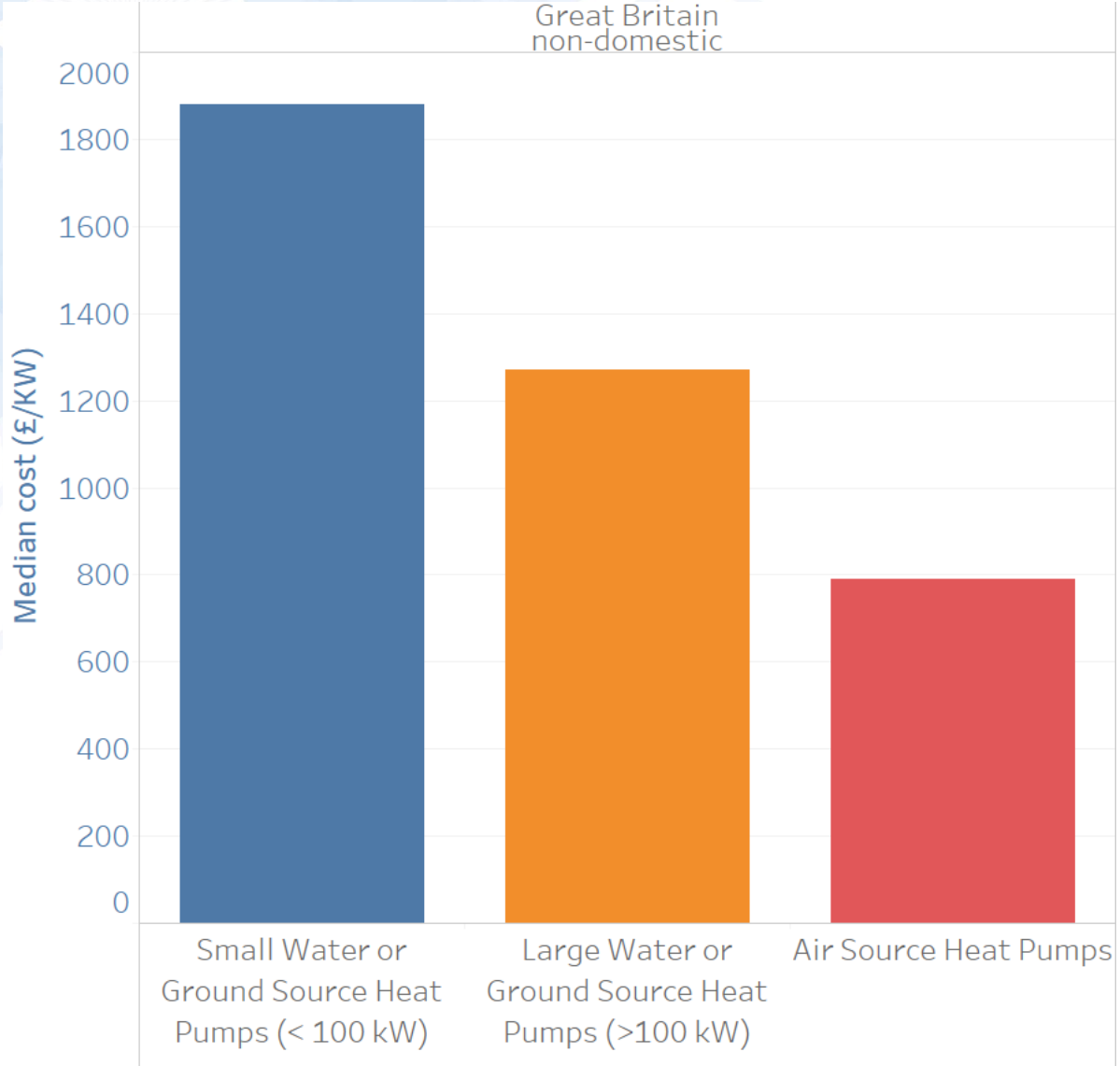
Important collaboration with EHPA on cost data collection

IRENA Renewable COSTING ALLIANCE

IRENA Renewable Costing Alliance: Collaboration with EHPA



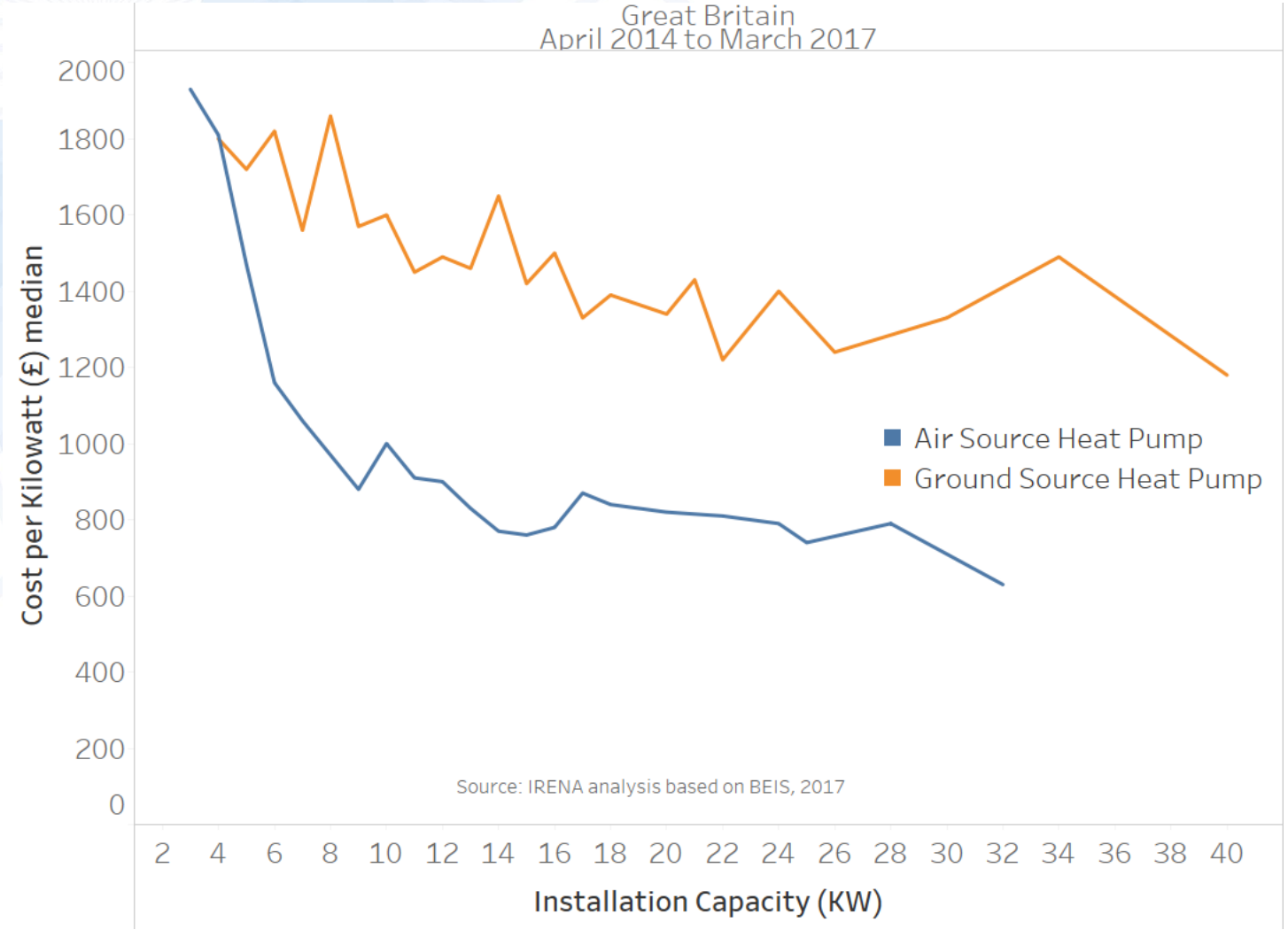
Heat pump installed costs in UK: Non-Residential Sector



Little difference in ASHP costs vs Residential

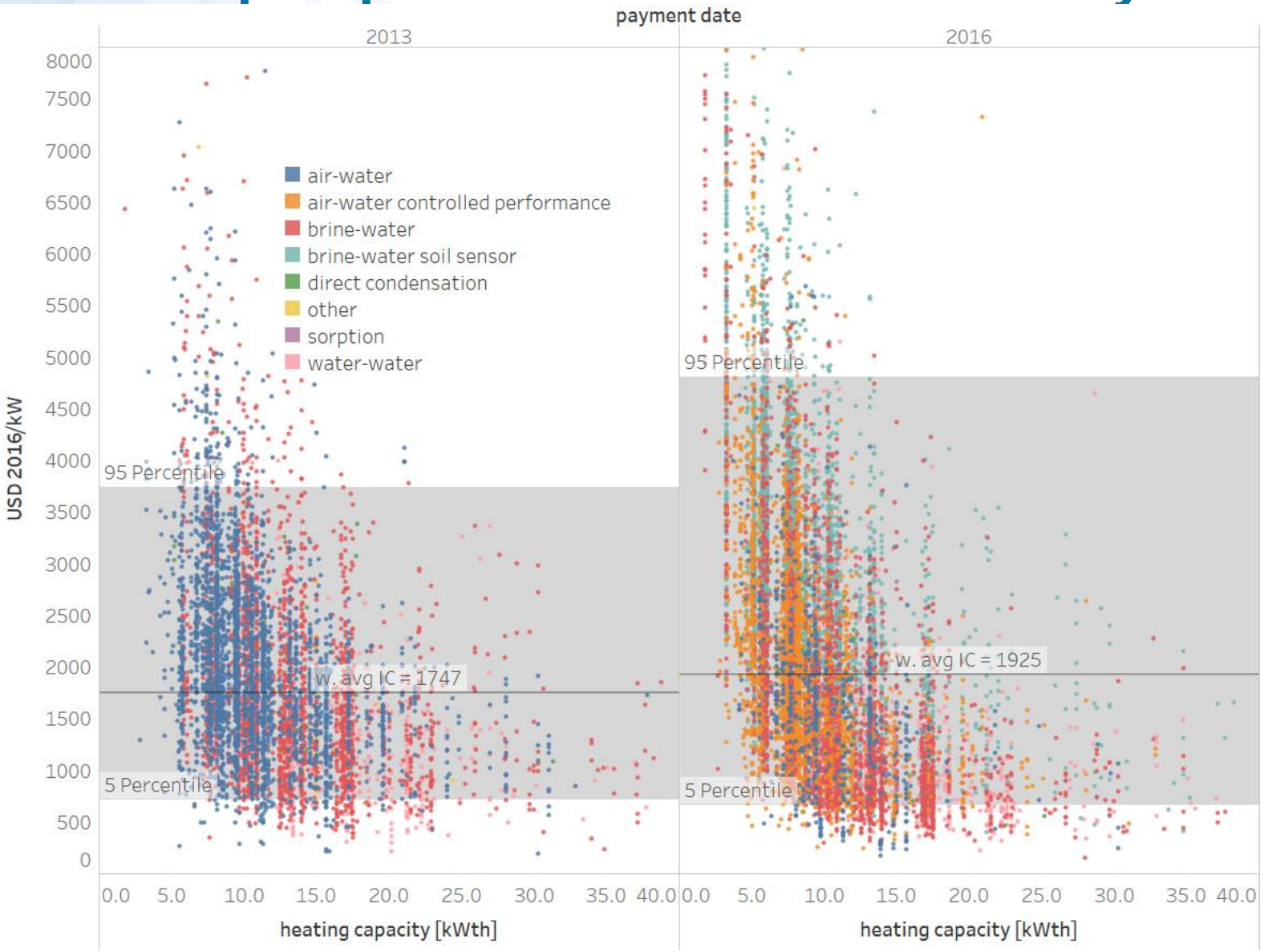
Small-scale W- or GSHP more expensive than residential

Small-scale heat pump installed costs in UK



Significant difference in cost for residential heat pumps above 4 kW

Small-scale heat pump installed costs in Germany

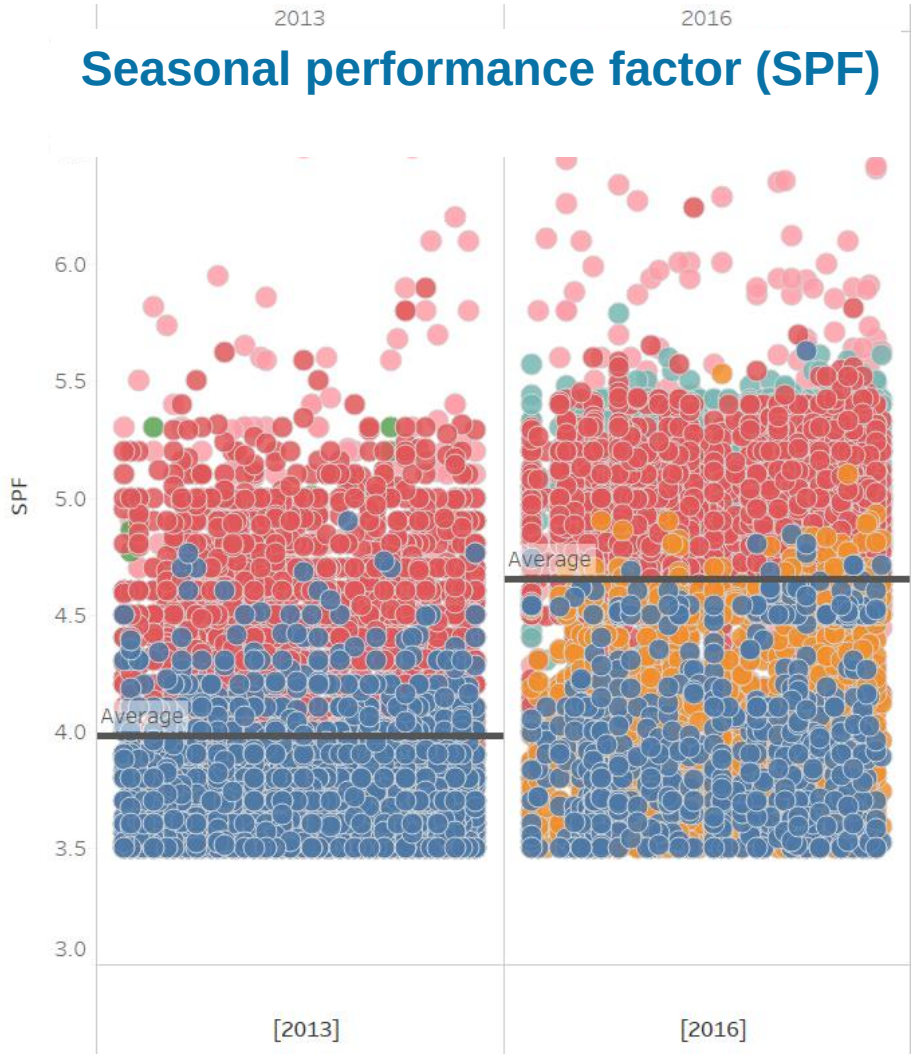


Source: Bundesamt für Wirtschaft und Ausfuhrkontrolle (BAFA) / Federal Office for Economic Affairs and Export Control (BAFA)

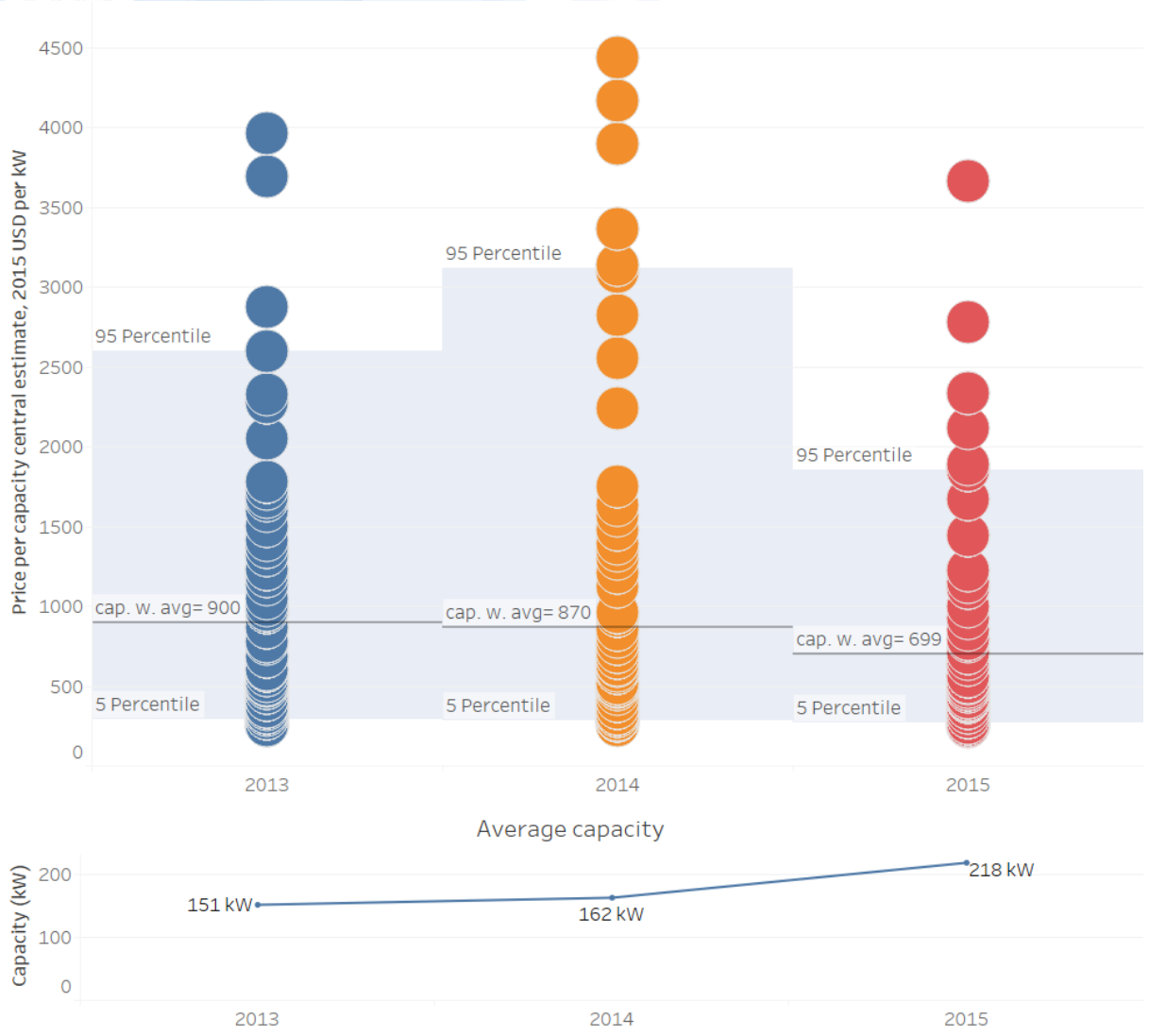
Small-scale heat pump installed costs in Germany

Higher average costs:

More than compensated by higher SPF



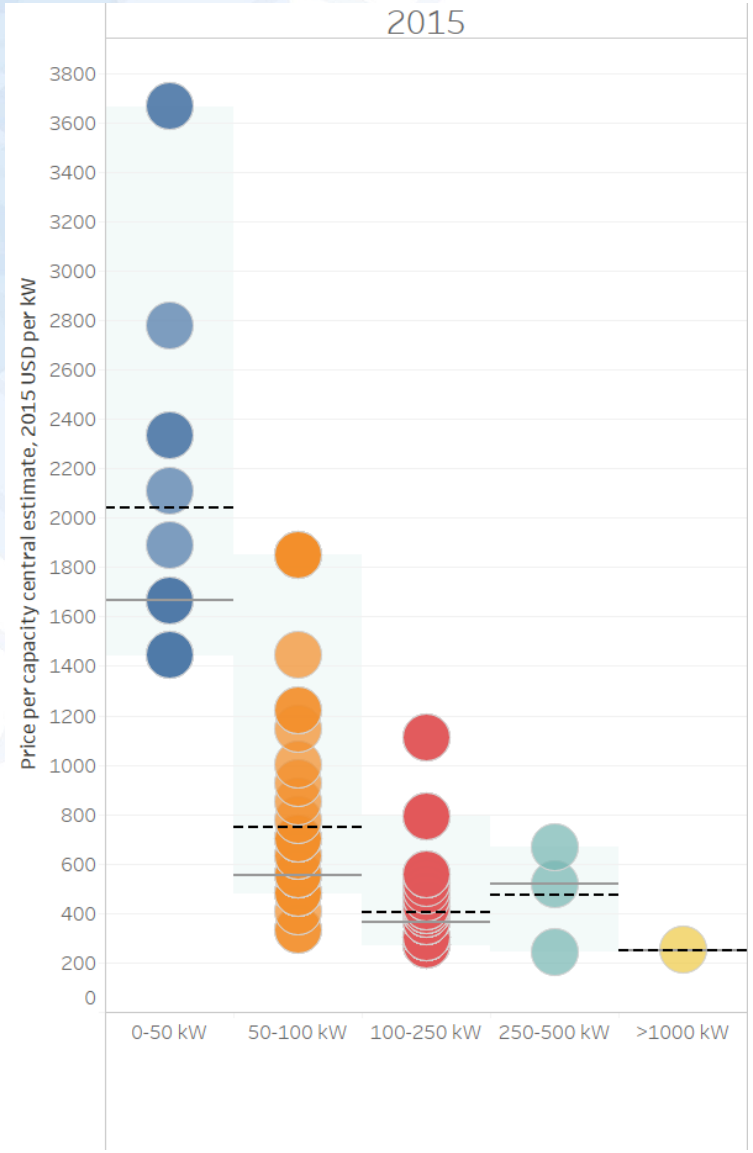
Large-scale heat pump prices in Europe



Average costs fell as average capacity of systems increased

But all system size classes also saw reductions 2013-2015

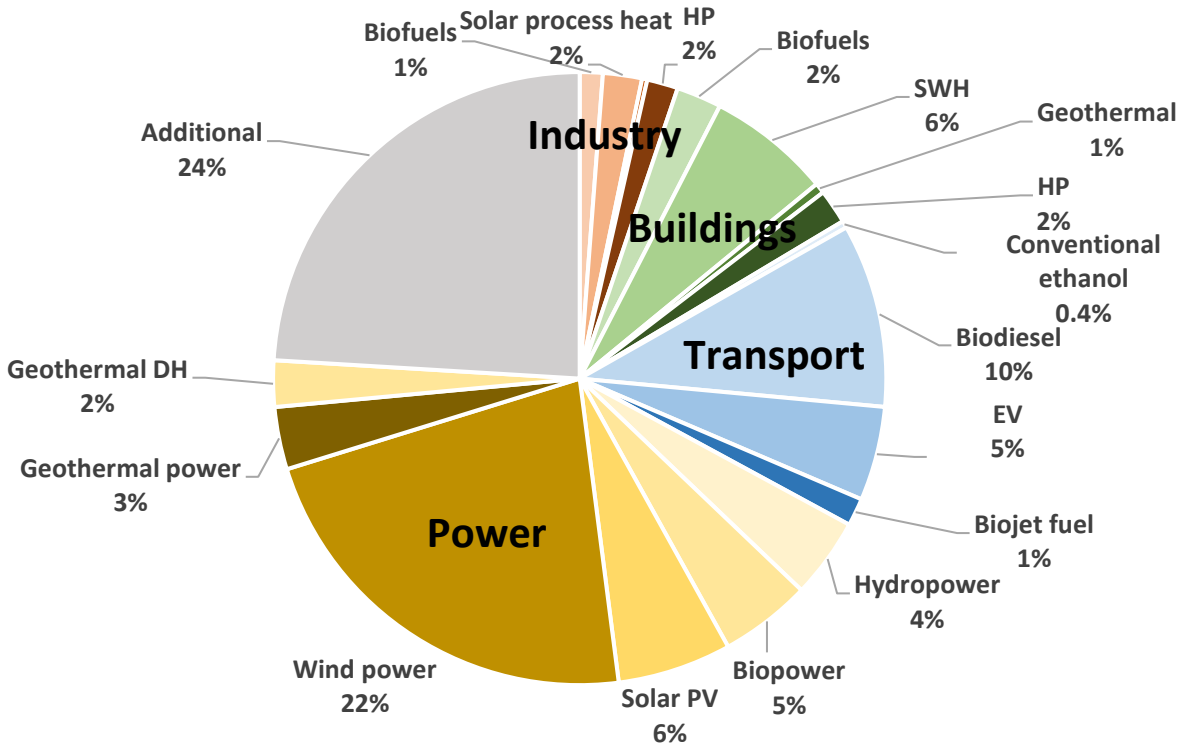
Large-scale heat pump prices in Europe



Significant economies of scale above 100 kW but data not conclusive

More data needed to draw statistically robust conclusions

Breakdown of REmap Europe options by sector and technology



- Shares based on TFEC
- Contribution of heat pumps is 3-4 times higher in useful energy terms, given their very high efficiency

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Heat pumps are part of the solution!

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