# Key considerations for bioenergy heat and power markets

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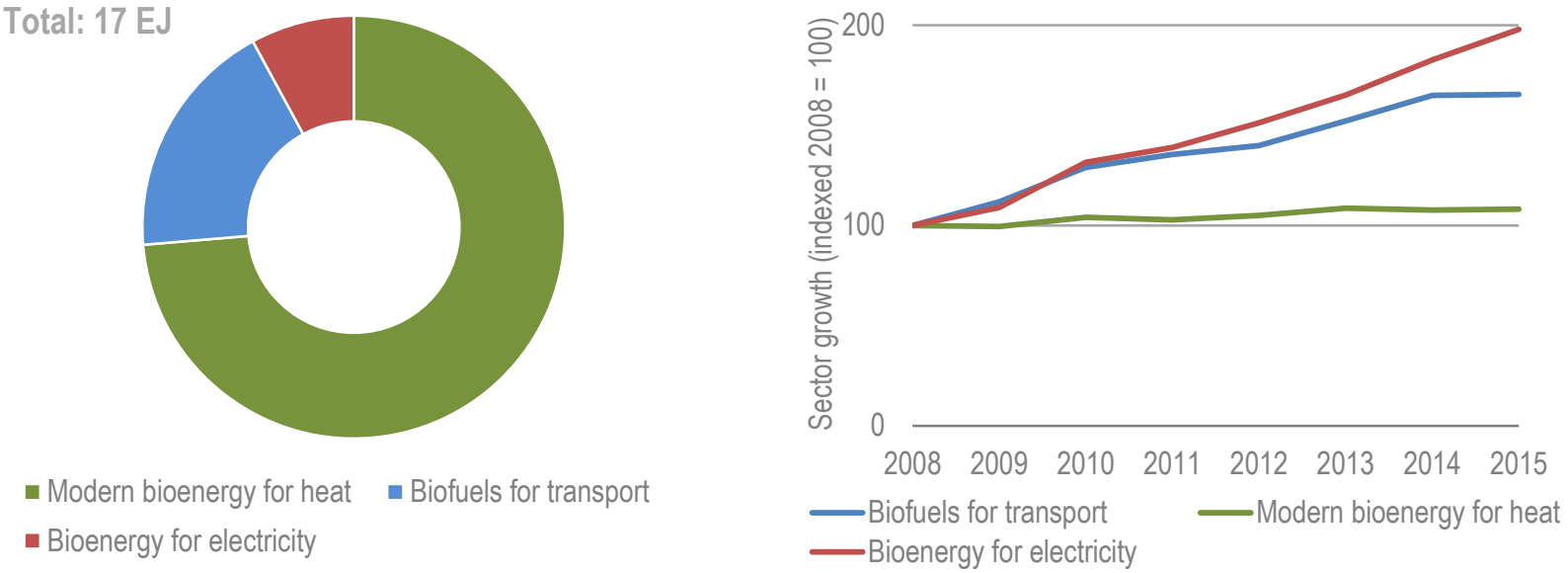
IEA

# *Key considerations for bioenergy*

- The current and future global context for bioenergy
- Key considerations for biomass heating in the buildings sector
  - Investment costs, fuel price dynamics and consumer behaviour
- The use of district heating and fossil fuel infrastructure as a facilitator for bioenergy
- Biomass in industry with a focus on co-processing in cement production
- Biomass for electricity and co-generation
  - Generation costs, technology types and auction considerations

# Bioenergy is already a significant global energy source

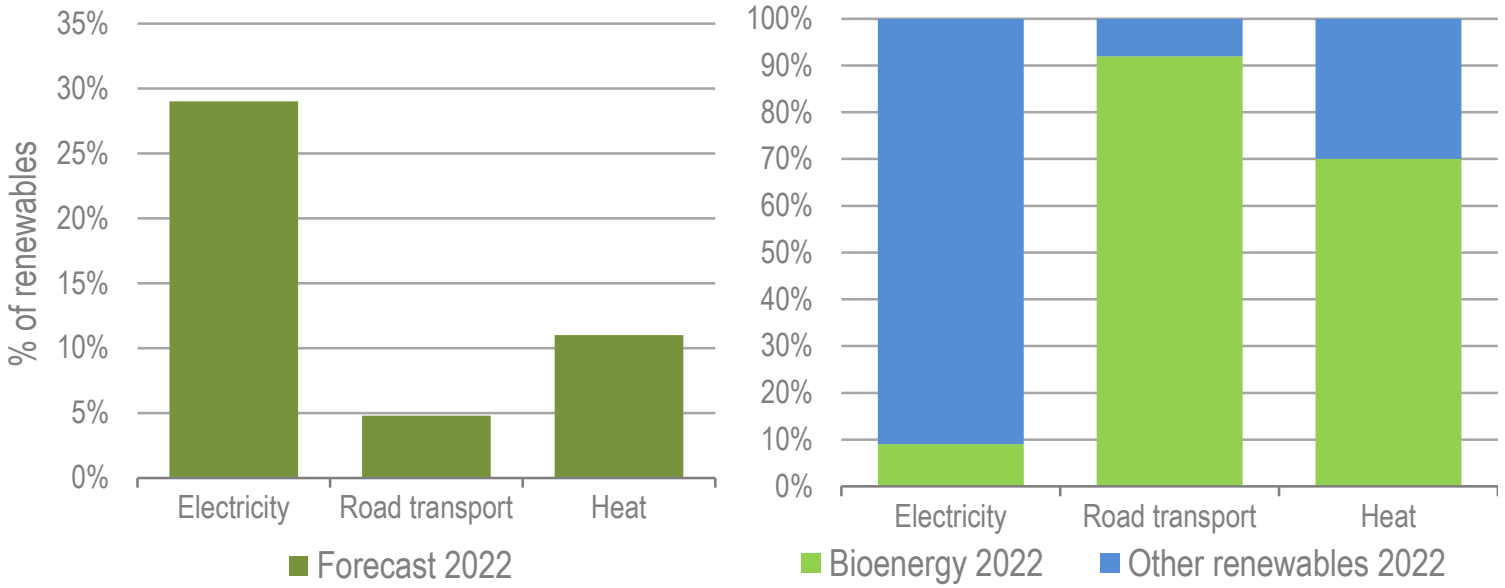
Modern bioenergy in final energy consumption 2015 (left) and growth by sector 2008-15 (right)




**Modern bioenergy accounted for around half of renewables in final energy consumption in 2015, a contribution five times greater than wind and solar PV combined. However, growth rates vary by sector.**

# Bioenergy is the leading renewable option in heat and transport

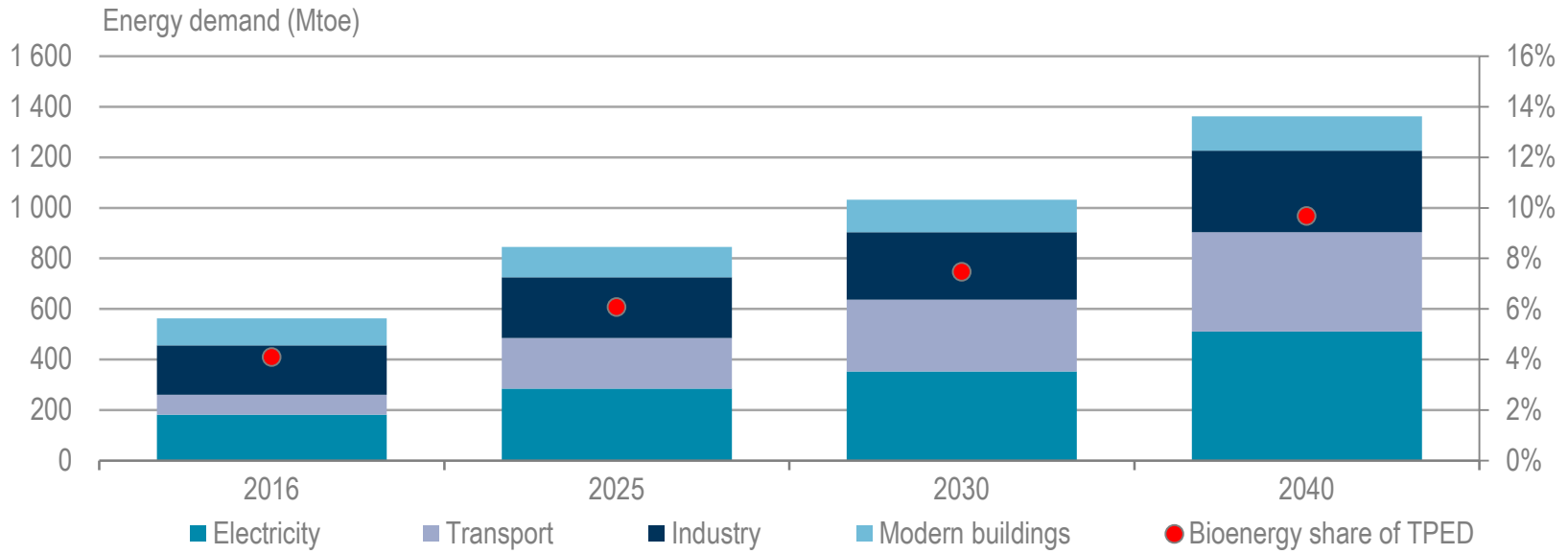
Global share of renewables in in each sector (left) and contribution of bioenergy and other renewables, both 2022




**Electricity leads in integrating renewables, with the renewable share of generation forecast to reach 29% in 2022. However, bioenergy is only one of a portfolio of contributors to renewable electricity.**

# Bioenergy to play an important role in decarbonising the energy system

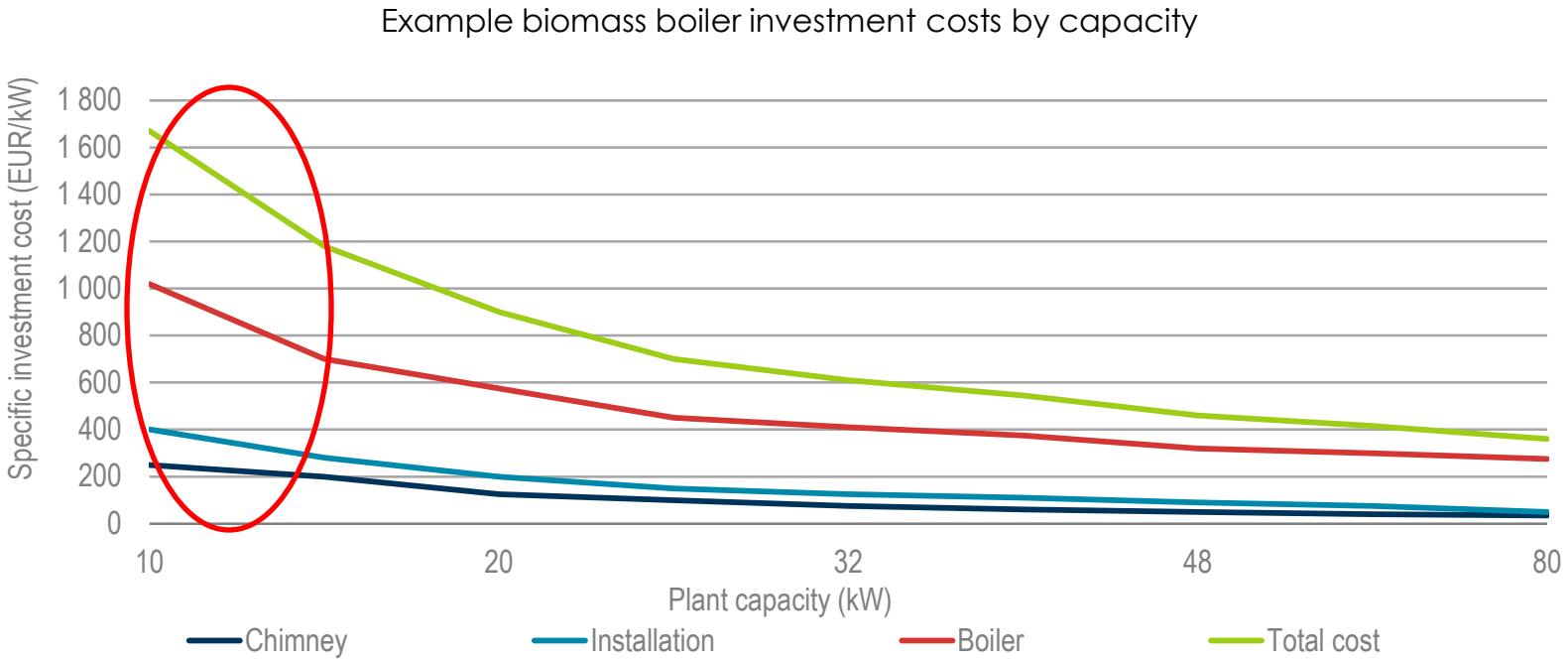
Primary energy demand for bioenergy in 2016 and until 2040 in the IEA's SDS




SDS = sustainable development scenario

**Global primary energy demand for sustainable bioenergy is anticipated to increase 2.5 fold within the IEA's SDS, providing 10% of total primary energy demand in 2040.**

# Unexploited potential for commercial-scale biomass systems

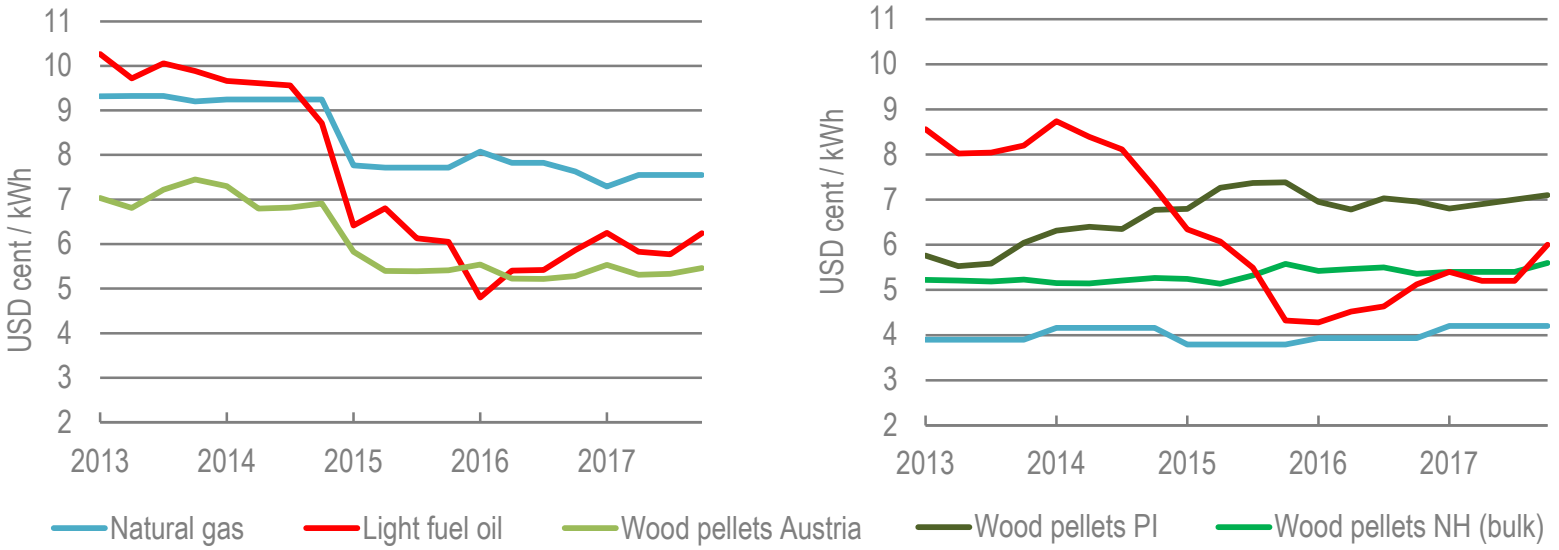



Source: reproduced from Rakos, C. (2017), "Pellet boiler markets – perspectives for the future", original data from Fröling.

**Relatively high investment for biomass versus fossil fuel systems is a key barrier to uptake. However, commercial-scale biomass plants offer economies of scale in both investment costs and fuel procurement.**

# Heating fuel cost dynamics differ by country

Heating fuel cost comparison in Austria (left) and the United States (right)

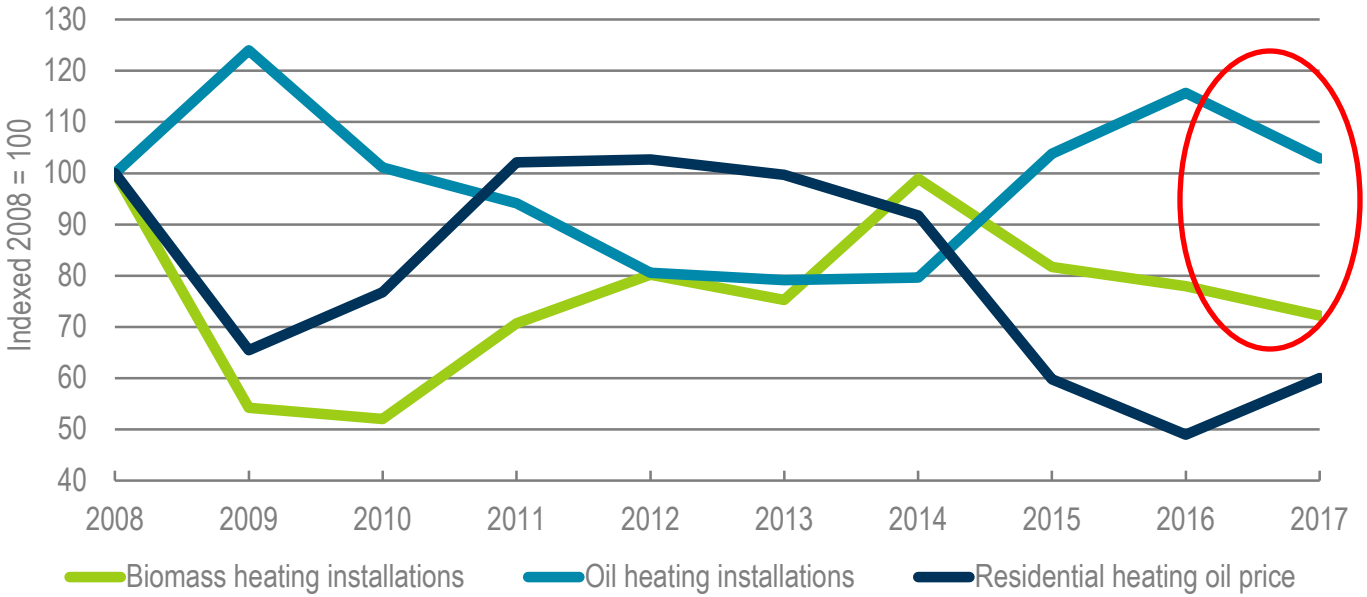



Source: pellet costs from F.O Lichts.

**Biomass is competitive versus fossil heating fuels in some countries, while low natural gas prices limit deployment in others. The price stability of wood pellets provides greater fuel cost certainty than heating oil.**

# Consumer purchasing behaviour sensitive to fuel prices

Residential heating oil price compared with biomass and heating oil system installations in Germany (2008-17)

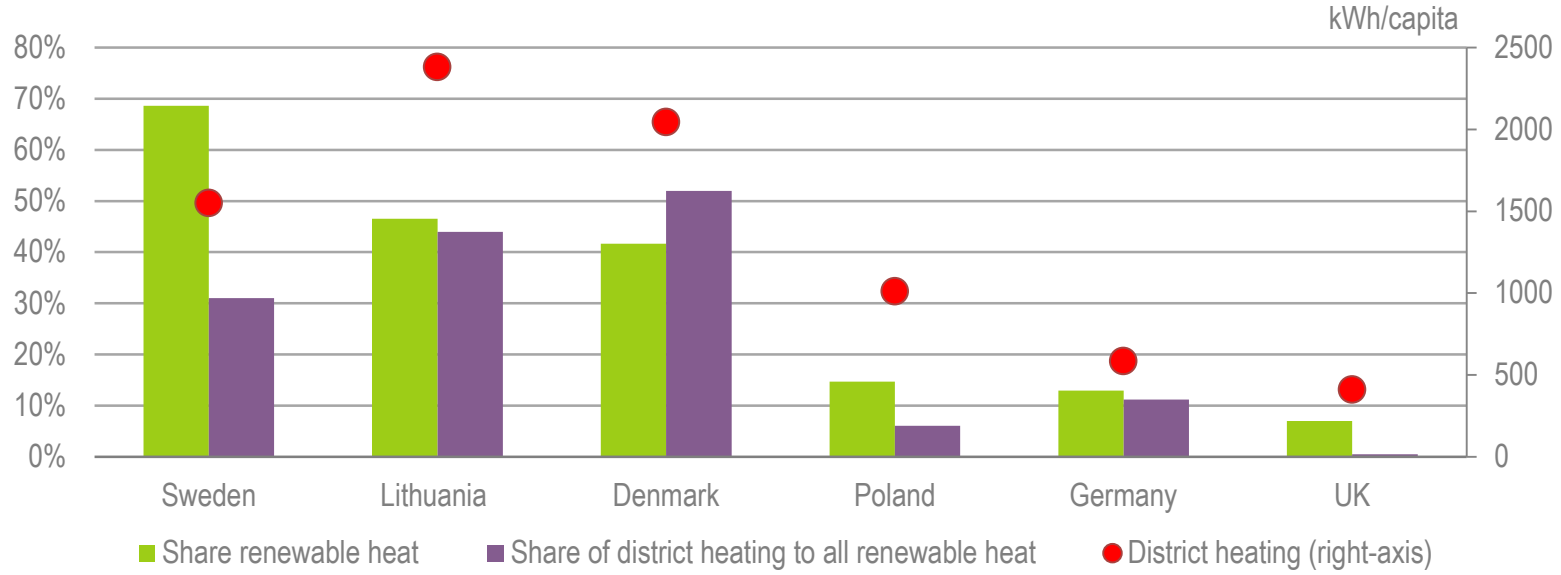



Source: heating system installations from BDH (2017)

**Lower heating oil prices represent a financial barrier to the uptake of biomass heating, as demonstrated by higher heating oil system installations in Germany during periods of low oil prices.**

# District heating infrastructure can facilitate renewable heat uptake

Renewable heat share, district heating share of renewable heat and district heating energy per capita, 2016

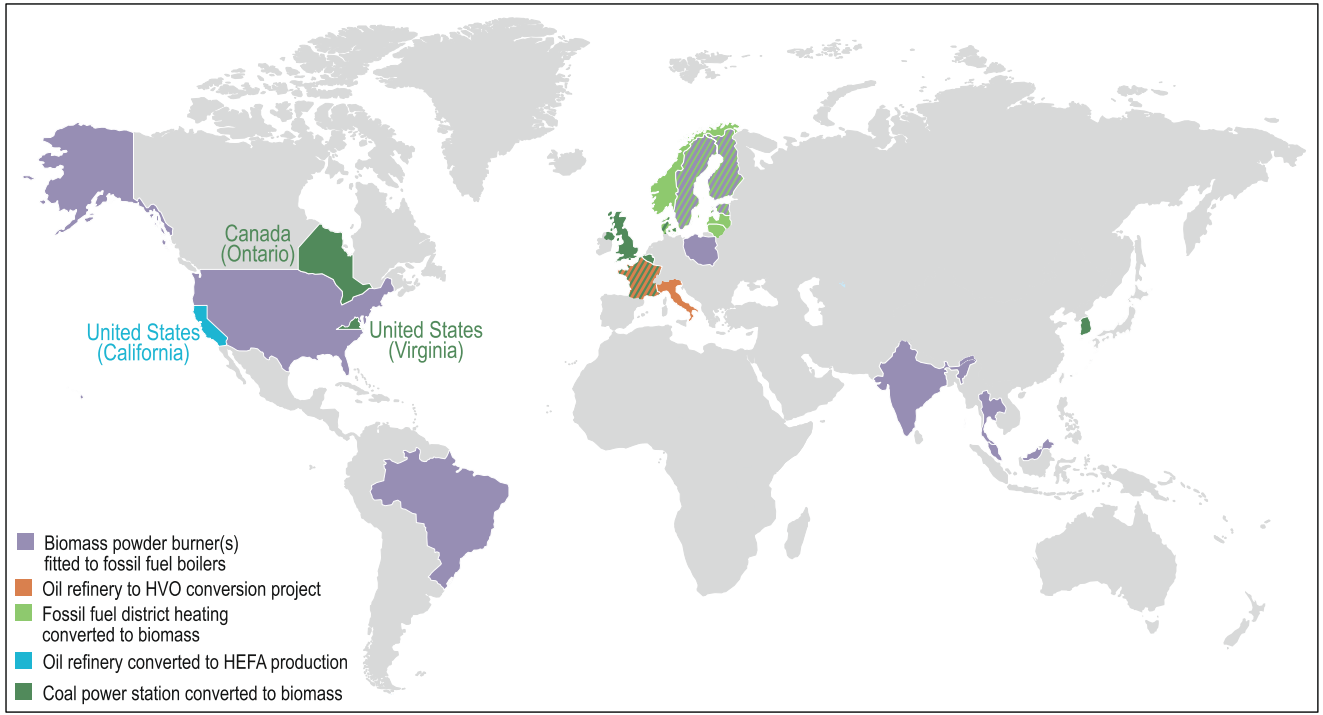



Source: Eurostat

**Biomass fuelled district heating using domestic resources is a key contributor to several European countries reaching high shares of renewable heat and increasing security of supply.**

# Conversion of existing fossil fuel infrastructure to bioenergy

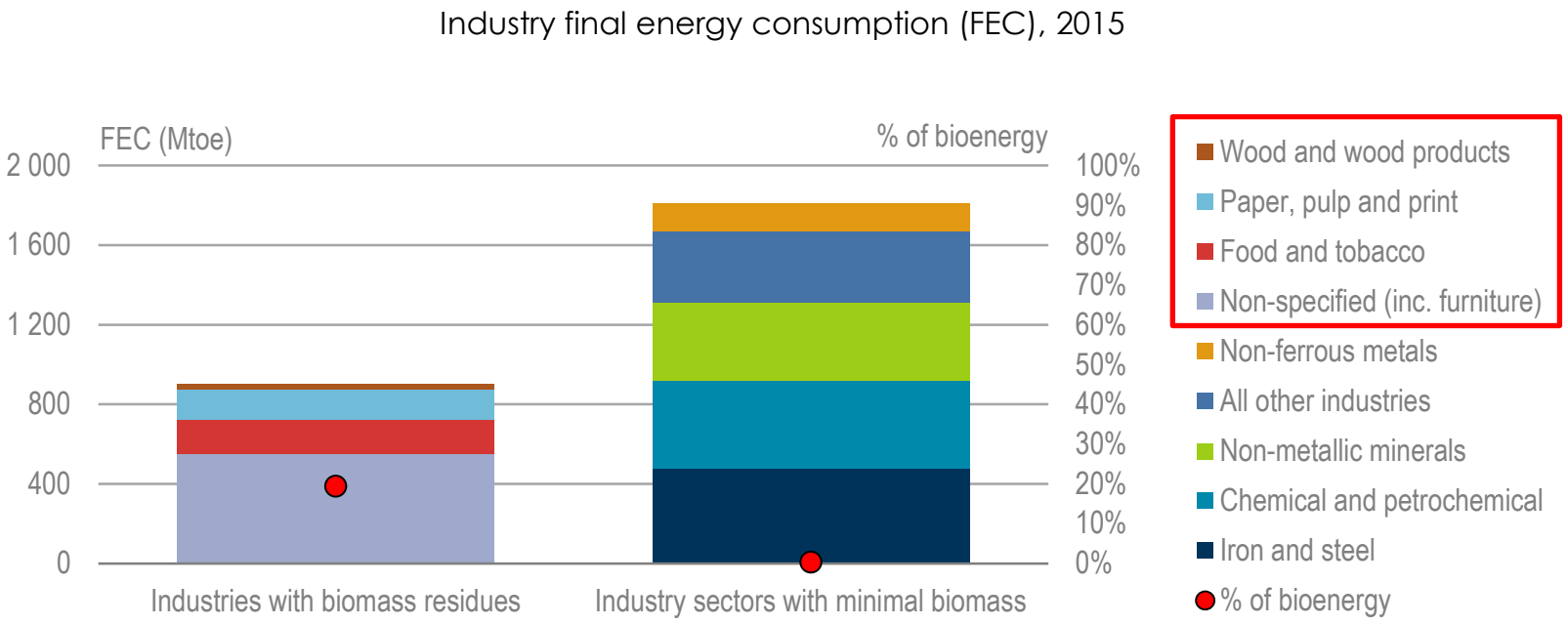
Global examples of fossil fuel to bioenergy conversion projects




This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

**The conversion of fossil fuel assets to biomass offers reduced investment costs and quicker delivery than new build projects, as well as direct substitution of fossil fuels and potential to conserve jobs in stranded assets.**

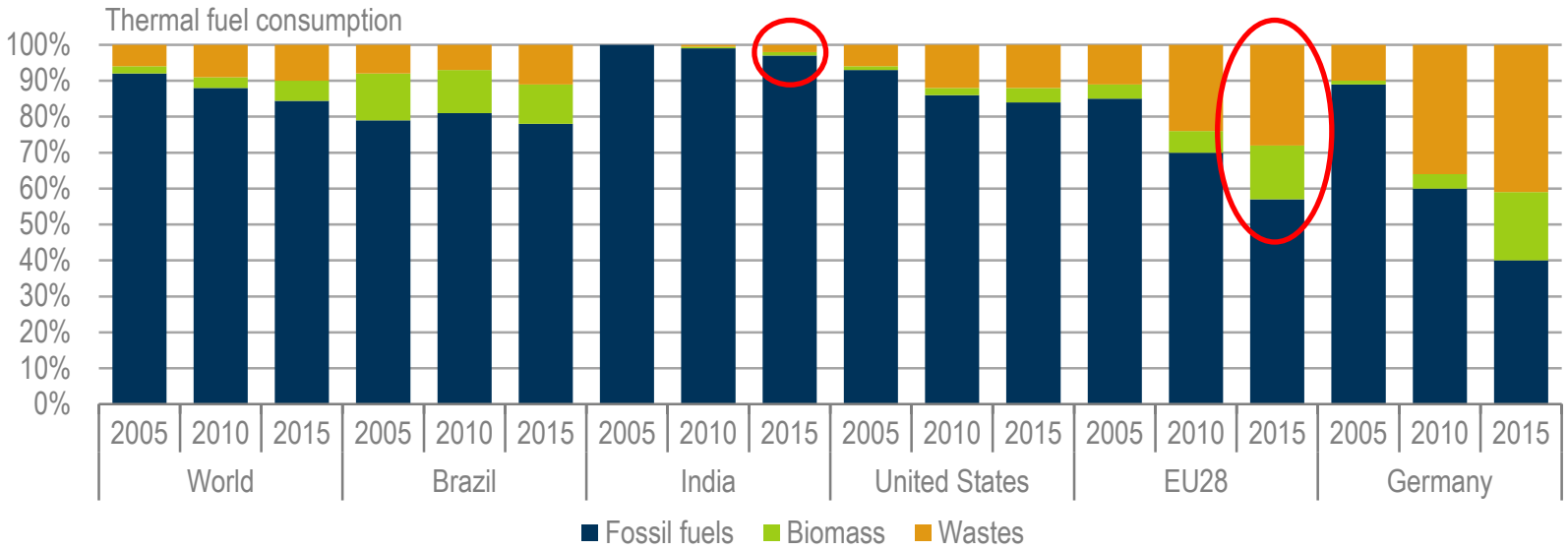
# Bioenergy consumption in industry differs significantly by sector




**Almost all bioenergy in industry is used in four industry sectors with biomass residues and a higher share of low/medium heat demand. Bioenergy use is minimal in other industries that consume twice as much energy.**

# Cement production offers scope to scale-up bioenergy use

Share of thermal energy consumption from biomass and waste over 2005-15

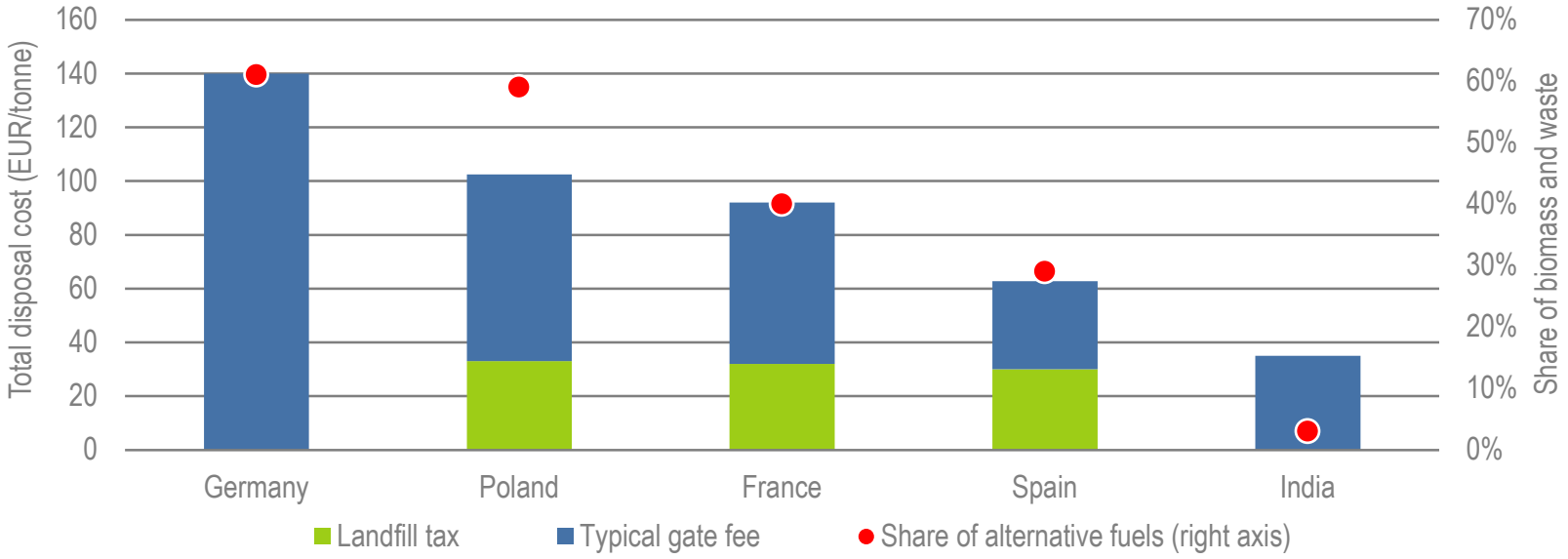



Source: Cement Sustainability Initiative

**In Europe around 40% of thermal energy demand for clinker production is met by biomass and to a greater extent municipal waste resources. However other countries lag behind.**

# Achieving high shares of waste in cement needs high disposal costs

Cost of waste disposal and alternative fuel share in cement in 2015 for selected countries

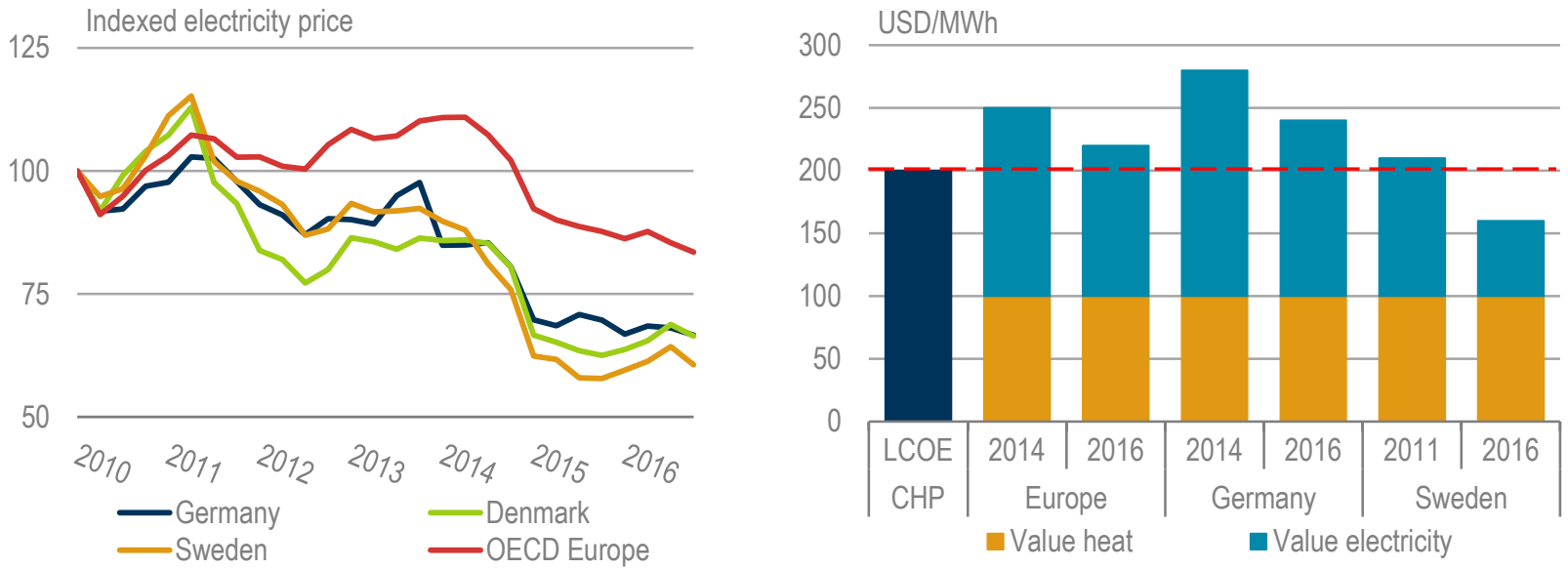



Source: CEWEP, Cement Sustainability Initiative

**The application of landfill taxation, gate fees and landfill bans has stimulated the use of municipal solid waste in cement plants, with high waste collection and segregation also key.**

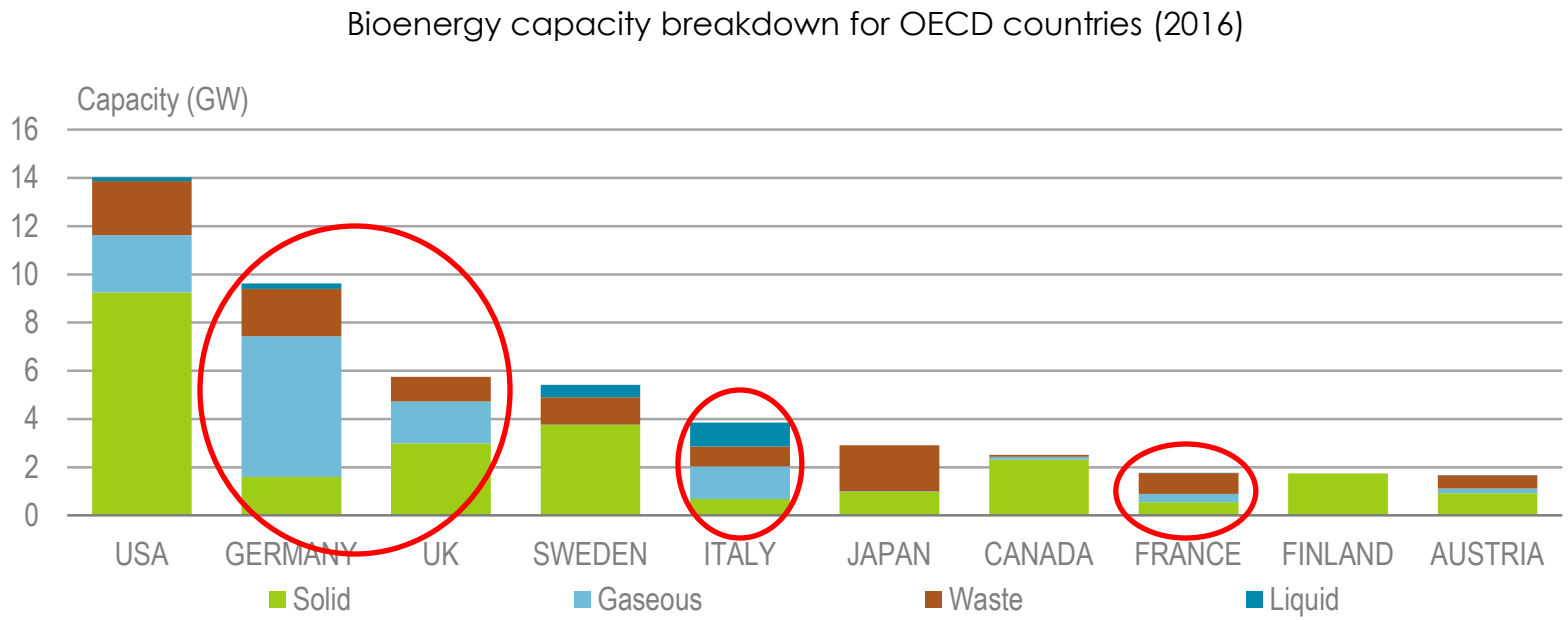
# How do lower power prices impact biomass CHP prospects…

Indexed electricity price 2010-16 (left) and example of impact on CHP economics (right)




**As policy support in Europe increasingly favours biomass co-generation over power only plants, the lower value of electricity produced could challenge the economics of some CHP projects.**

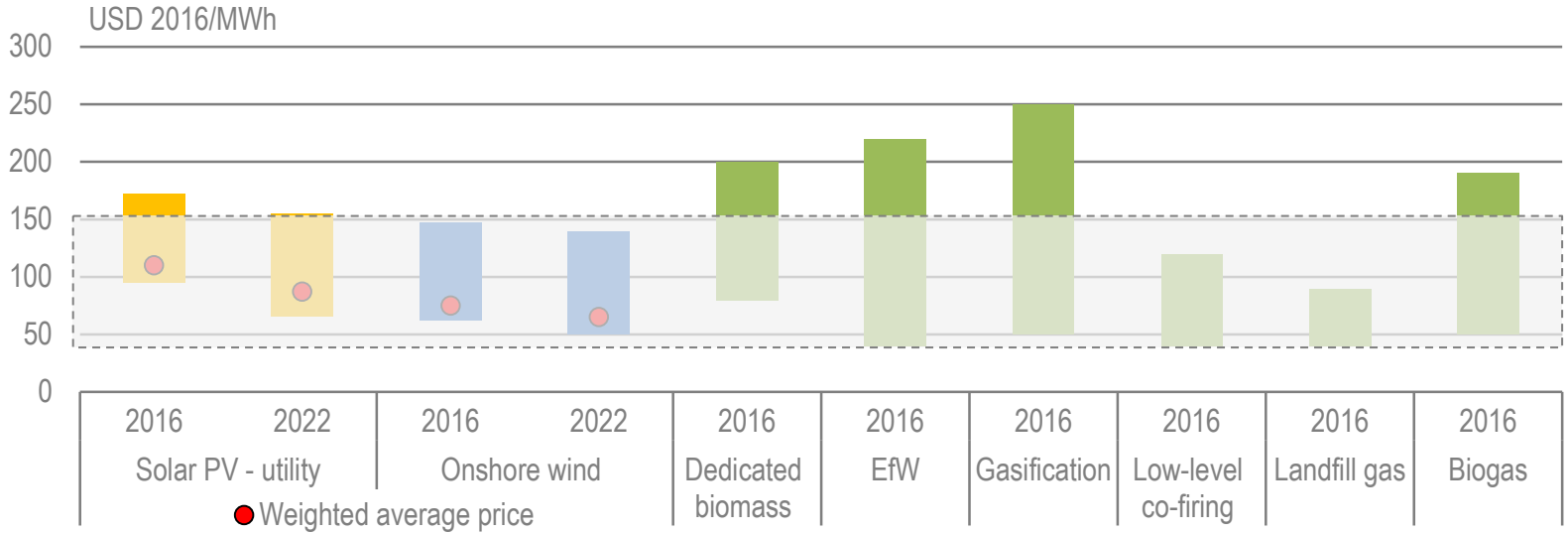
# Biomass for power portfolios vary by country




**Solid biomass is the dominant form of fuel used for bioenergy electricity generation, however EfW and biogas / landfill gas also make key contributions to capacity in certain countries.**

# Cost competition for bioenergy is increasing in the electricity sector

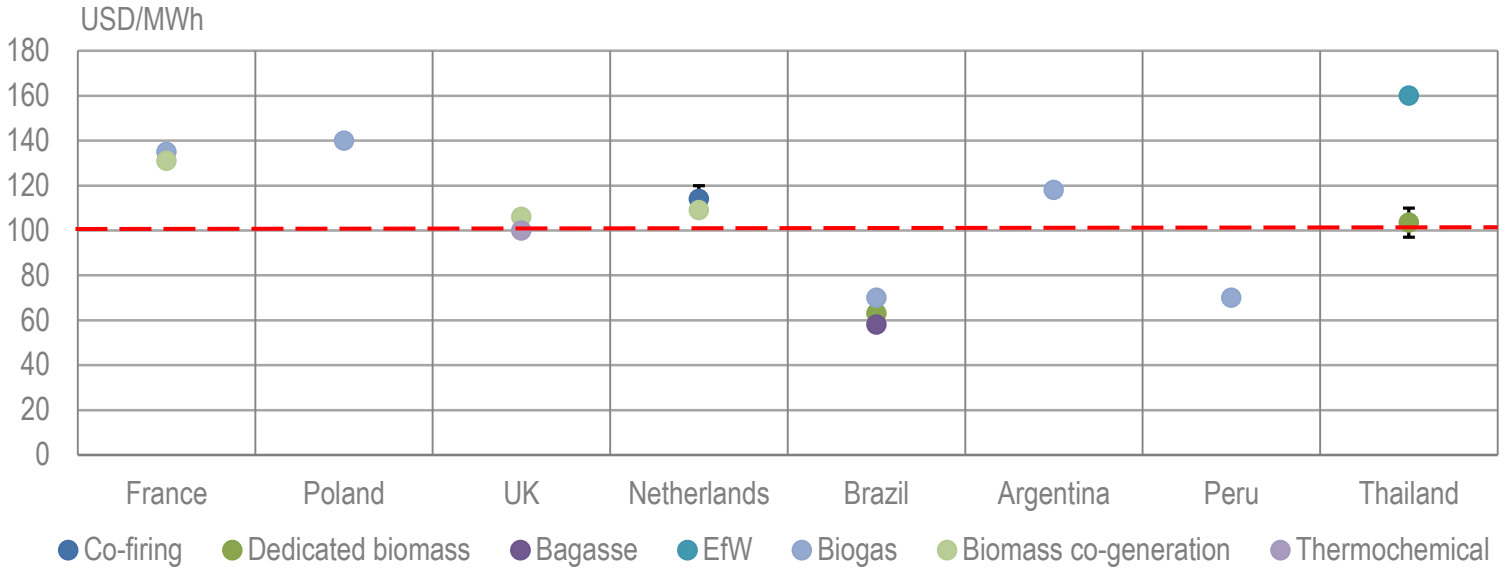
Global weighted average generation costs for new onshore wind and utility PV plants vs. reference bioenergy LCOE ranges




**VRE generation costs exhibit a downward trend. However, there should still be opportunities for bioenergy projects which combine a strong economic case with wider policy drivers.**

# Auction design crucial to biomass deployment prospects

Awarded auction price by bioenergy technology, auctions held over 2016-17




**Contracts awarded for bioenergy are generally ≥$100/MWh, but higher generation costs than VRE technologies need to be viewed in the context of biomass dispatchability and wider benefits.**

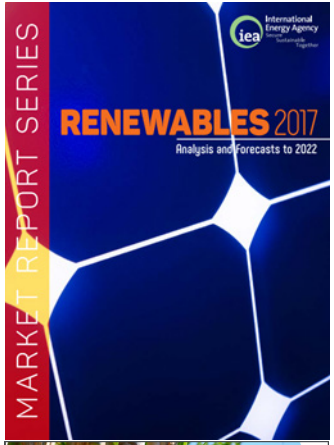
# Conclusions

- Bioenergy is the largest renewable energy source globally, increasing 2.5 fold by 2040 in the IEA's SDS
- Commercial-scale biomass heating offers economies of scale in investment and fuel costs
- Competitiveness versus fossil heating fuels differs by country, but pellets display price stability
- District heating and the conversion of fossil fuel infrastructure can facilitate bioenergy use
- Bioenergy occurs in industry sectors that produce biomass residues but is limited elsewhere
- The cement industry can scale up biomass and MSW use under supportive conditions
- Policies increasingly favour biomass co-generation over power-only projects in Europe, but lower power prices could challenge the economic case for some projects
- Where auction frameworks are used design taking account of bioenergy's dispatachability and contribution to wider socio-economic factors is key to market prospects.

# For further insights and analysis…

- *Renewables 2017* Market Report
- Technology Roadmap - delivering sustainable bioenergy (free)
- How2Guide for Bioenergy (free)

For more information see: www.iea.org/publications/




# Discussion points for EU4Energy countries

- How do biomass fuel costs compare to other heating fuels?
- Is there potential to convert district heating infrastructure to bioenergy?
- What key industry sectors could increase bioenergy use?
- What policy frameworks support renewable/biomass heat and electricity?