6th International Conference on Smart Energy Systems
6-7 October 2020

The role of electro-energy carriers under uncertainties for Belgian energy transition

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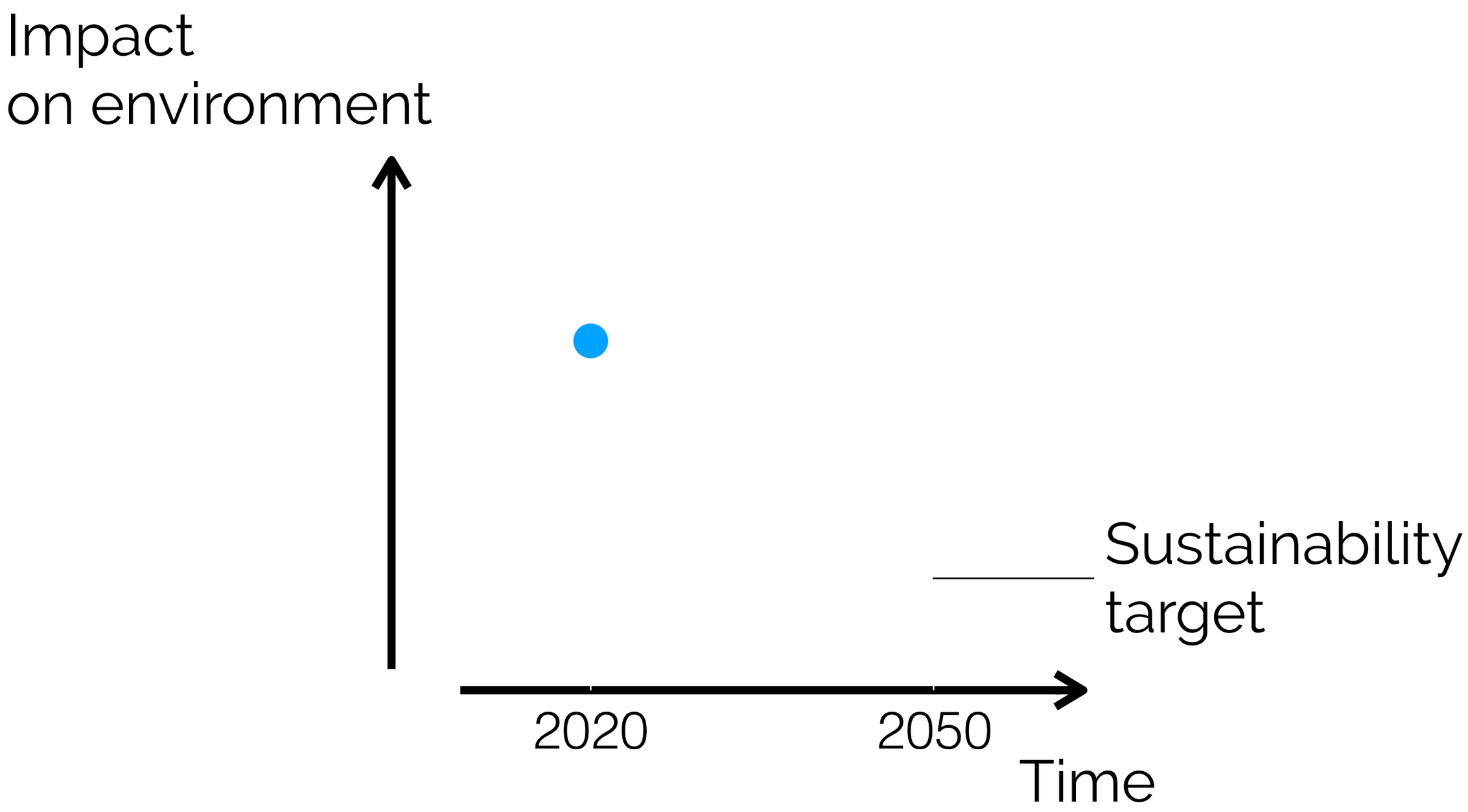
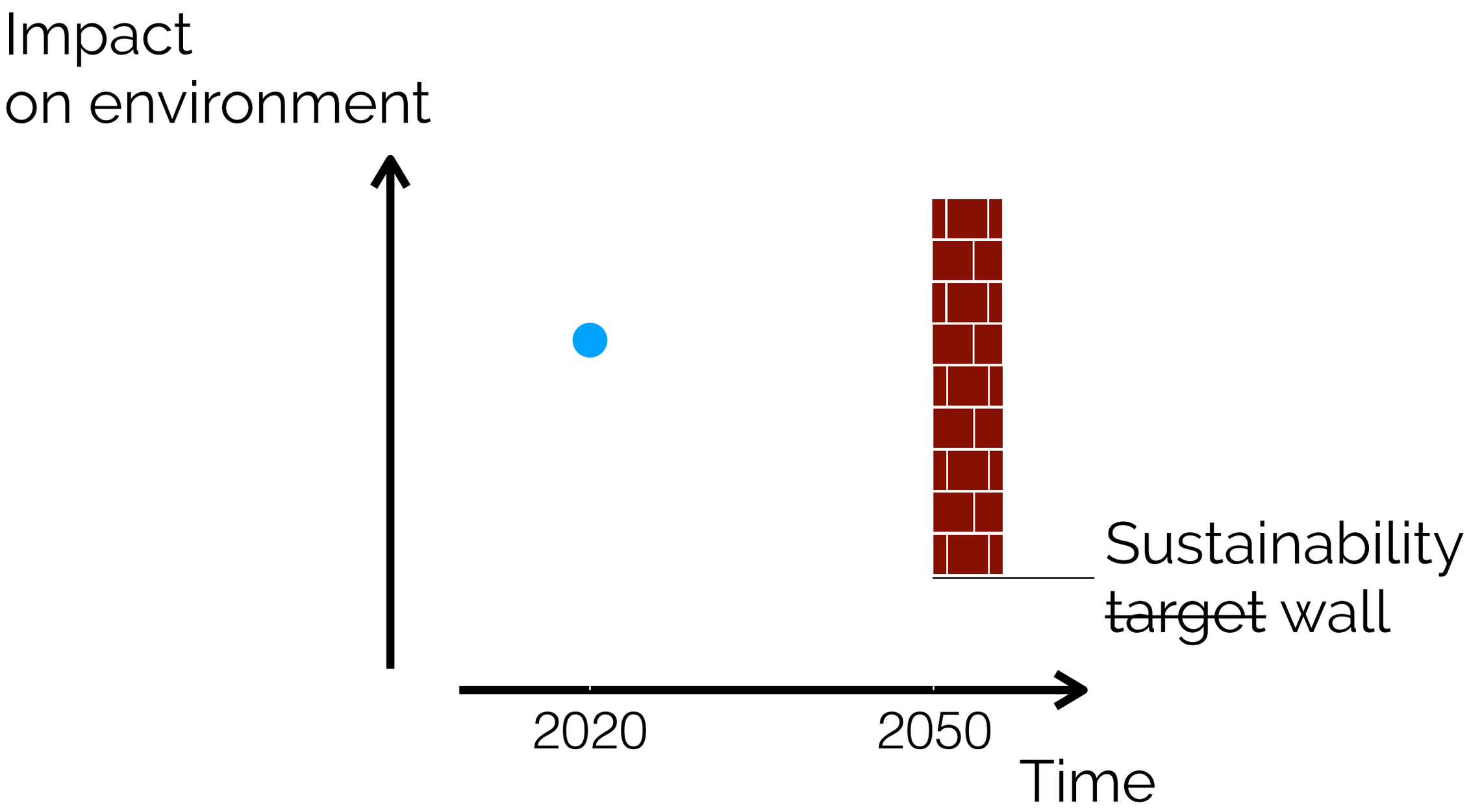
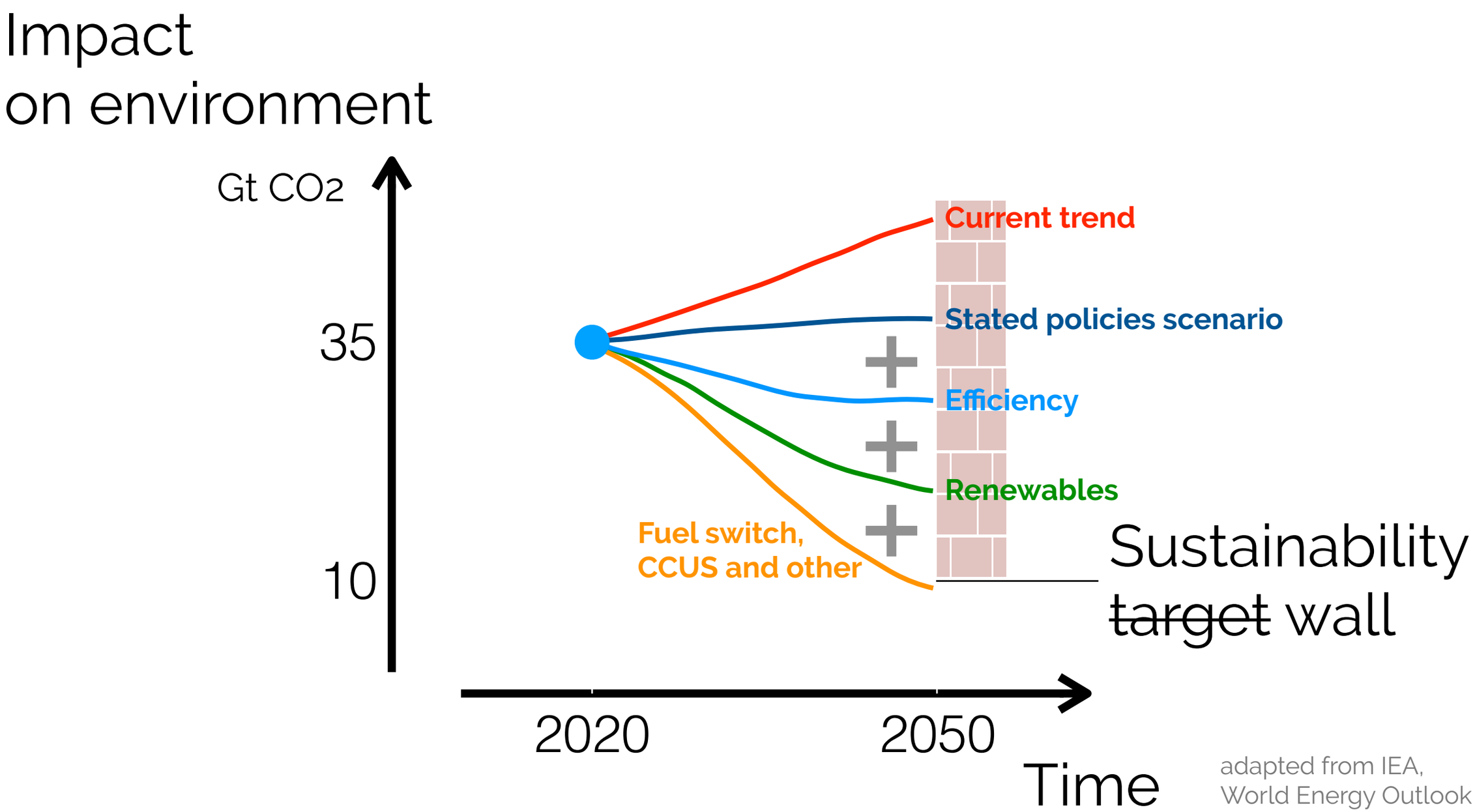
In the context of energy transition, we know where we are and where to go



In the context of energy transition, we know where we are and where to go



Many sails to raise to reach the destination



adapted from IEA,
World Energy Outlook 2019

Electro-fuels:
One keystone of the energy transition

Storage

Renewable intermittency and space disparity

Supply-demand mismatch

Infrastructure compatibility

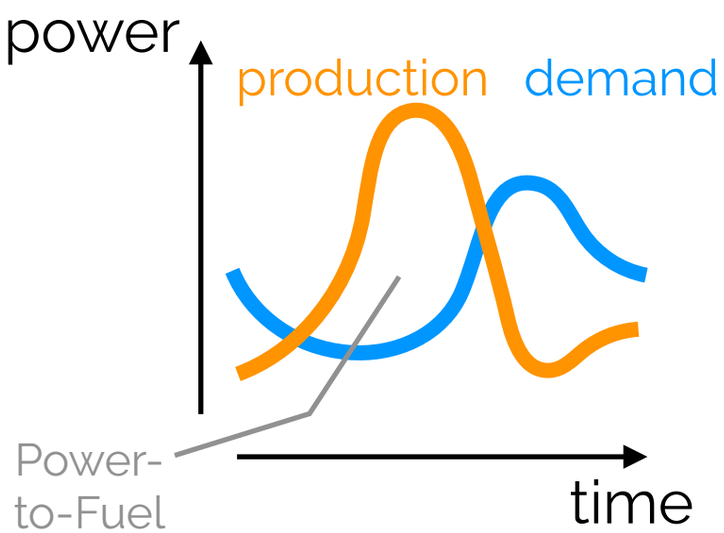
Existing transport network

Need for high-density energy carriers

Cross-sectorial approach

Boost the whole-system efficiency

Need for flexibility

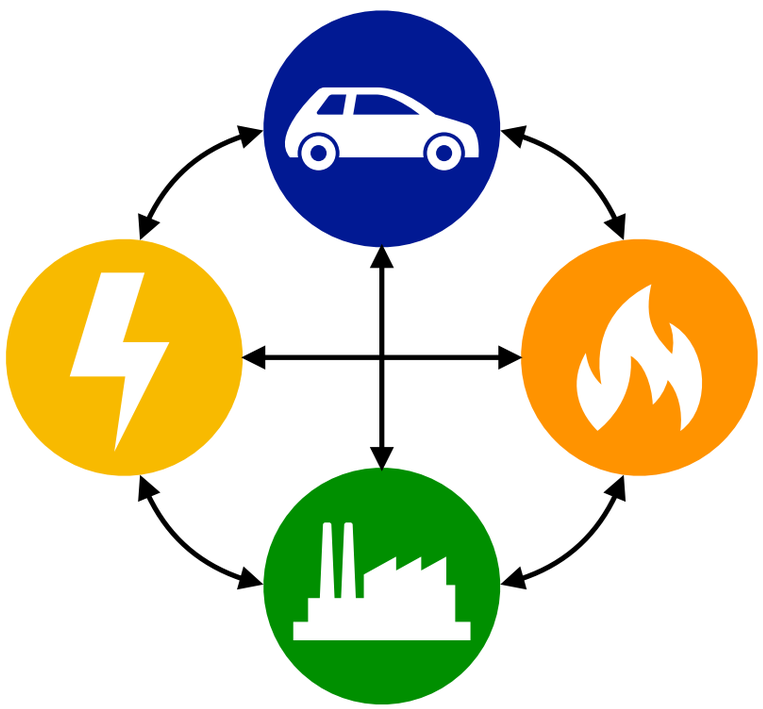


Methane

Ammonia

Hydrogen

Methanol



What role for the electro-fuels under uncertainties for Belgian energy transition?

METHODOLOGY

Whole-energy system optimization

Uncertainty quantification

CASE STUDY

Belgium energy system in 2050

RESULTS

Evolution of the system cost during decarbonization

Importance of electro-fuels

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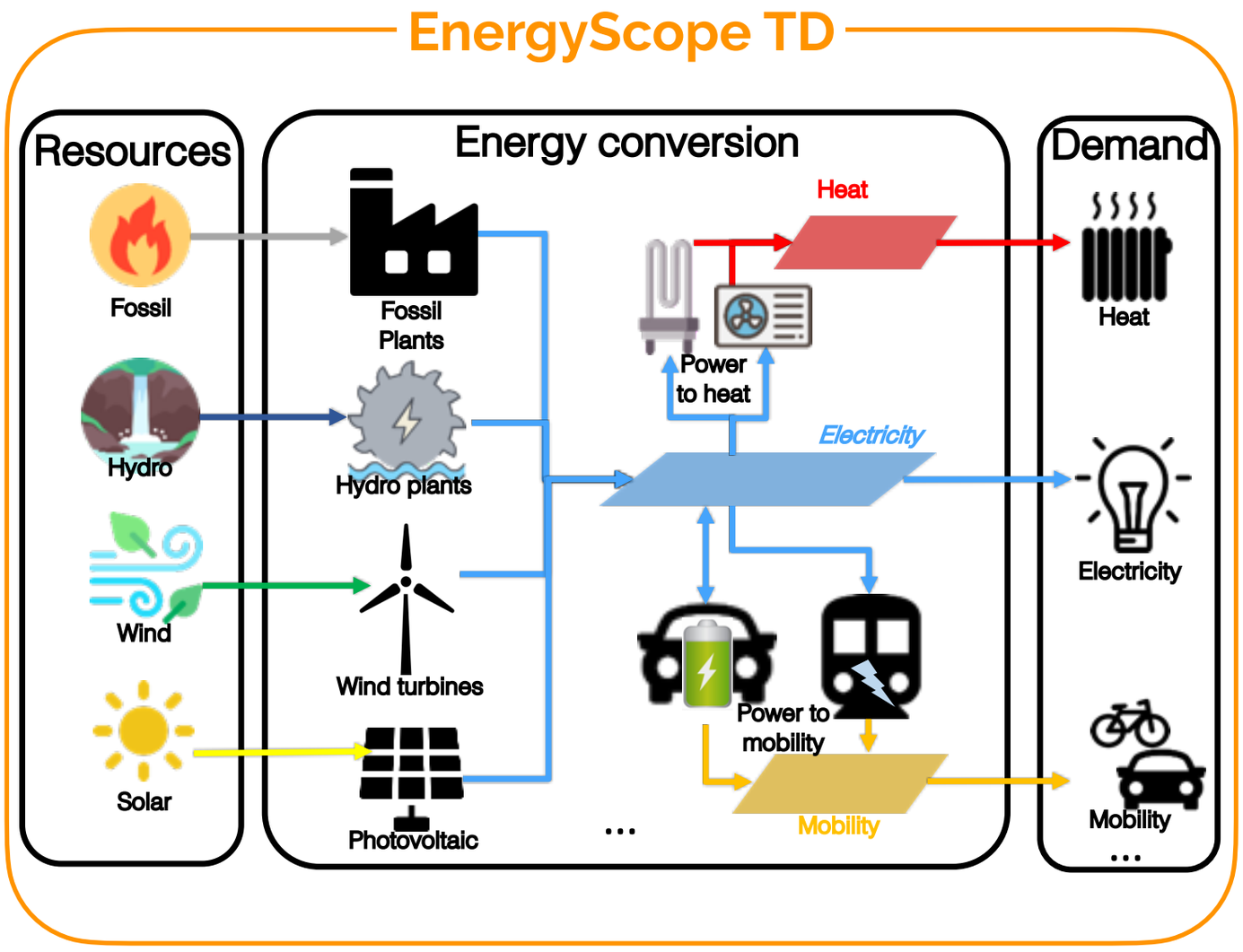
EnergyScope TD: a whole-energy system model to minimize the total cost



Multi-**sector** and multi-**carrier**

Optimization of **investment & operation** strategies

Snapshot modeling approach

optimization of a target future year

Hourly resolution

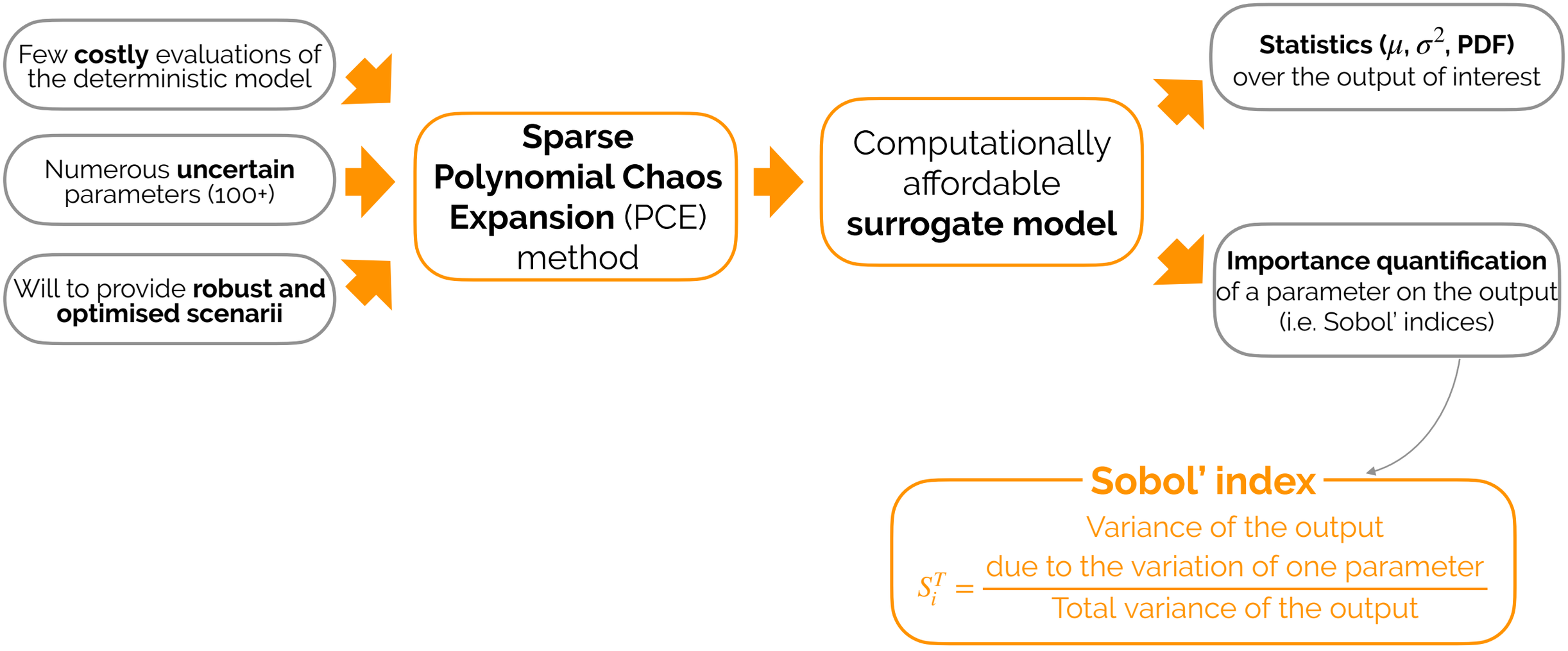
necessary for high integration of renewables and storage

Tractable formulation

suitable for uncertainty quantification

Limpens et al., 2019

Sparse Polynomial Chaos Expansion (PCE) provides uncertainty quantification and statistical insights, in a tractable time



Abraham et al., 2017

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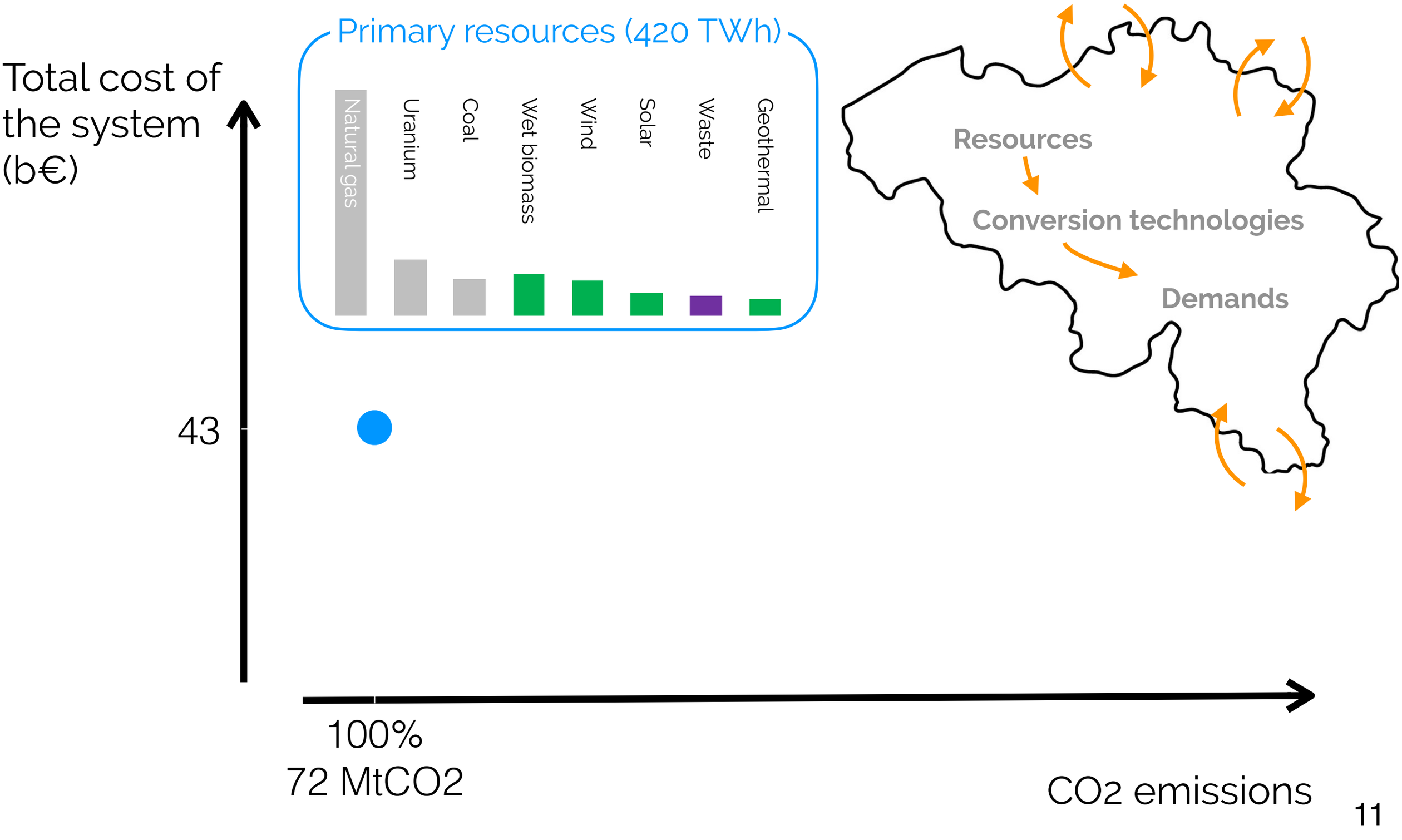
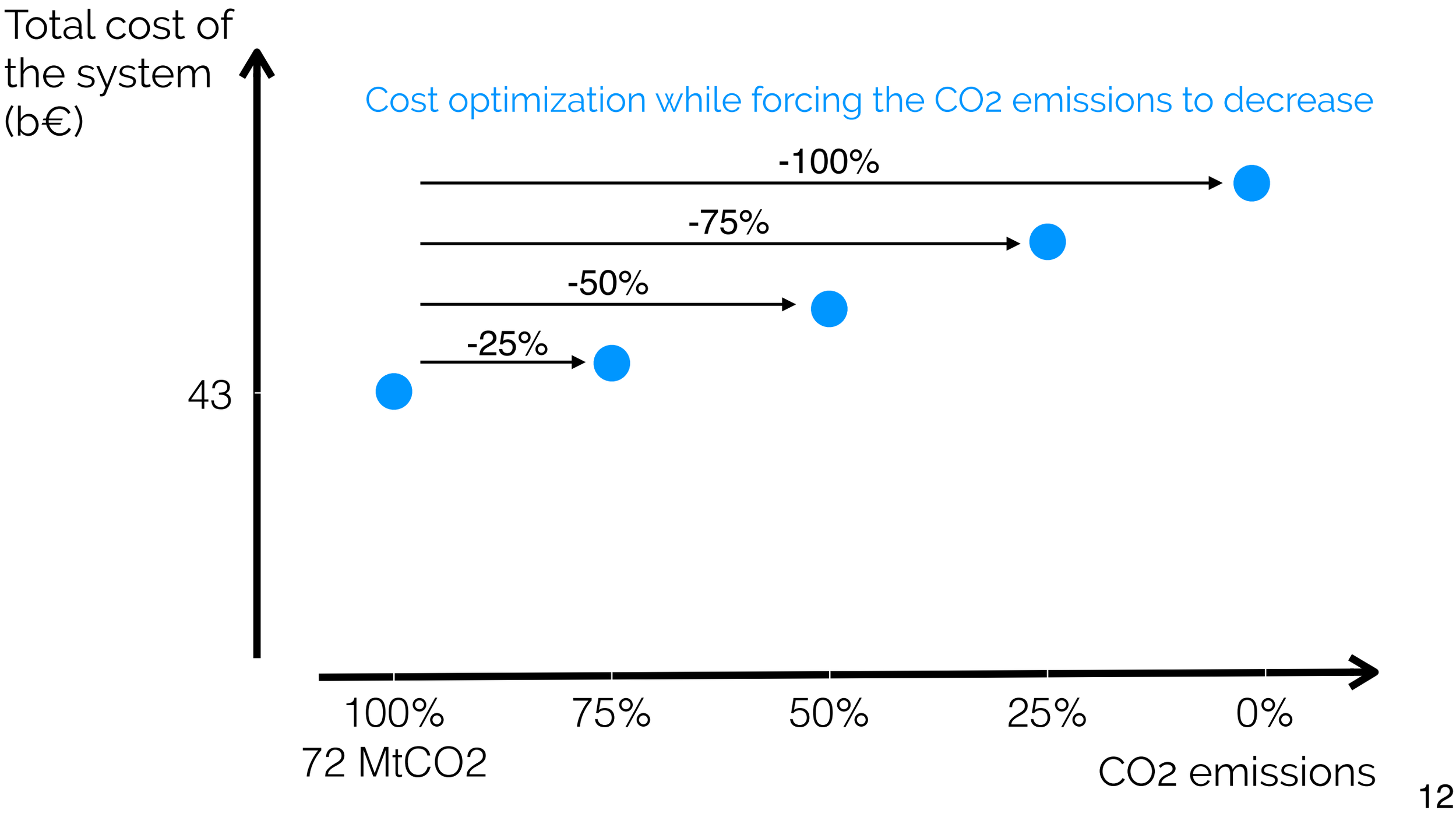
Case study: from the cost-optimum of the Belgian energy system in 2050…



…to the CO2-optimum and a full decarbonization of the Belgian energy system in 2050



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Belgium energy system in 2050
Major share
of natural gas (50%)

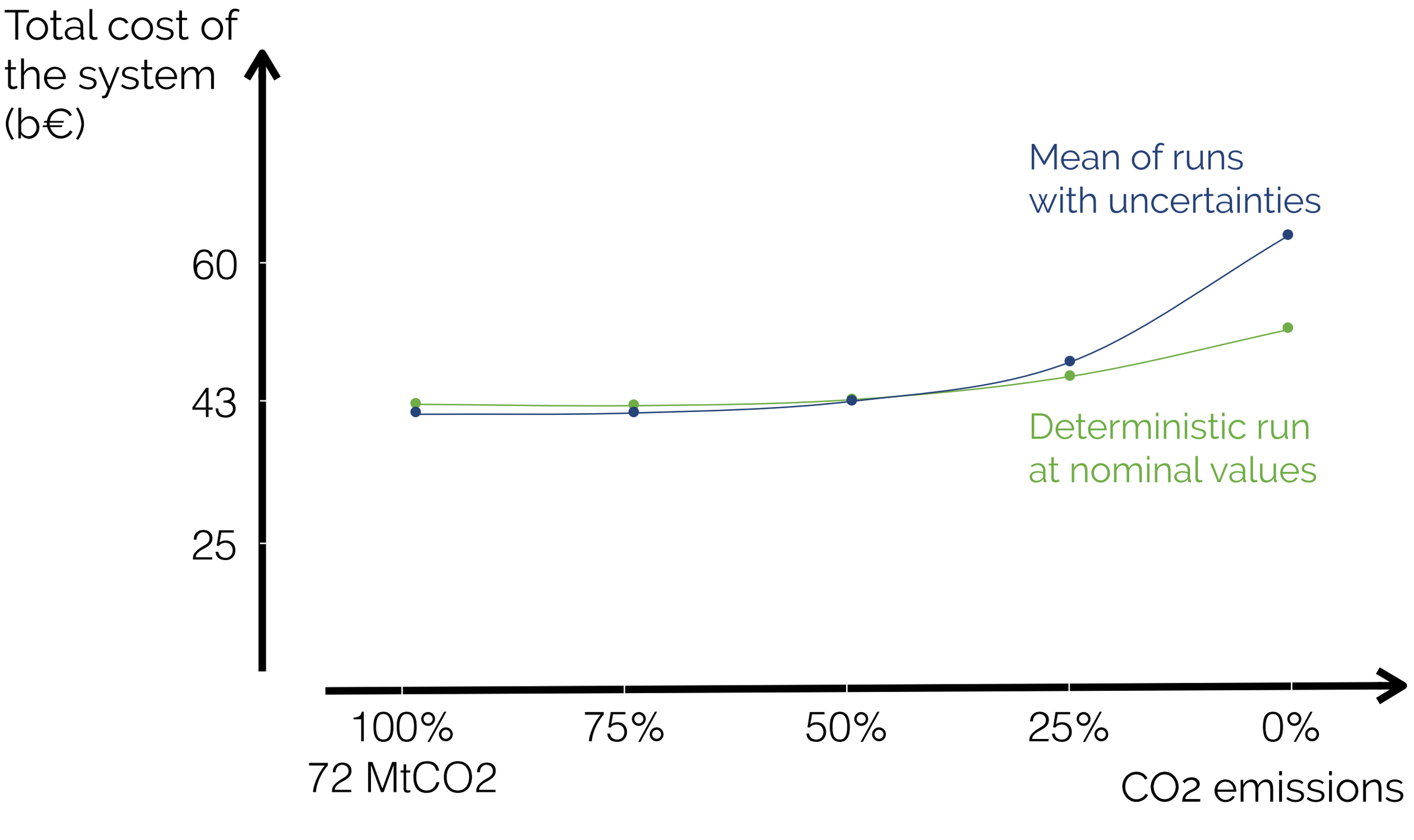
Limited use
of renewables (26%)

RESULTS

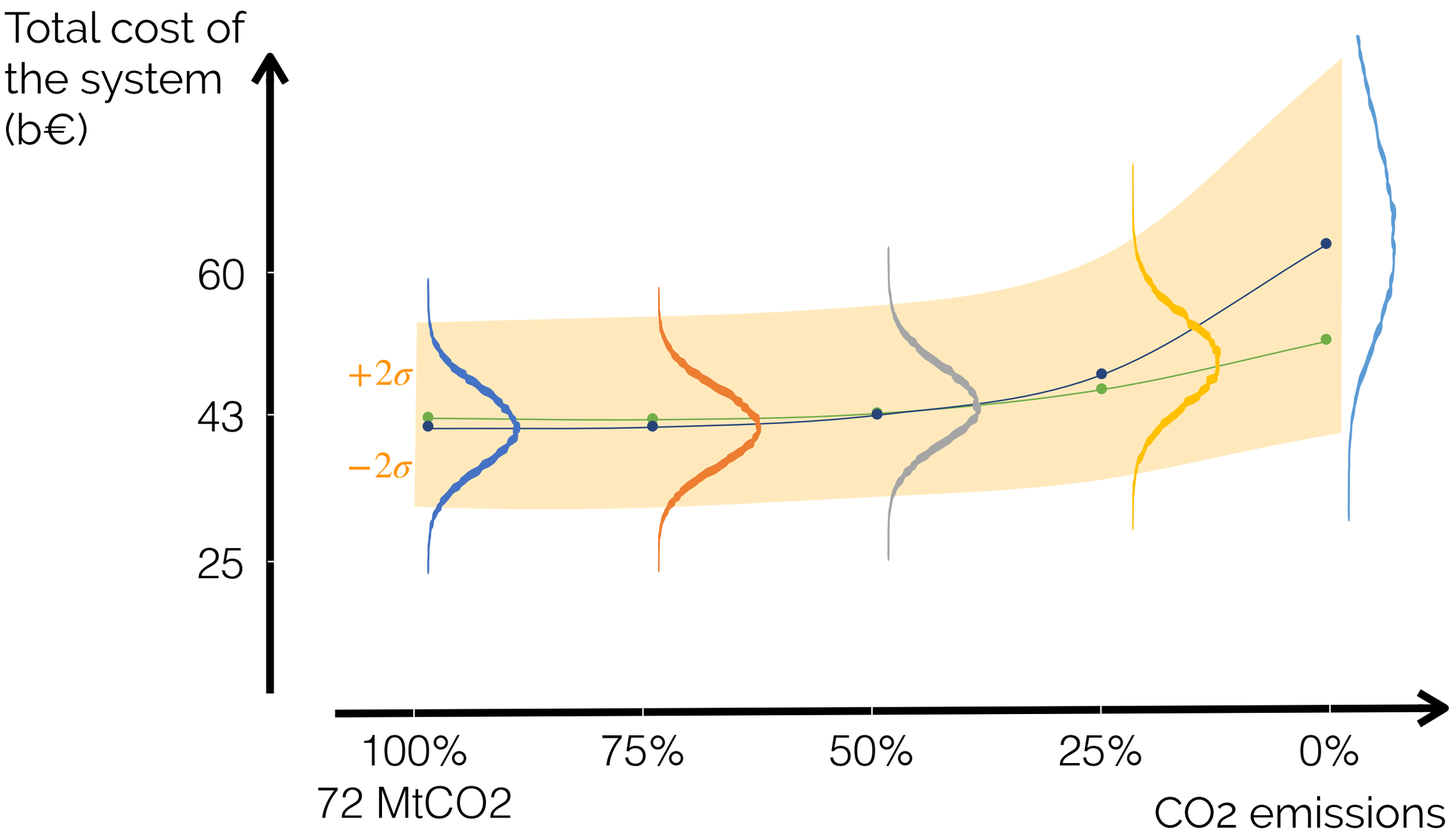
Evolution of the system cost during decarbonization

Importance of electro-fuels

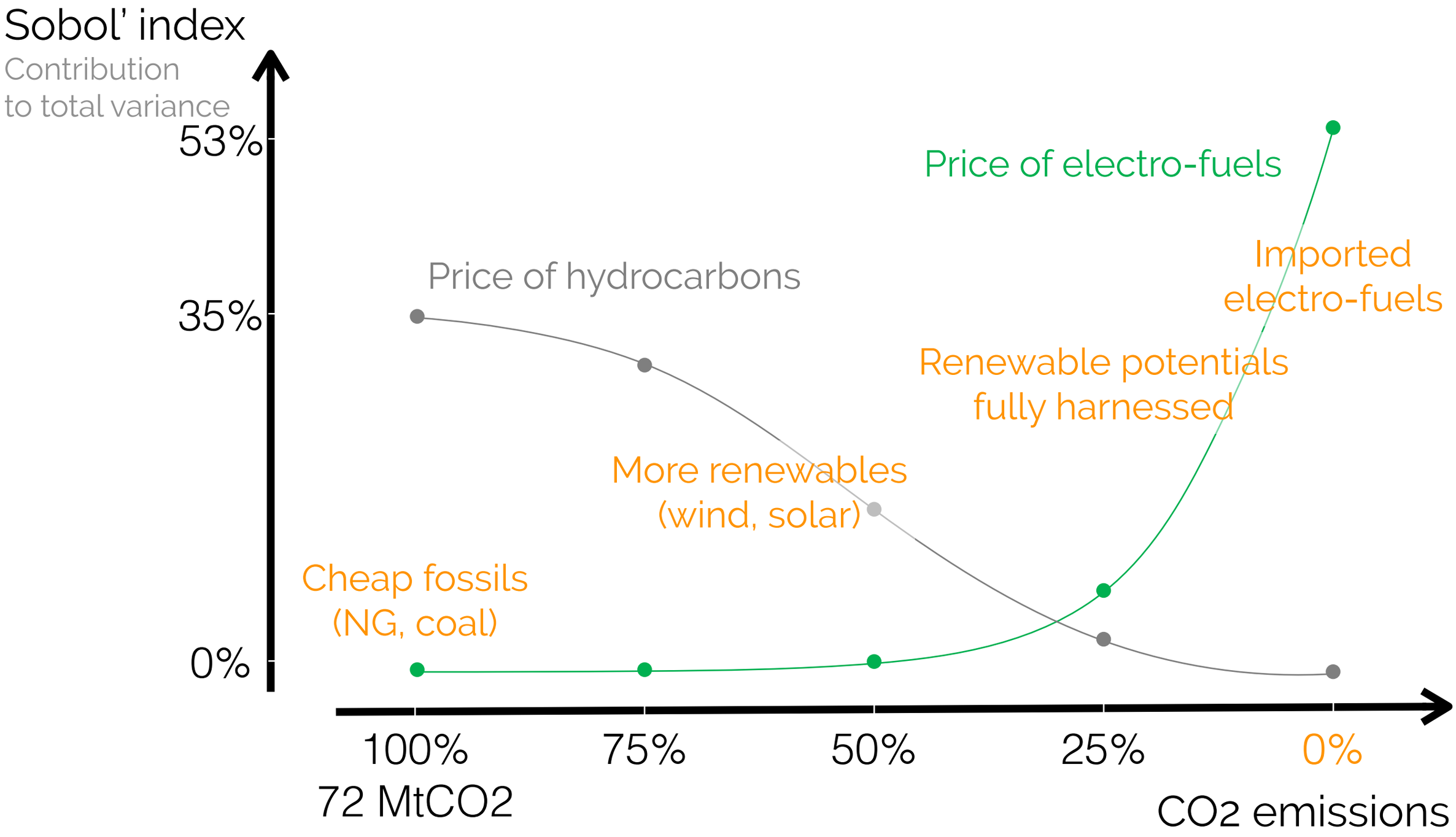
Going for decarbonization drives up the cost of the system



Going for decarbonization drives up the cost of the system and makes it more uncertain



High uncertainty on the price of electro-fuels drives the variation of the cost to reach 0% CO2



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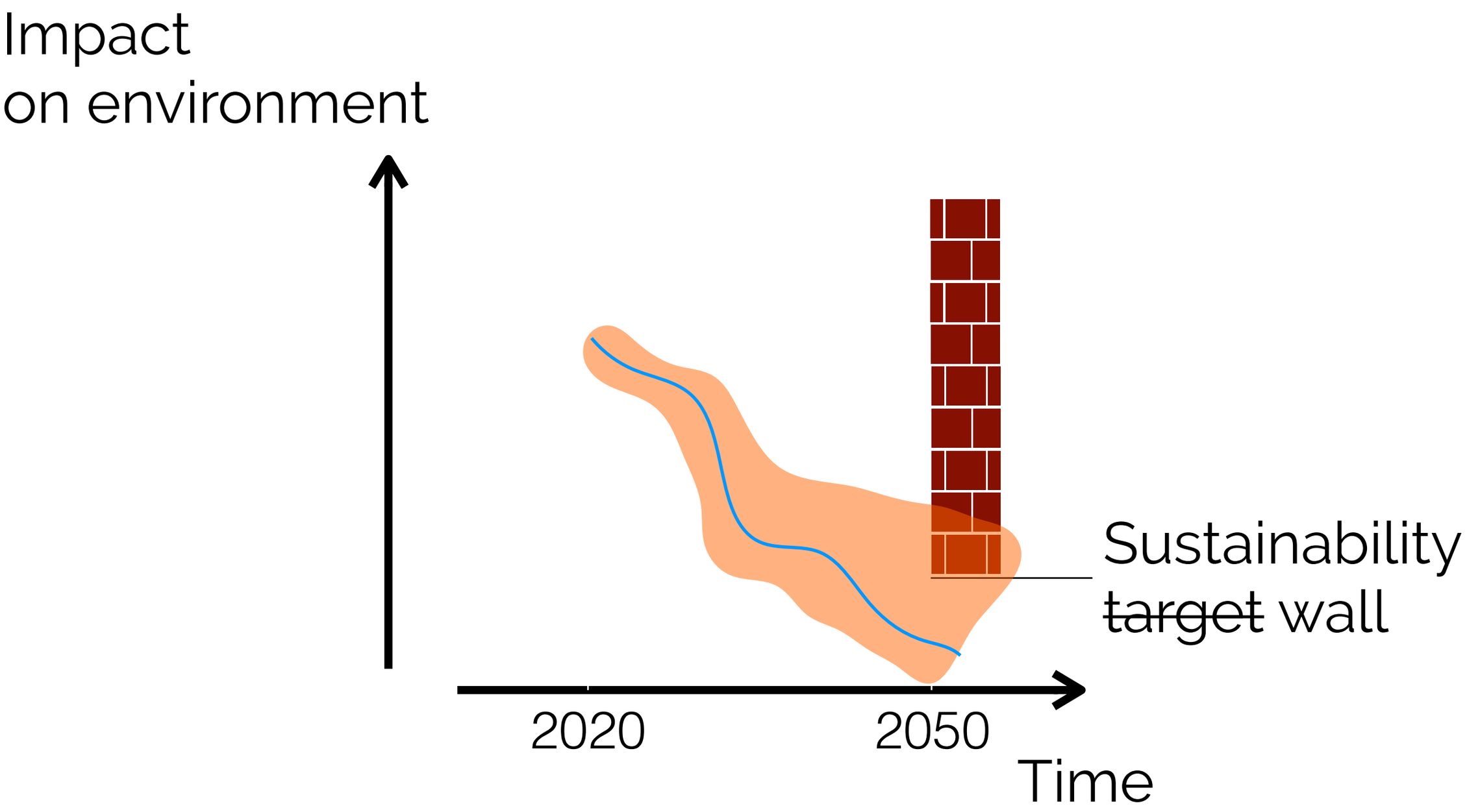
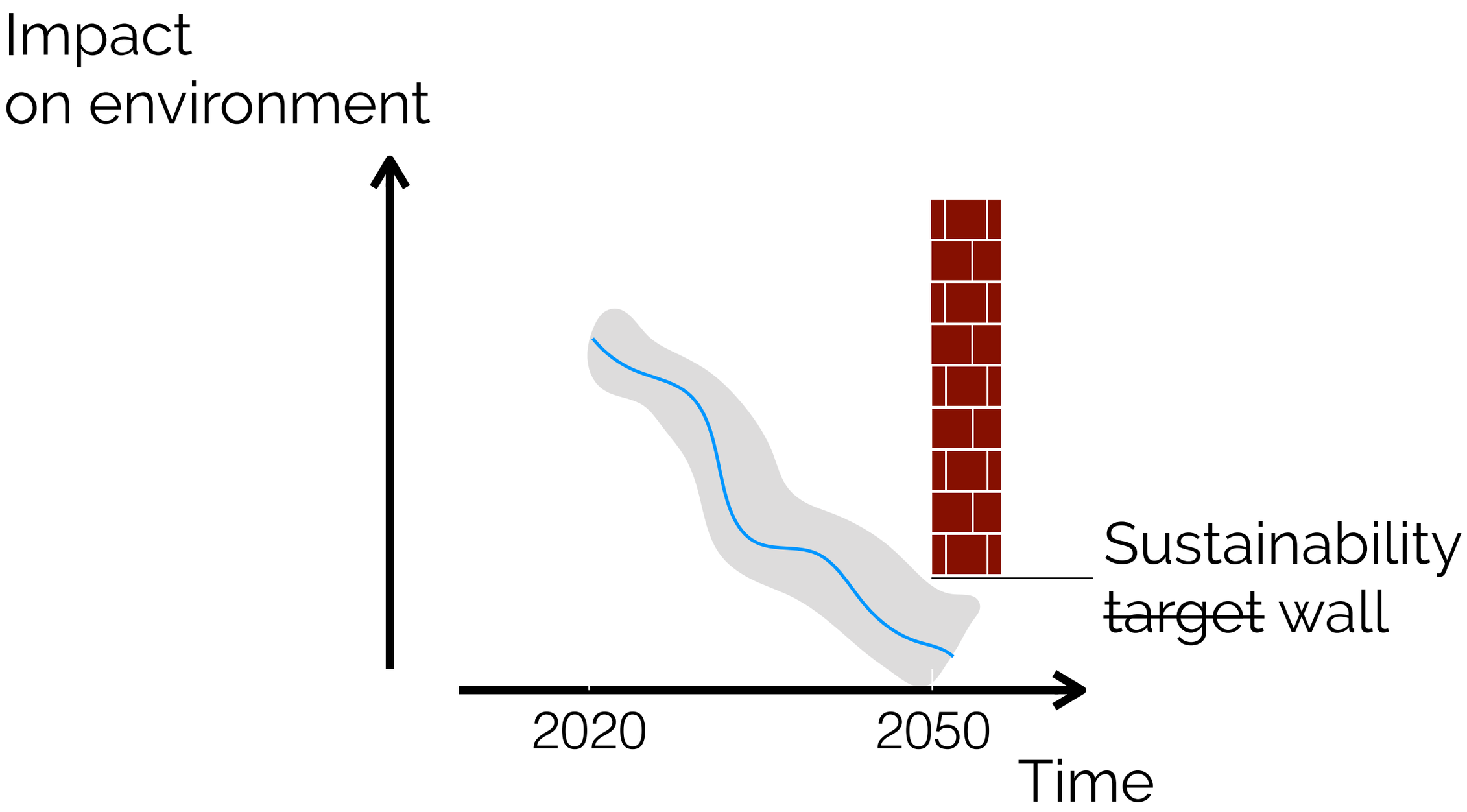
Evolution of the system cost during decarbonization
Increase of the mean **and** the standard deviation of the total cost

Importance of electro-fuels
Too expensive to play a role sooner in the decarbonization
High uncertainty drives the variation of the cost to reach 0% CO_2

To avoid hitting the sustainability wall…



We need to work on reducing the uncertainties on electro-fuels to reach a robust and net-zero emissions energy system



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