THE DECISION PROCESS WHEN INVESTING OR REINVESTING IN A HYDROPOWER PLANT

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Trondheim, February 2020

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Lysebotn II
Source: Lyse Energi

Source: NVE

Motivation behind investments

Why invest in hydropower?

→ Clean, cheap (?) and flexible energy for the future!

The investment decision process

→ At the end it is all about profitability

"Rule No. 1: Never lose money. Rule No. 2: Never forget rule No.1" – Warren Buffett

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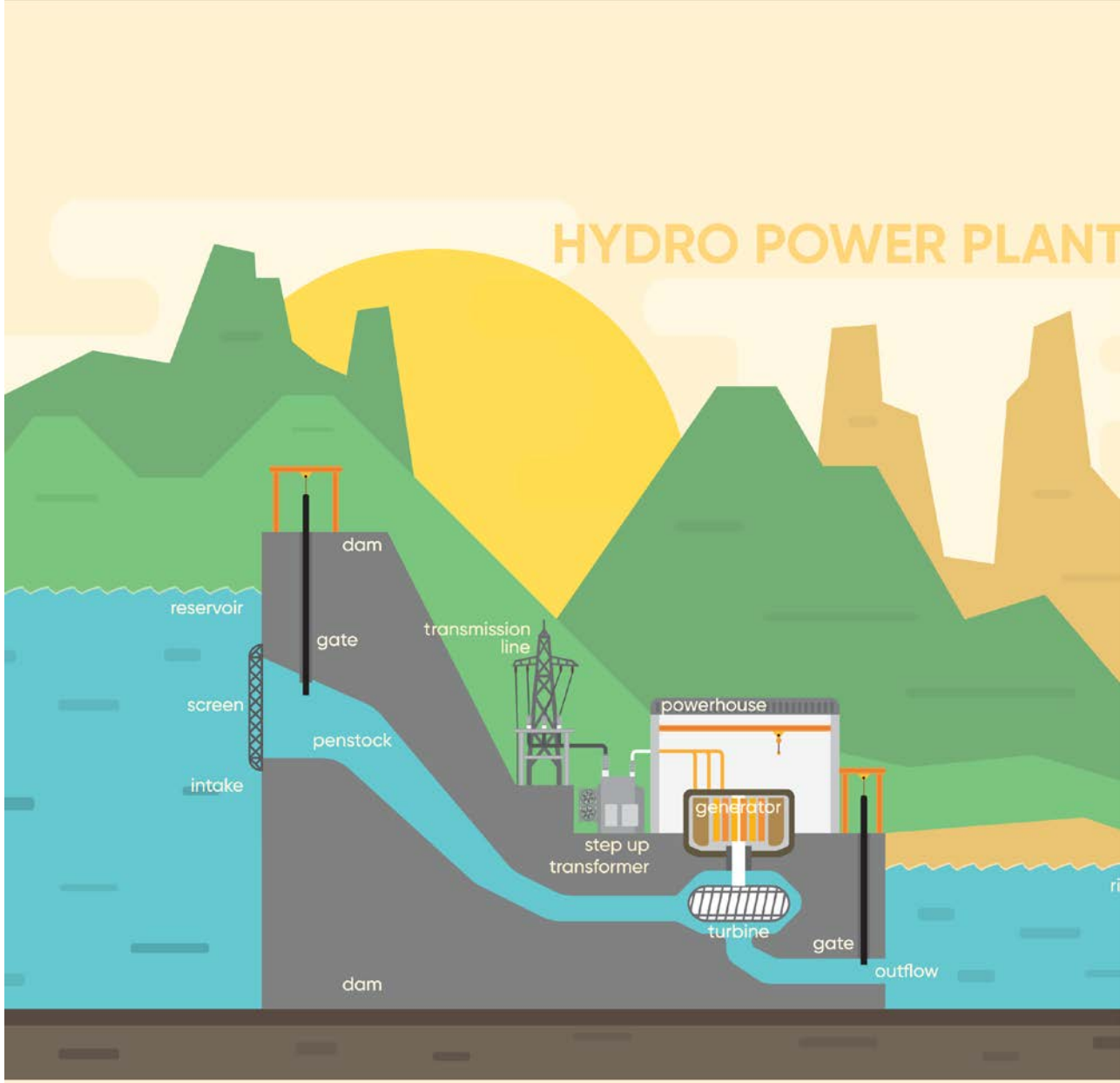
Main challenges

- Hydropower plants are long-term investments (long lifetimes!)
- Understanding the needs and value potential in future energy systems
- Combining long-term valuation of water and detailed modelling of short-term variations



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The importance of short-term variations

Main drivers: climate targets and rapidly falling technology costs

Result: Power systems with higher shares of unregulated generation

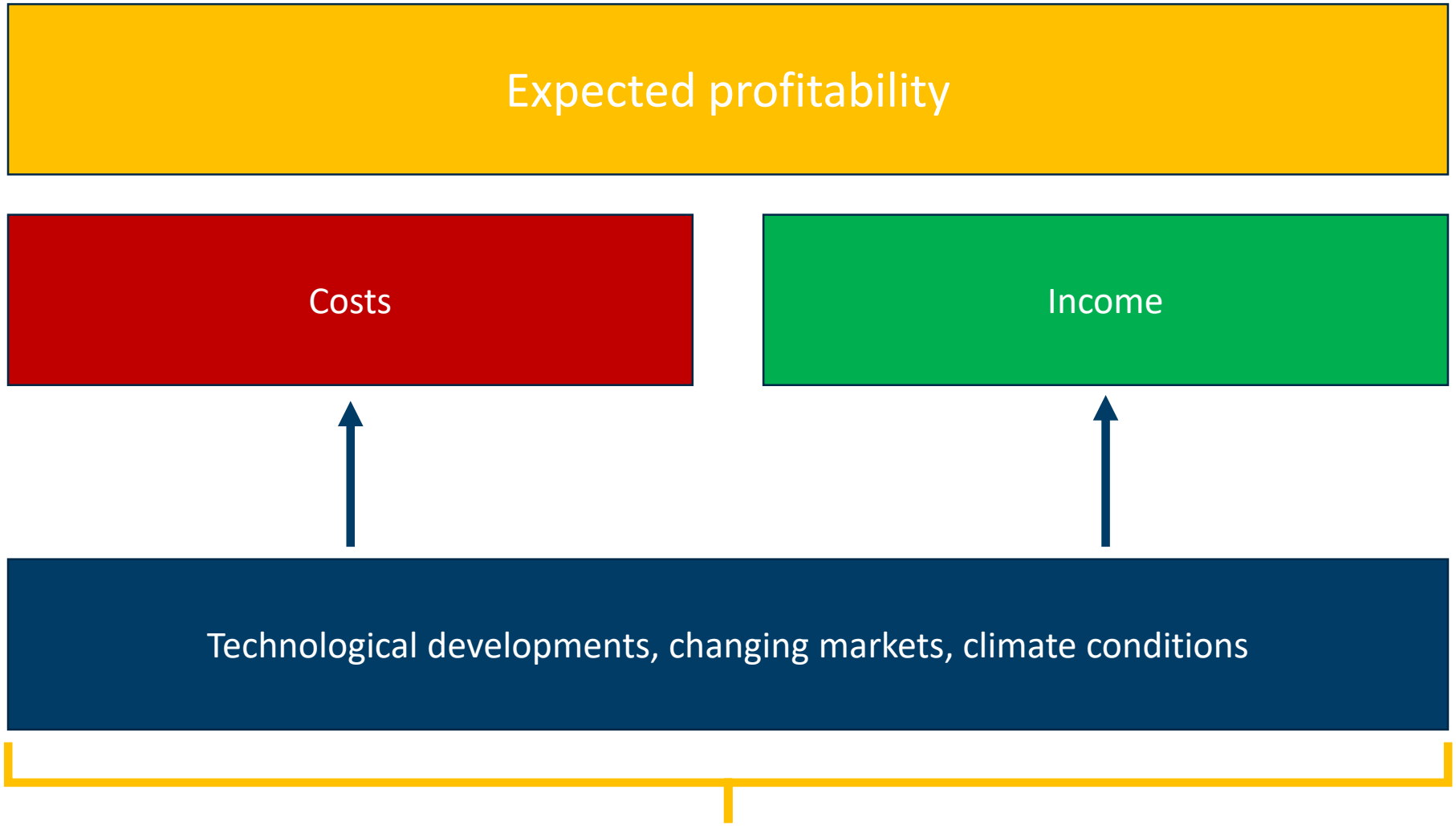
-> Higher variability

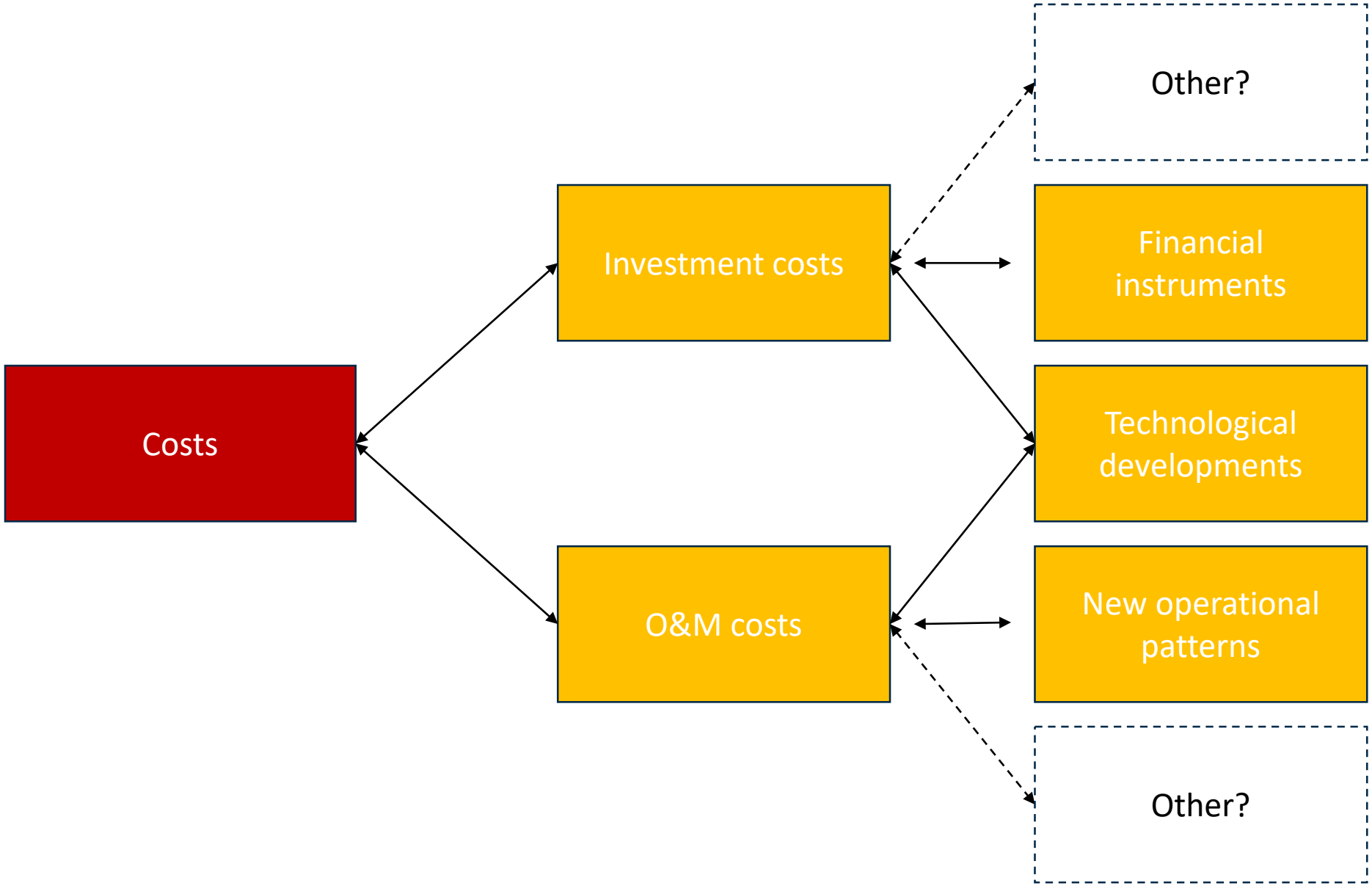
-> Higher uncertainty

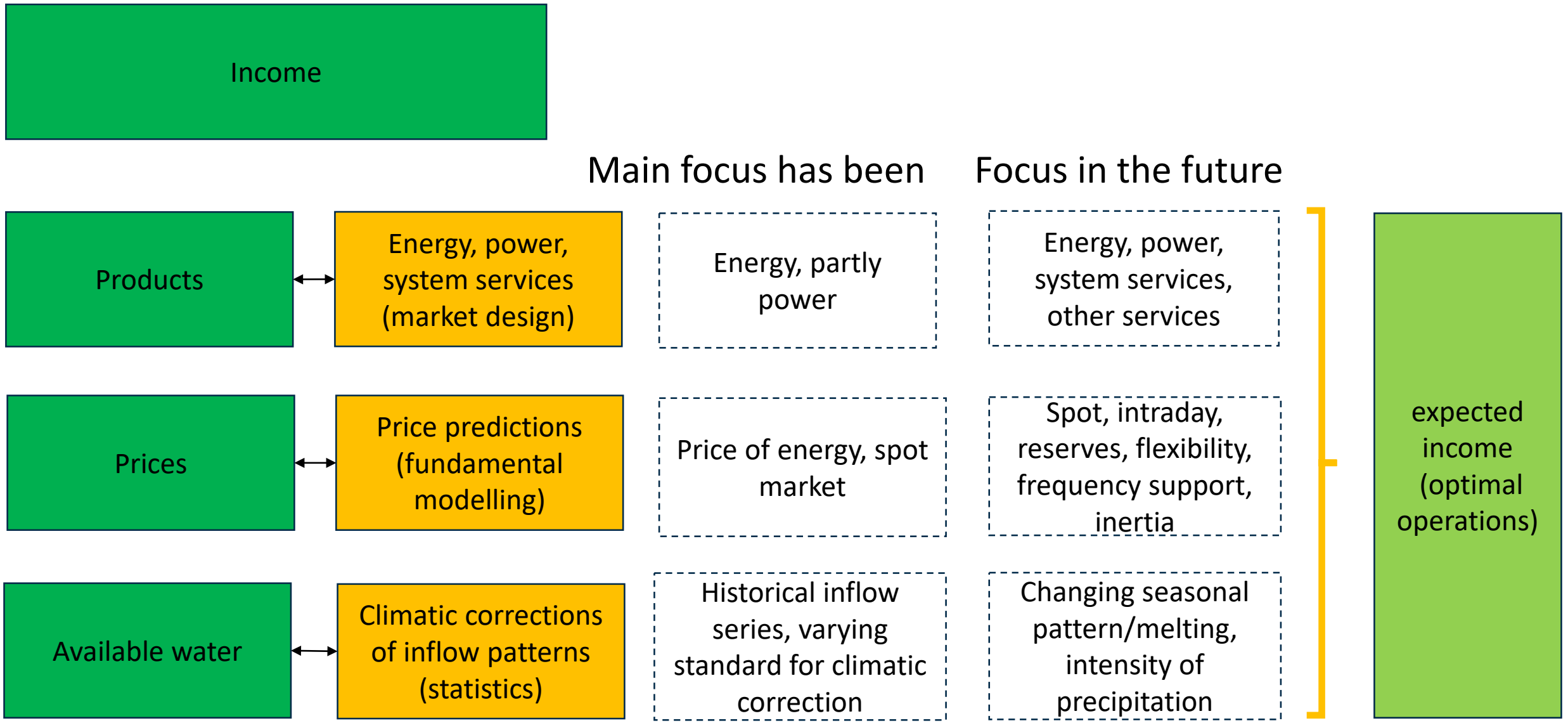
-> Higher value of adjusting generation to short-term variations

This will also unlock alternative (and new) flexibility sources that will reduce the variability

Implication:
Detailed operational modelling necessary to evaluate long-term decisions?


Expected profitability
Costs
Income
Technological developments, changing markets, climate conditions
Uncertainties / Opportunities


Costs
Investment costs
O&M costs
Other?
Financial instruments
Technological developments
New operational patterns
Other?


Income
Main focus has been
Focus in the future
Products
Energy, power, system services (market design)
Energy, partly power
Energy, power, system services, other services
Prices
Price predictions (fundamental modelling)
Price of energy, spot market
Spot, intraday, reserves, flexibility, frequency support, inertia
Available water
Climatic corrections of inflow patterns (statistics)
Historical inflow series, varying standard for climatic correction
Changing seasonal pattern/melting, intensity of precipitation
expected income (optimal operations)

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Massive amount of assumptions

Cannot predict the future, only simulate "potential futures"

Why use models?

- To analyse the price impact of ongoing and expected developments we can use fundamental modelling of supply and demand.
- A tool for testing out assumptions and scenarios for the future.
- More detailed operational models can be used to optimise operations considering the constraints in the system
- A correct evaluation of the need for flexibility and the system's potential to provide flexibility

Assumptions on Inflow patterns, climatic trends

Analyses to evaluate future income: 2030, 2040, 2050

Fundamental modelling of demand and supply

- Stochastic
- large scope
- aggregated regions
- 3h time intervals

Development of the energy system

Demand patterns, electrification?

Generation capacity, shares of wind and solar power?

New flexibility, batteries, demand response?

Fuel and CO2 prices?

Transmission grid?

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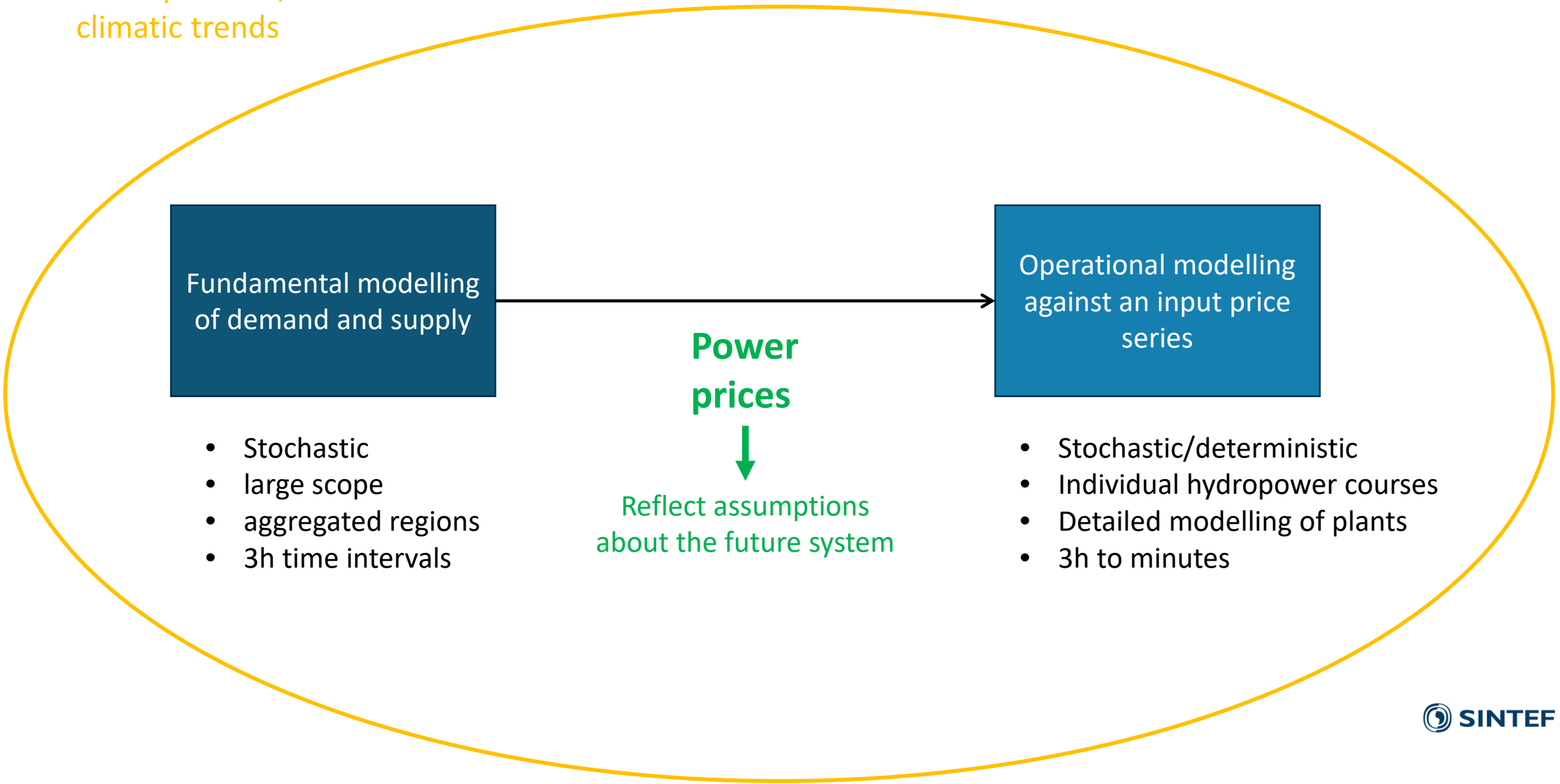
Assumptions on Inflow patterns, climatic trends

Analyses to evaluate future income: 2030, 2040, 2050



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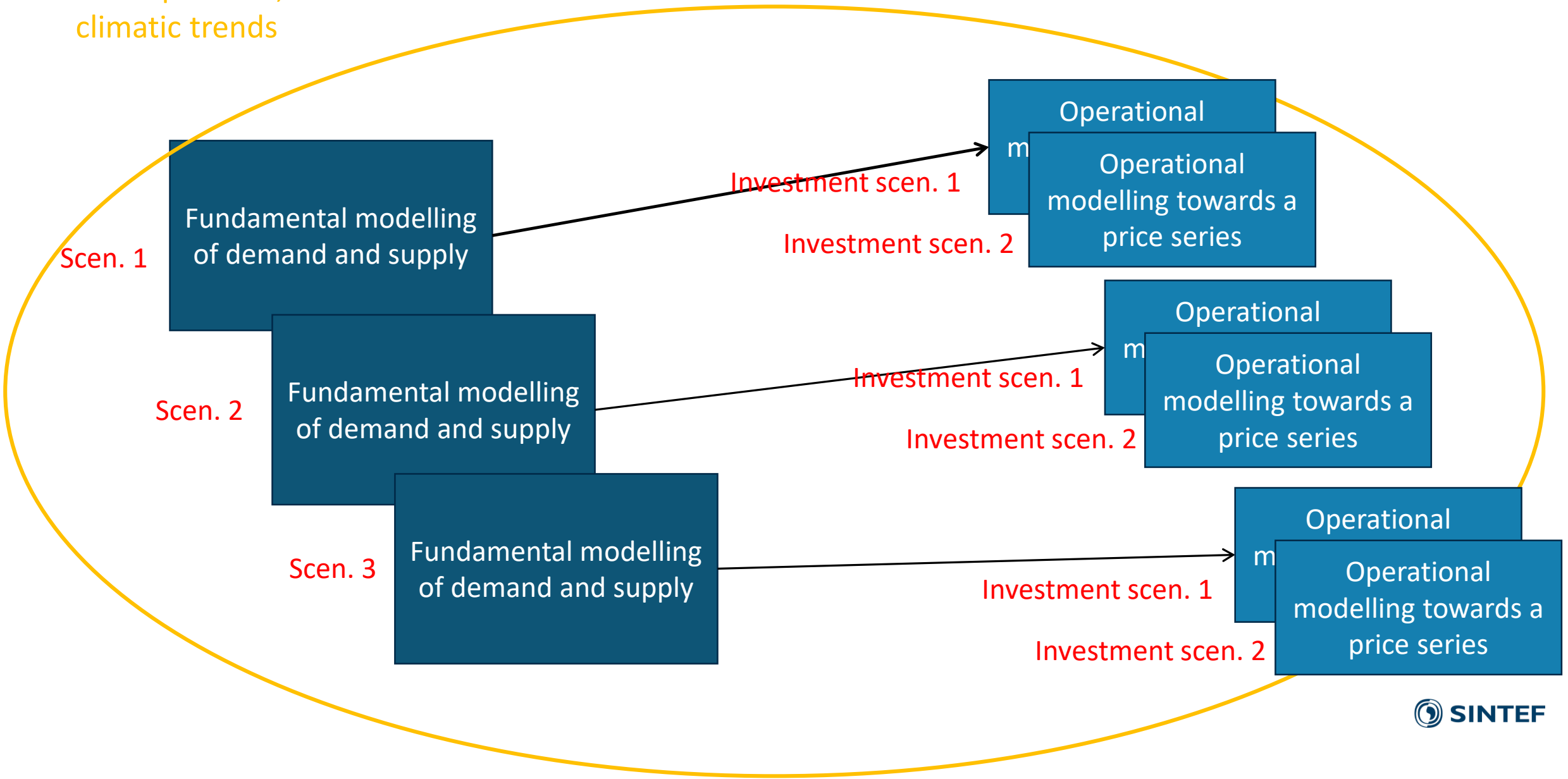
Assumptions on Inflow patterns, climatic trends

Analyses to evaluate future income: 2030, 2040, 2050



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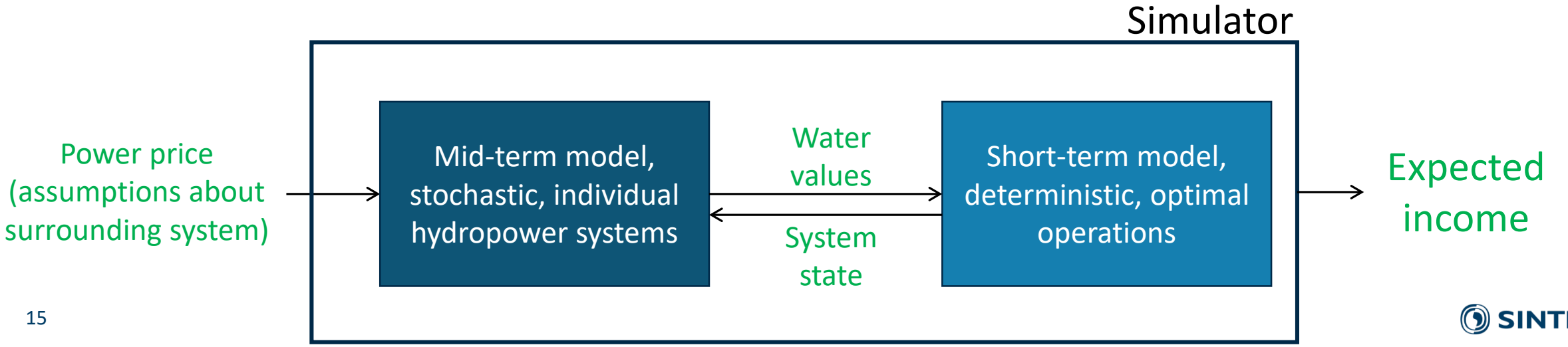
The Simulator Concept

Premise is to analyse profitability in future systems:

1. Good long-term strategy
2. Detailed description of short-term operation (physical system)
3. Balance between long-term strategy and short-term operation



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Conclusions

- Qualified assumptions are necessary → But are not predictions
- Modelling tools are useful → But never better than we make them
- Short-term variations increasingly important → But long-term assumptions also important
- Potential new products and markets → But best guess is to understand the needs
- There are also risks involved in not investing in new technology

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Technology for a better society