

EU energy system investments: capital requirement pathways towards 2050

Beijing, June 2014

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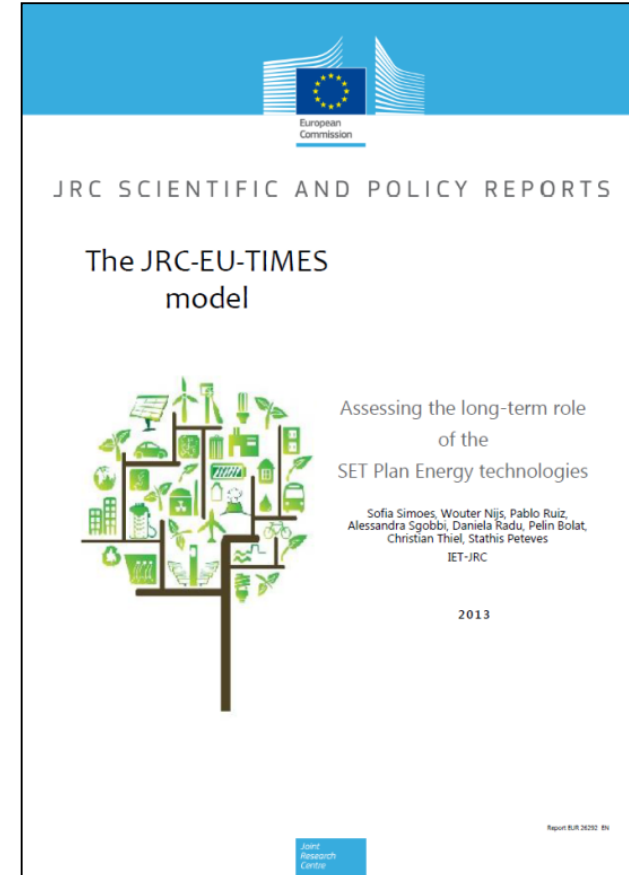
Context

- The **JRC-EU-TIMES energy system model** is used to model the future prospects of low-carbon technologies
- **New investments in the EU energy system** are triggered by a growing demand of energy services, the need to replace ageing infrastructure and by energy and climate policies.
- Over the period 2011-2030, **average annual additional investments** in the EU energy system are projected to amount to **38 billion Euros** to meet the -40% GHG target, as in the communication of the European Commission on a policy framework for climate and energy up to 2030.
- What are the **EU28 capital requirements** in scenarios up to 2050 with a 85% reduction CO₂ target, **focusing on key technologies** of the European Strategic Energy Technology Plan (SET-Plan) ?

JRC-EU-TIMES model

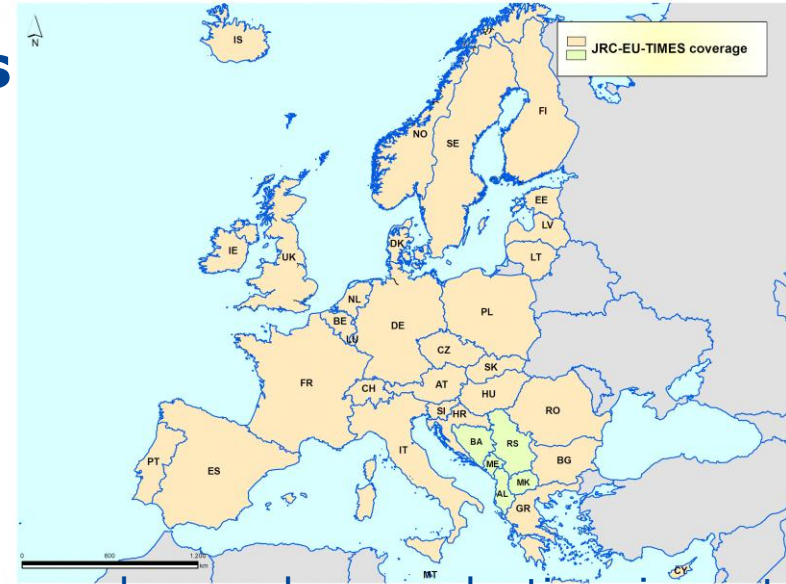
- > Model **fully owned and operated** by the JRC
- > EU28+ and Balkan **countries**
- > Model **validation** with Commission Services and external modelling experts

- > Model geared to **support** the follow up of the ETI Communication / SET-Plan implementation
 - evaluate the contribution of SET-Plan Technologies to a future cost-effective low-carbon energy system (assess long-term role of technologies)
 - assess the impact of technology policy i.e. SET-Plan to energy and climate change policies



JRC-EU-TIMES key characteristics

- Model **horizon** is 2005-2050 (2075)
- 70 exogenous **demands** for energy services across 5 **demand sectors** (agriculture, residential, commercial, industry, and transport)
- Economic drivers from general equilibrium model **GEM-E3** – with demand elasticities used for different drivers
- **Supply sector** description (fuel mining, primary and secondary production, import and export)
- Explicit representation of **country-to-country energy flows**, incl. endogenous electricity and gas trade, and import / exports with non-European regions
- Electricity **multi-grid model** (high, medium and low voltage grid), tracking demand-supply via **12 time slices** (4 seasons, 3 diurnal periods), and gas across **4 seasons**
- **Country specific differences** for characterisation of the conversion and end-use technologies
- **Renewable potential** (onshore wind, offshore wind, geothermal, biomass, biogas, hydro)



Modeled scenarios

CPI

+ 20-20-20 targets in 2020, annual EU ETS cap afterwards, extended biofuels target

CAP85 (85% CO₂ Cap)

HRES

+ 90% RES-e, +30% RES potential available

LSW

+ Maximum of 25% electricity from wind and PV

HNUC

Max nuclear capacity as 2005 & announced expansions

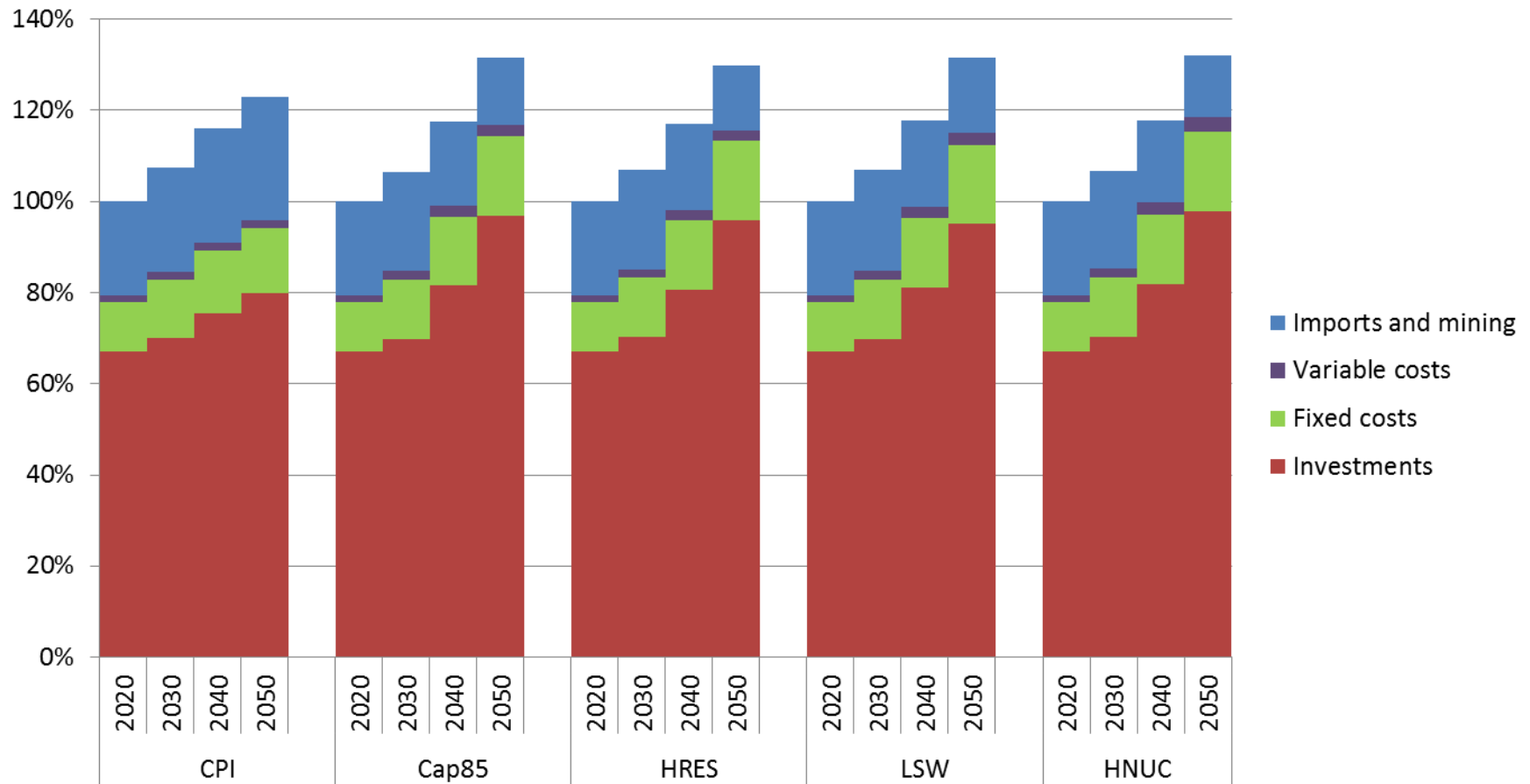
(Until 2025 the only new nuclear power plants to be deployed in EU28 are the ones currently being built in FI and FR. After 2025 all plants currently under discussion in EU28 can be deployed but no other plants)

New nuclear as cost-effective

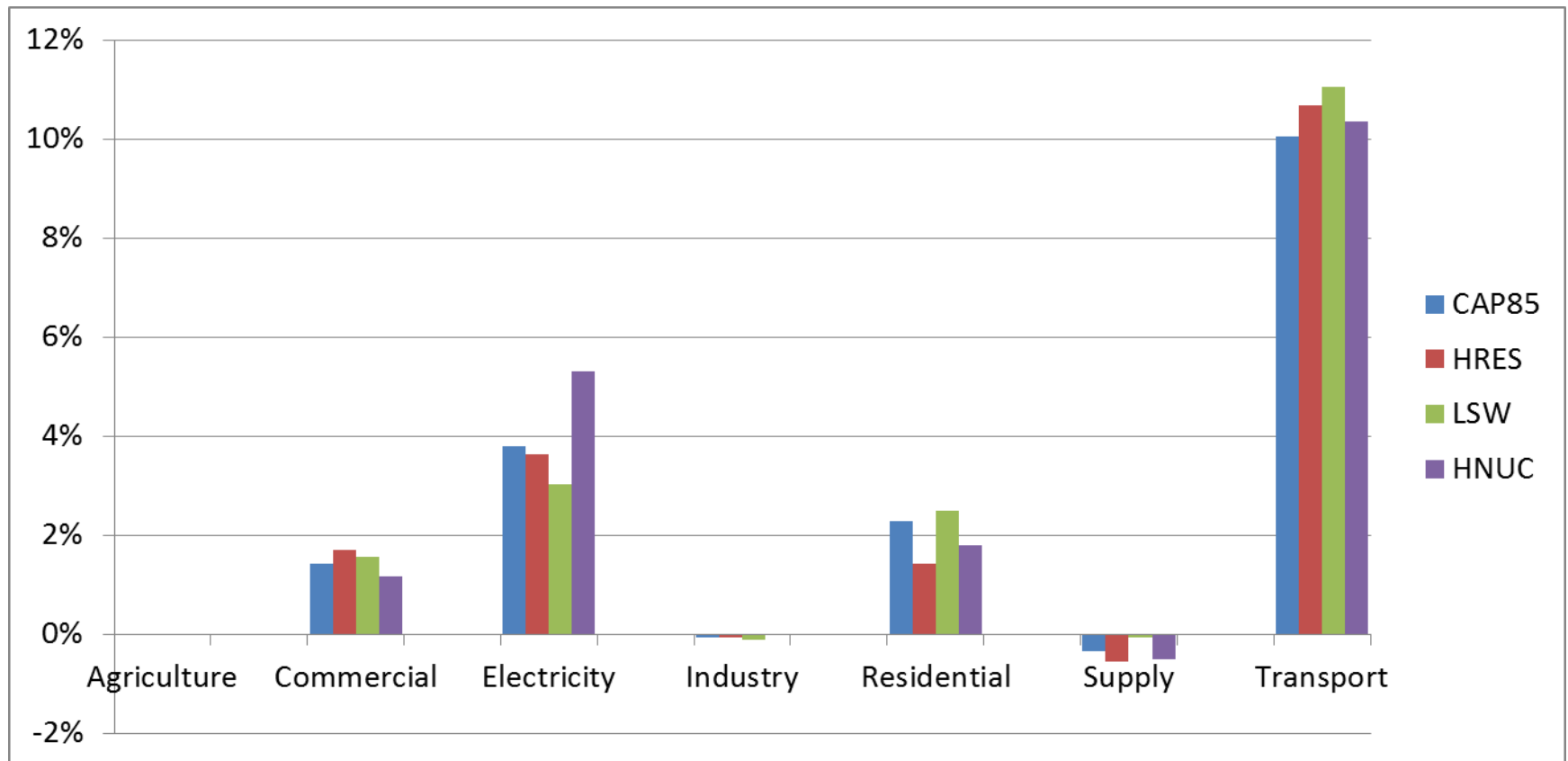
CO₂ reduction
40% in 2030
85% in 2050

Results: Total energy system costs

(relative to total energy system cost in 2020 of CPI scenario)

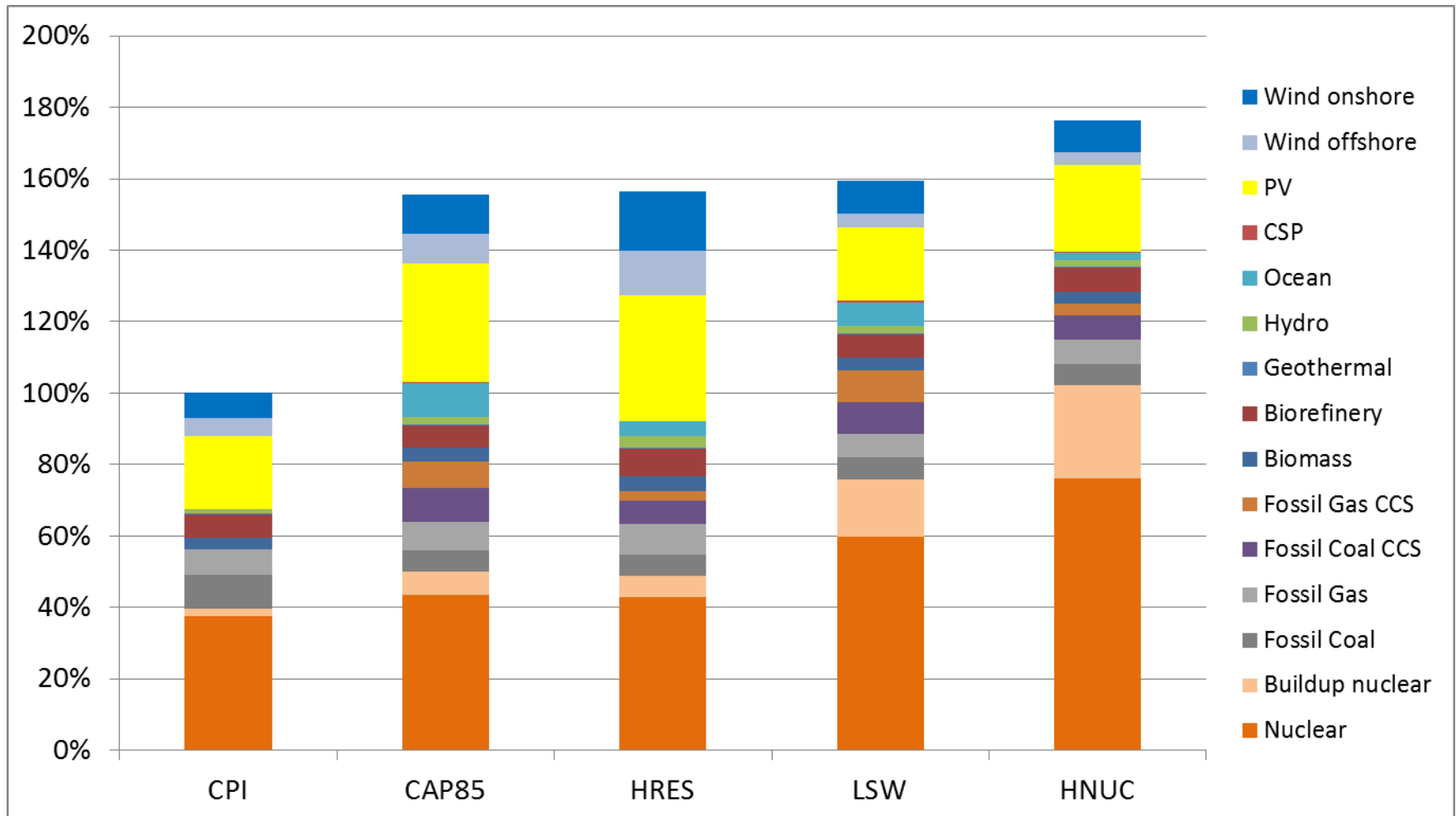


Sectoral additional investment costs from decarbonisation (relative to total investment cost of CPI scenario, annualised, average 2020-2050)

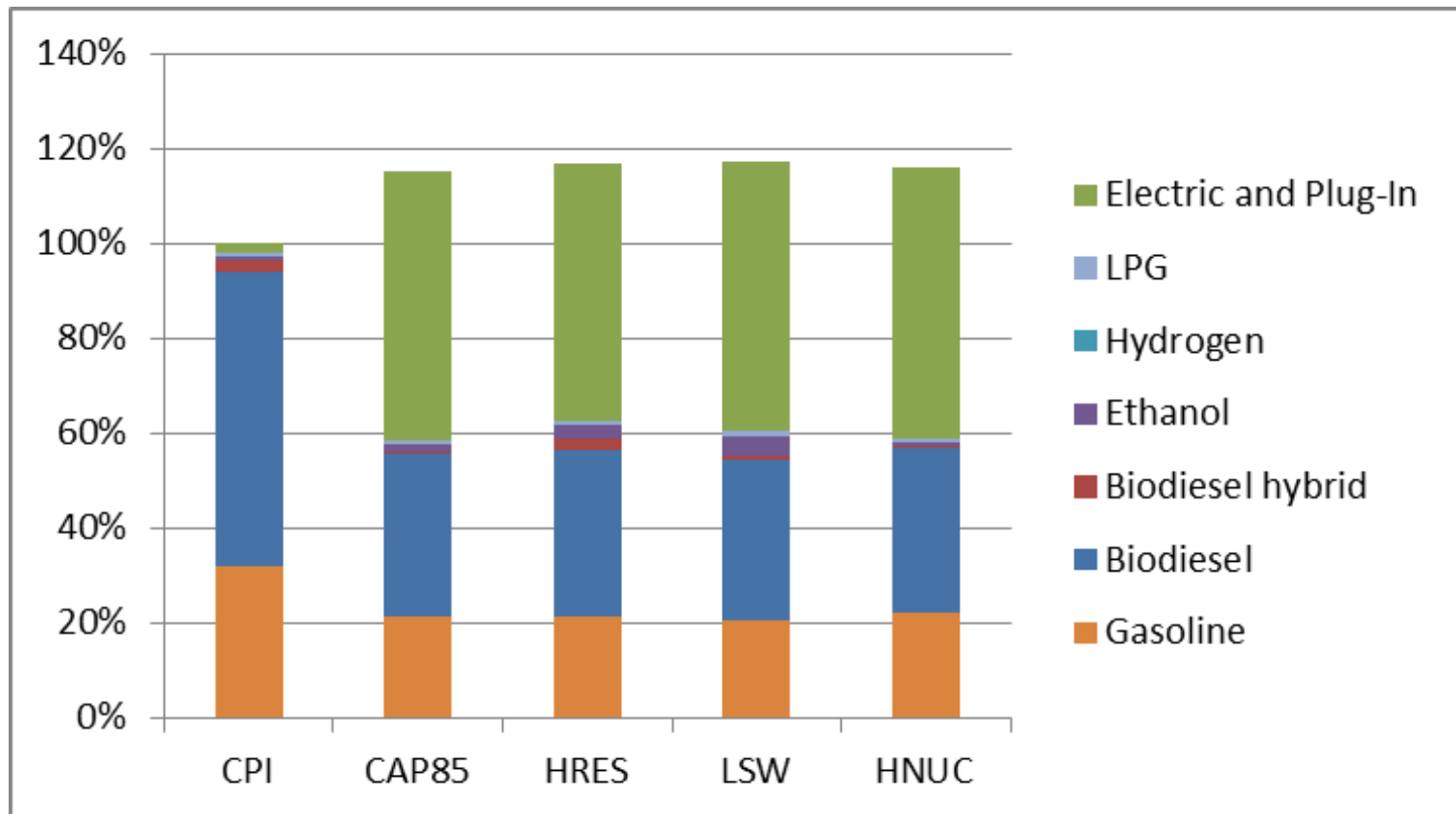


Power production investment costs

(relative to CPI scenario, annualised, average 2020-2050)



Cars investment costs (relative to CPI scenario, annualized, average 2020-2050)



Conclusions

- Between 2020 and 2050 the **average annual additional investments** in the decarbonised EU energy system are between 96 and 137 billion Euros.
- Costs are projected to **shift from operational costs to capital costs**.
- On average for 2020-2050
 - for power production, there is an additional capital requirement of **60 to 80 B€ per year** (excl. additional costs for grids and storage). Investments **increase in both fossil and non-fossil** power plants.
 - The biggest additional capital requirement is in the transport sector. Electric and plug-in hybrid cars, together with improved fossil cars, amount to **170 B€/year and more**.
- Further R, D & D needed to increase the portfolio of cost-efficient low-carbon technologies

Thank you!

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JRC-EU-TIMES Report available at:

http://publications.jrc.ec.europa.eu/repository/bitstream/11111111/30469/1/jrc_times_%20eu_overview_online.pdf