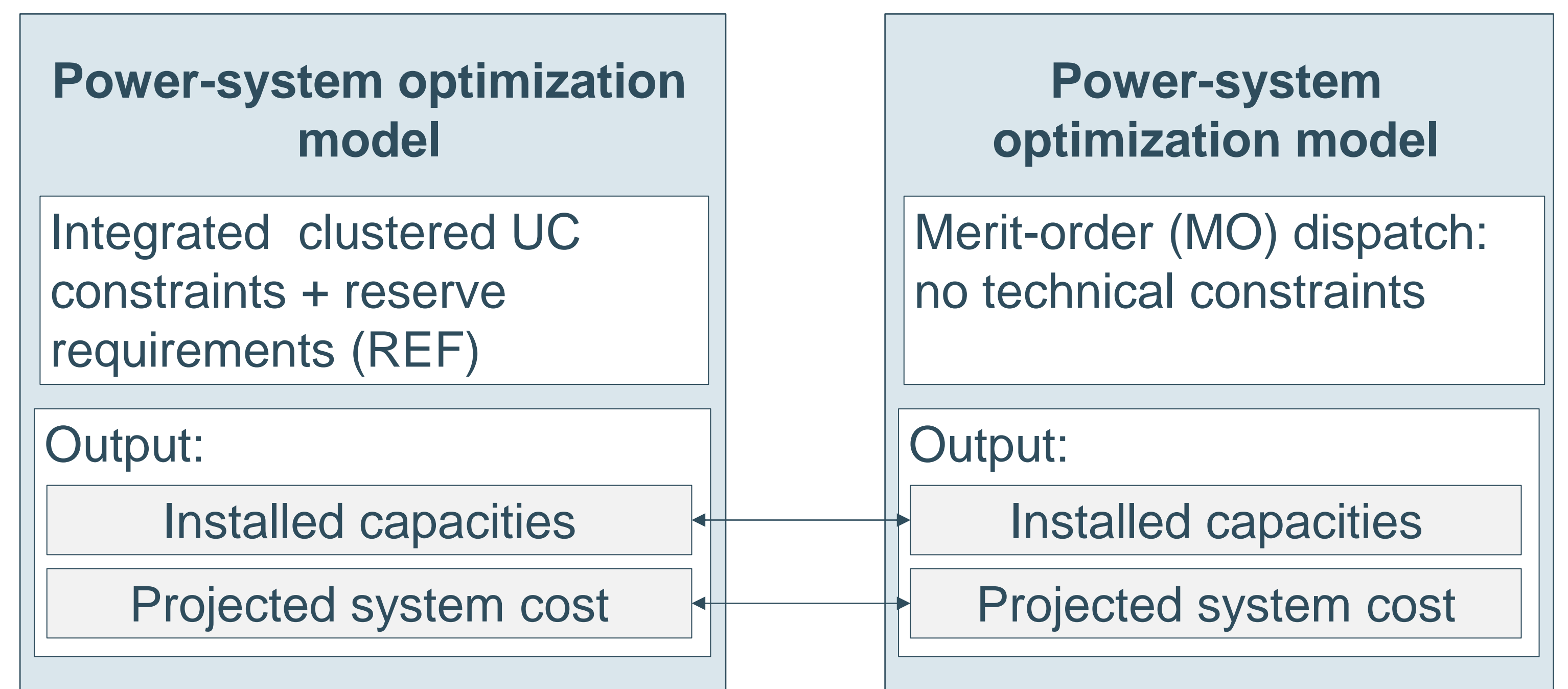


Kris Poncelet, Erik Delarue & William D'haeseleer
 Department of Mechanical engineering, KU Leuven
 Leuven, Belgium

Context

- 1 Long-term energy-system planning models (e.g., MARKAL/TIMES, NEMS) frequently used for analyzing transition pathways for the decarbonization of the overall energy system (incl. electrical power, heating, transportation, etc.)
- 2 To limit the computational complexity, a low level of technical detail typically used for modeling the operation of the electrical power system
- 3 Increased need for flexibility due to rising share of intermittent renewable energy sources, such as wind and solar PV

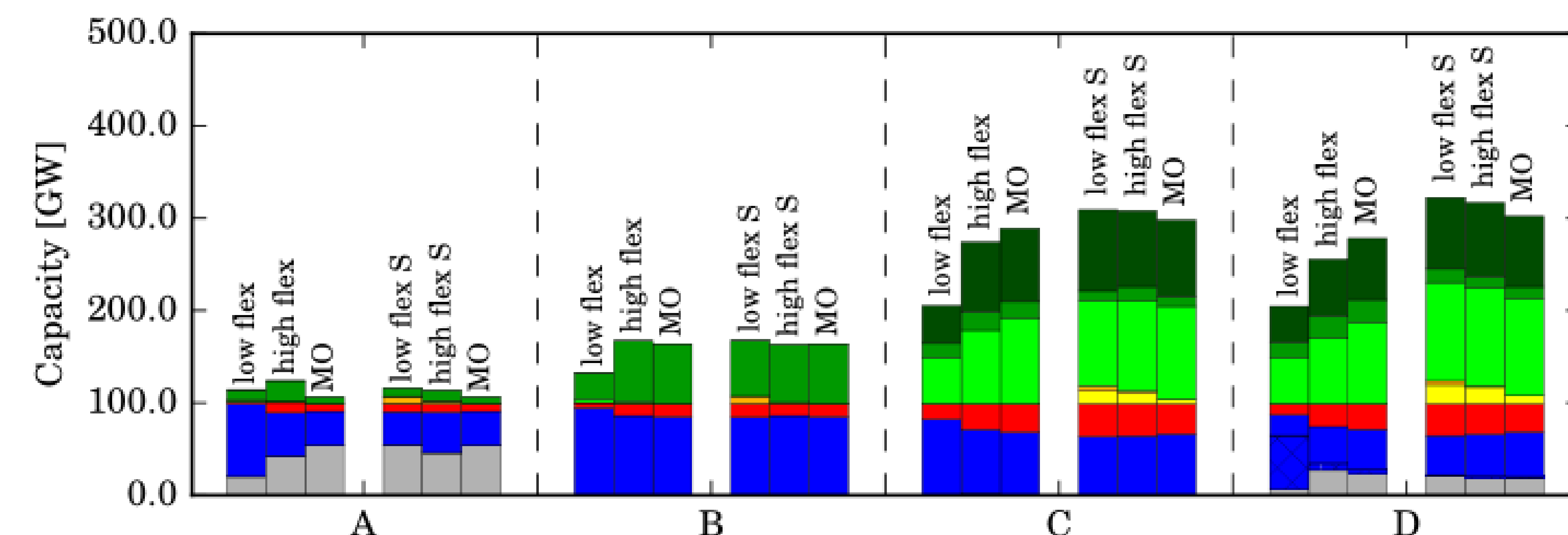
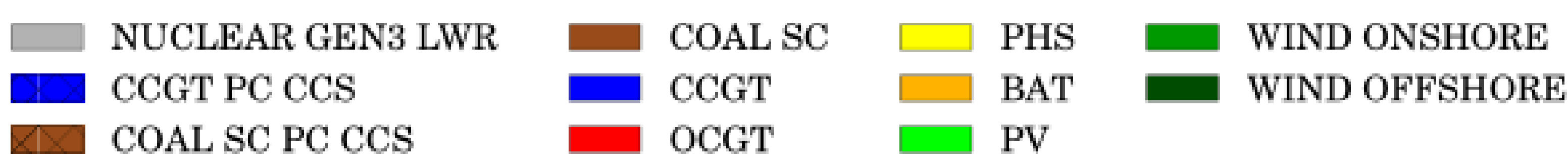
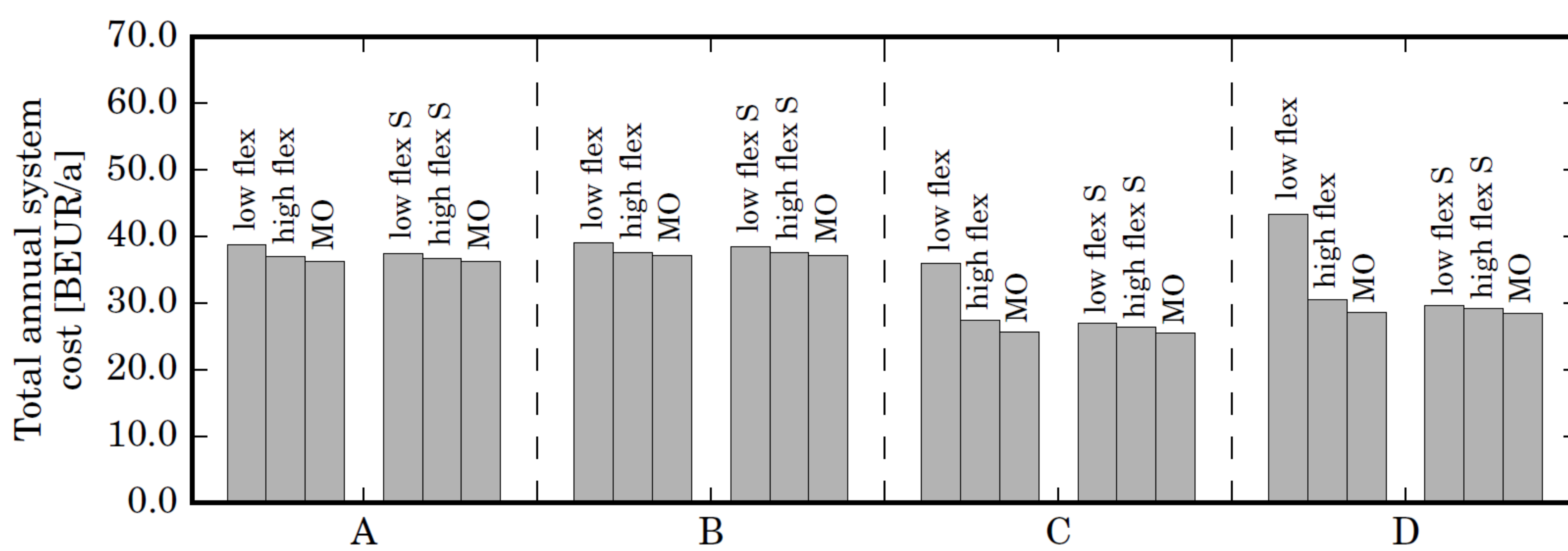
Methodology



- 1 Varying capacity mix
- 2 Varying assumptions regarding available flexibility

Case	low flex	high flex	low flex S	high flex S
Flexibility of thermal power plants	low	high	low	high
Investments in storage allowed	no	no	yes	yes

Relevance of incorporating UC constraints



- 1 In most cases, limited impact on projected total system cost (1.5-7%) and capacity mix
- 2 Main exception: investments in storage technologies
- 3 Assumptions regarding available flexibility have a large impact on results:
 - Might be unrealistically restrictive => consider options to increase flexibility
 - High impact on investments in storage technologies

Further work

- 1 Less computationally demanding formulations of the clustered UC constraints
- 2 Impact of assumptions regarding system needs: sizing of operating reserves and inertia