Uncertainty Classification for Strategic Energy Planning

Stefano Moret*,[a], Michel Bierlaire[b], François Maréchal[a]

[a] Industrial Process and Energy Systems Engineering, EPFL
[b] Transport and Mobility Laboratory, EPFL
* stefano.moret@epfl.ch

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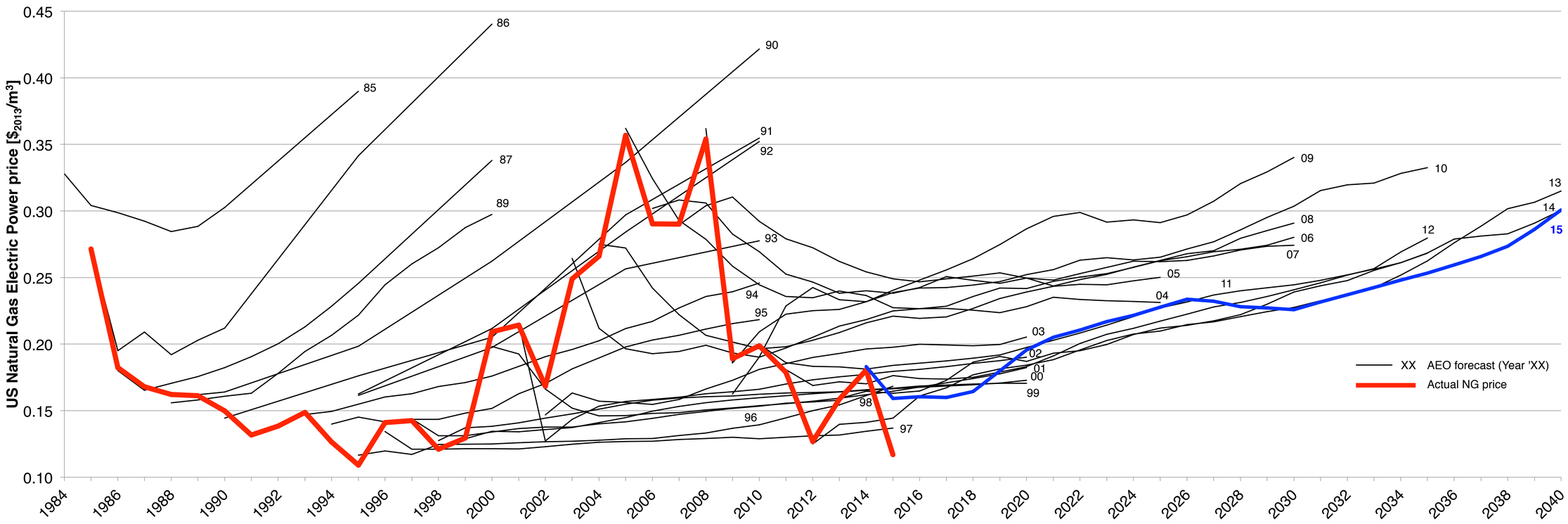
MOTIVATION & GOALS

Strategic Energy Planning
Large-scale: urban/national energy systems
Long time horizon: 20-50 years
Errors in **forecasts**

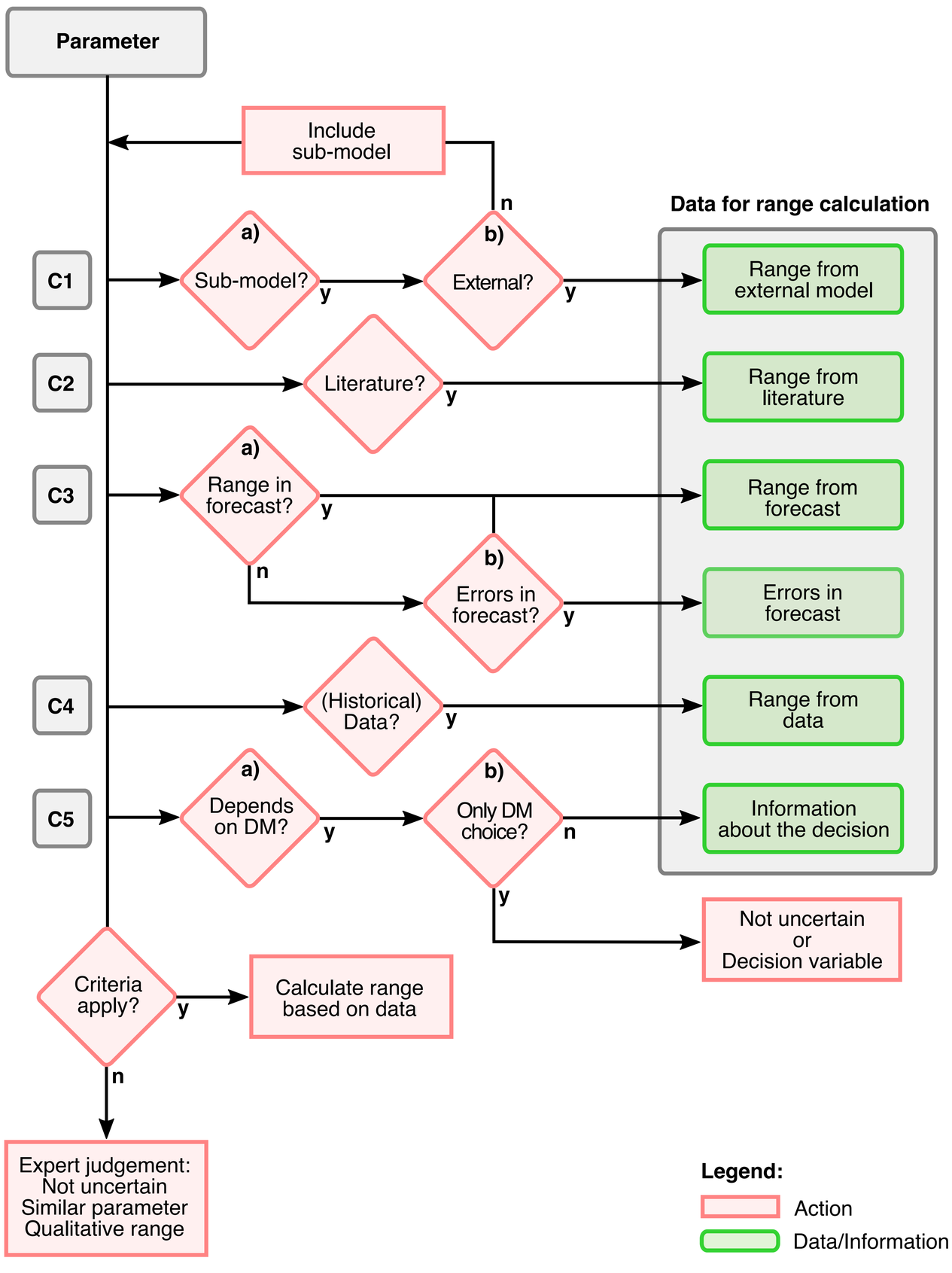
Quantifying Uncertainty

Uncertainty Classification
Definition of ranges of variation for uncertain parameters

Historical U.S. AEO Natural Gas for Electricity Production Price Forecast vs Actual Price[1]



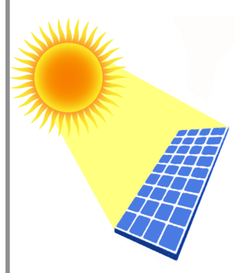
METHODOLOGY



APPLICATION

Model of the Swiss energy system to 2035[3]

c_p - PV capacity factor



C1b Sub-model: dependent on solar irradiation
C4 Range from irradiation historical data[4]

Proposed Range: [-11%,+8%]

c_{ng} – Natural Gas price

C2 Uncertainty > ± 0.087 $\$_{2013}/m^3$ [2]
C3a EU projections range: [-38%, +31%] [5]
C3a US EIA projections range: [-37%, +33%] [1]
C3b EIA errors in forecasts[1]:
average "worst-case" error: [-41%, +72%]
max errors: [-72%, +182%]

Proposed Range: [-41%, +72%]

CONCLUSIONS

- Methodology for uncertainty classification in strategic energy planning
- Application to example parameters

Future work:

- Application to typical strategic energy planning problem
- General classification → pre-screening
- Link to optimization under uncertainty applications

References

[1] U.S. EIA - Energy Information Administration.
[2] R. Wiser and M. Bolinger. An Overview of Alternative Fossil Price and Carbon Regulation Scenarios. LBNL-56403. 2004
[3] V. Codina Gironès et al., Strategic energy planning for large-scale energy systems: A modelling framework to aid decision-making. Energy, 2015.
[4] World Radiation Monitoring Center – Baseline Surface Radiation Network (BSRN). (data elaborated by A. Wallerand, EPFL)
[5] European Commission, Energy Roadmap 2050, Impact assessment and scenario analysis, 2011.