Intelligent Power System Solutions: Towards interactive planning framework

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Outline

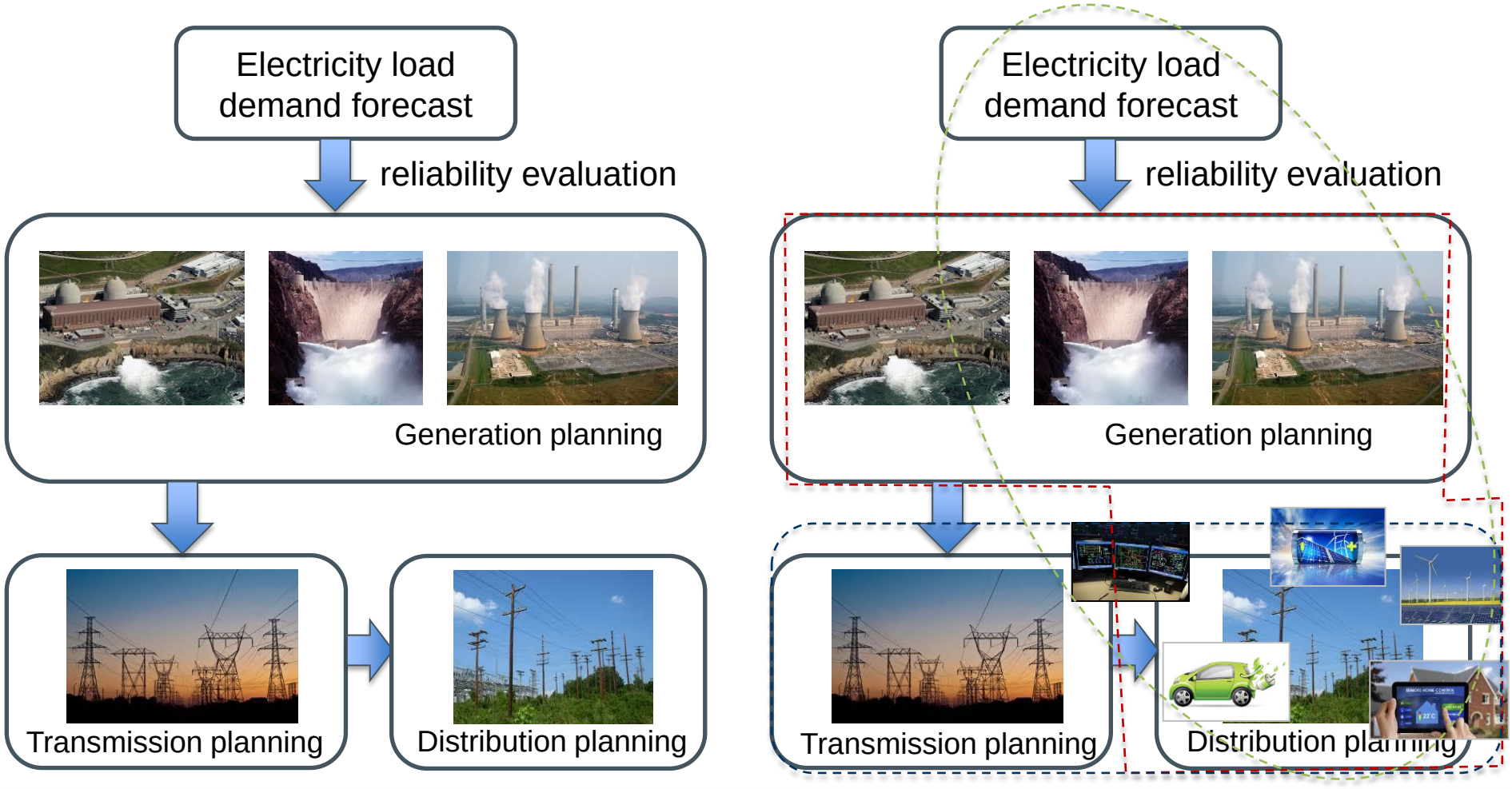
- Motivation
- Traditional vs. future planning
- Interactive planning framework
- Summary

Motivation

- Systematic comparison of candidate technologies for the changing electrical energy industry

- It is insufficient to invest into given technology without accessing its cumulative operational effects (efficiency, reliability and environmental impact)

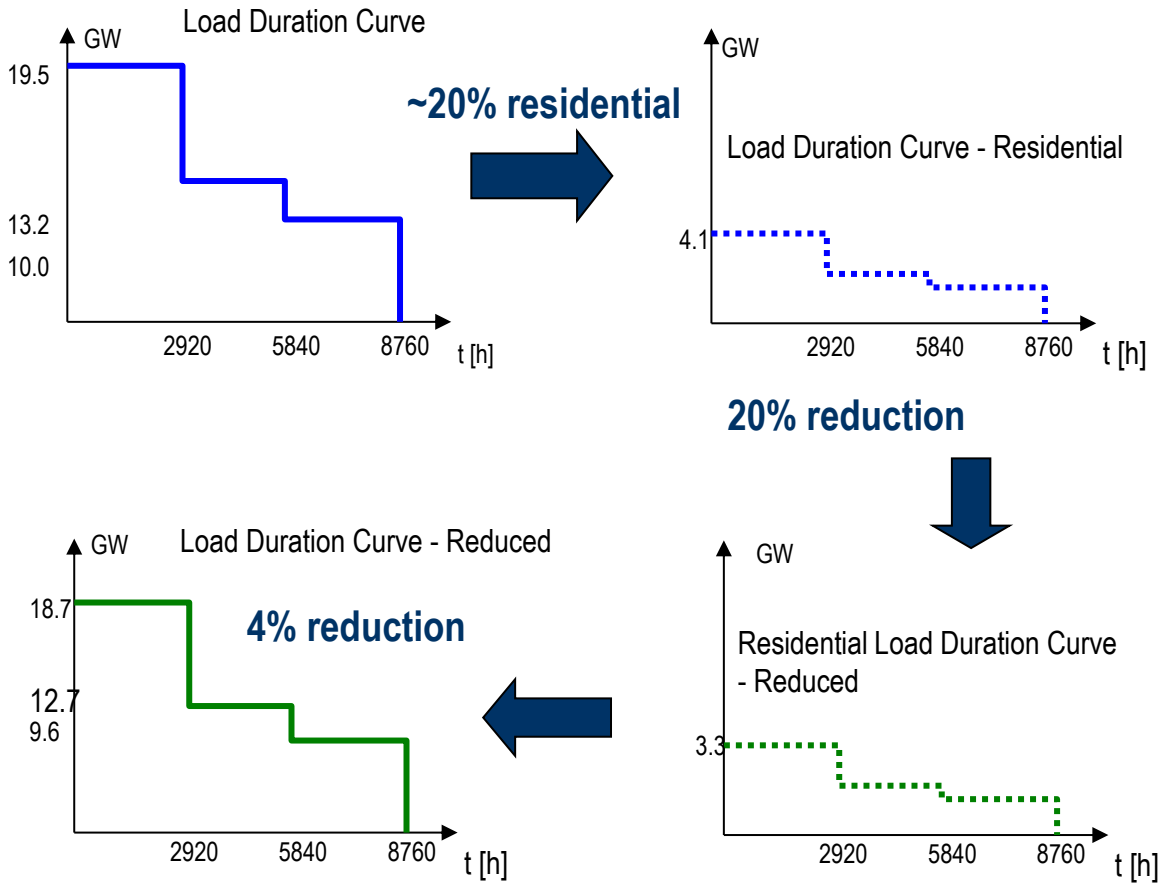
Traditional planning vs. future planning



Key planning concepts

- Inter-spatial coordination between the generation, transmission, distribution and the end users - distribute spatially dispersed consumer needs throughout the rest of the system
- Inter-temporal coordination - coordinate costs over different time scale
- Inter-contextual coordination - define who is optimizing at which level and what the objectives are

Inter-spatial coordination



Assumptions:

Average residential consumption
934 kWh per month

Insulation cost
$2,500 per households

2,339,743 household

$5.85e9 Capital Cost

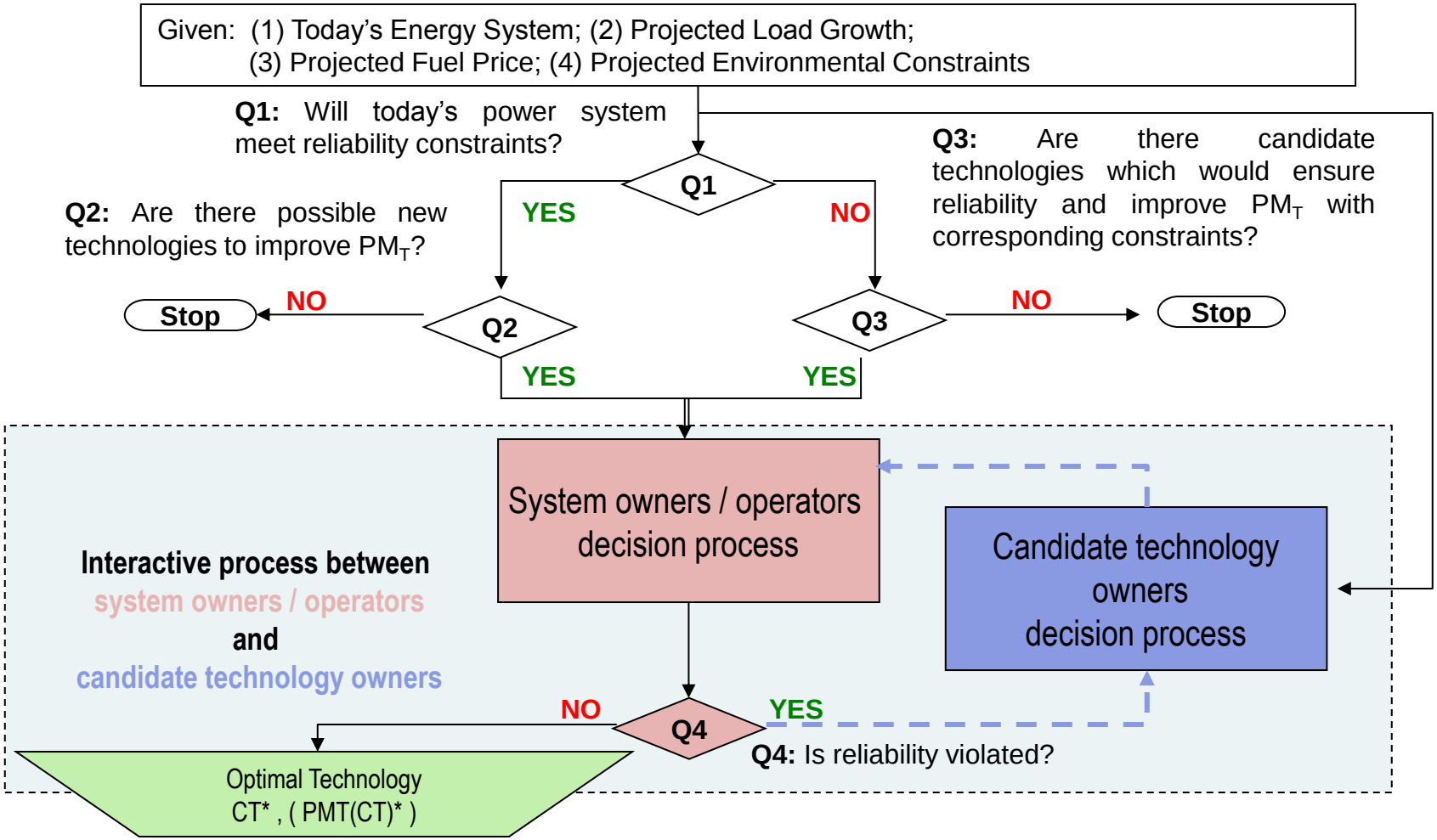
815 MW Reduction

Average residential consumption
1000 kWh per month

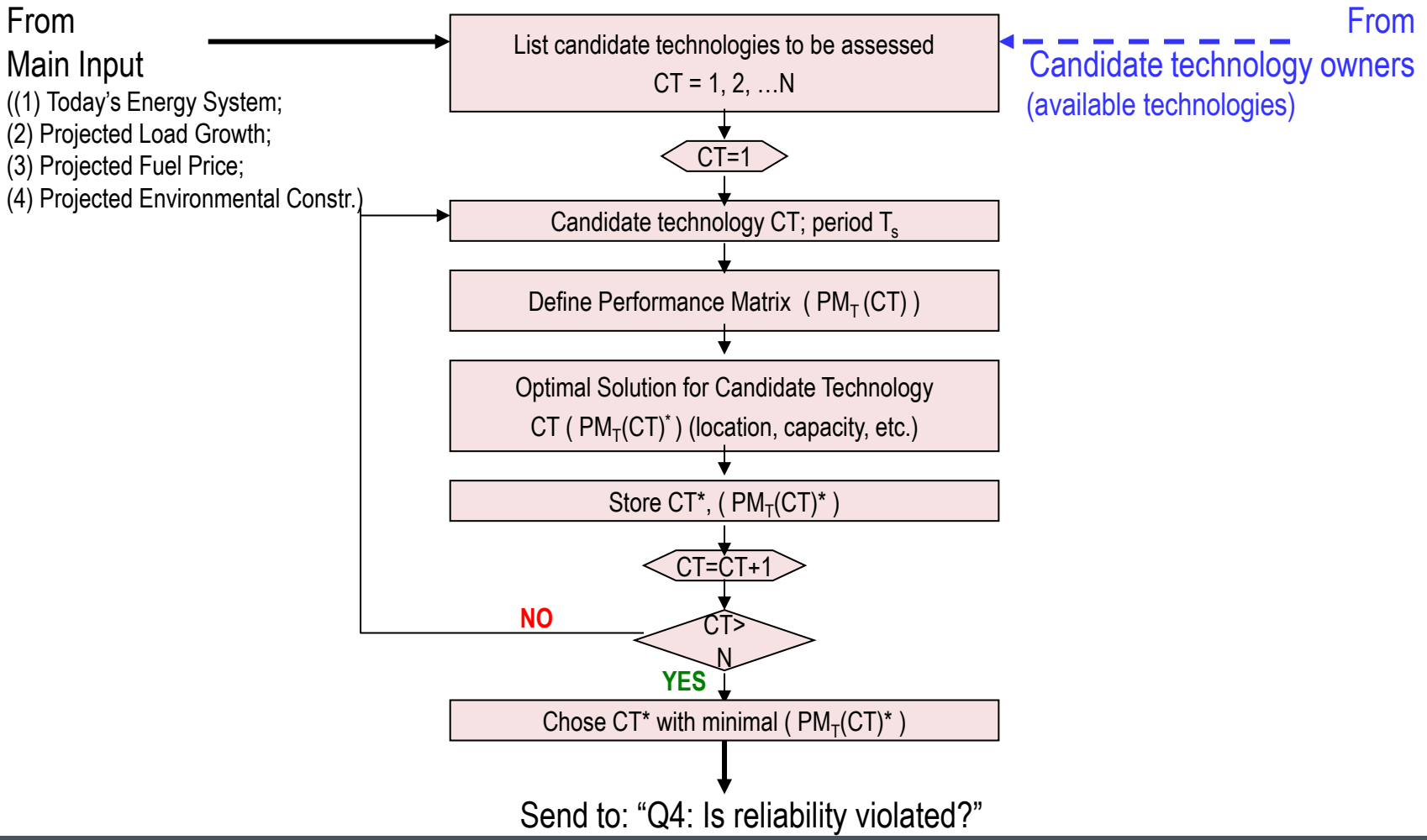
2, 186,800 household

$5.47e9 Capital Cost

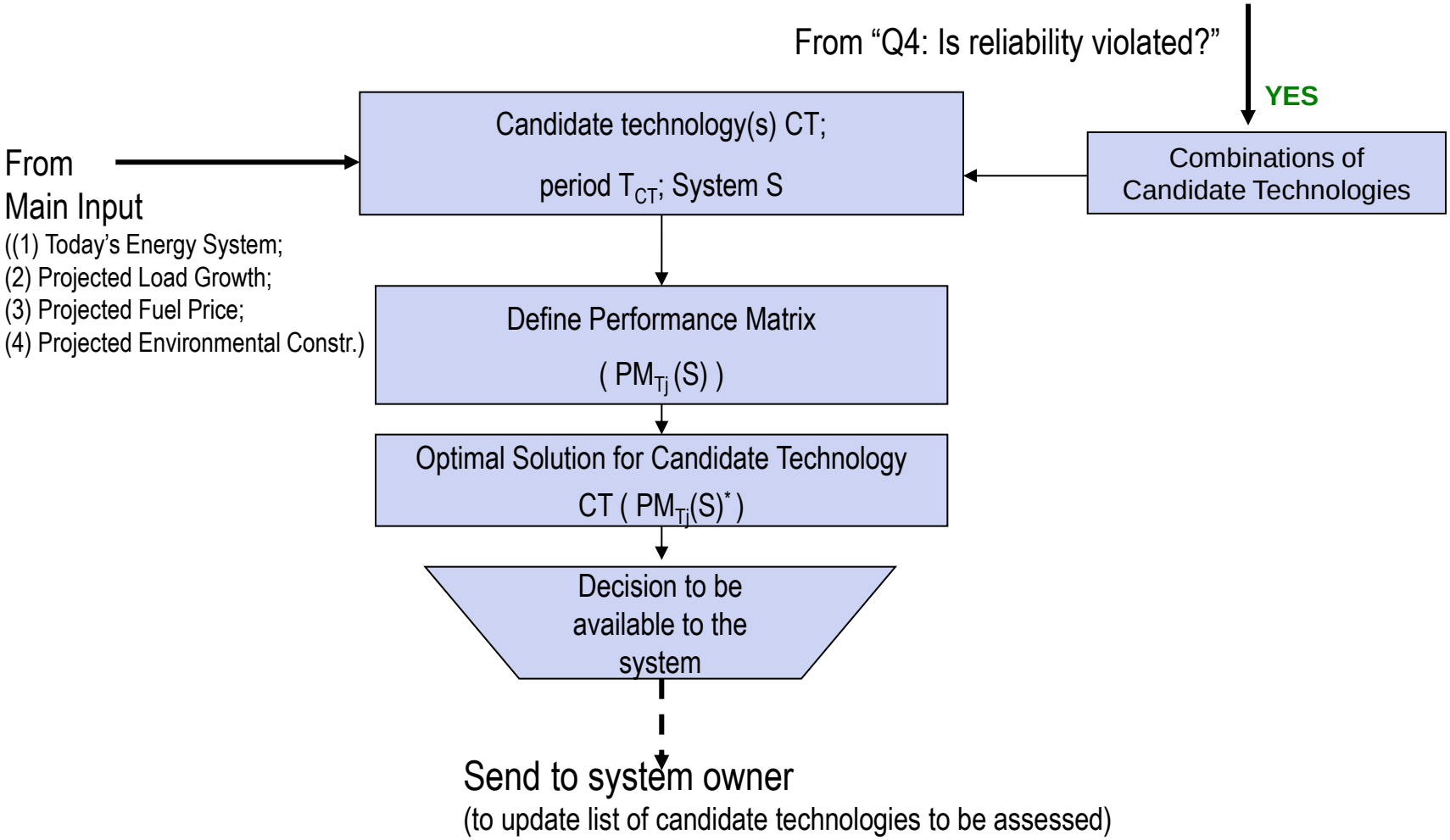
Interactive planning framework



IPF: system operator decision process



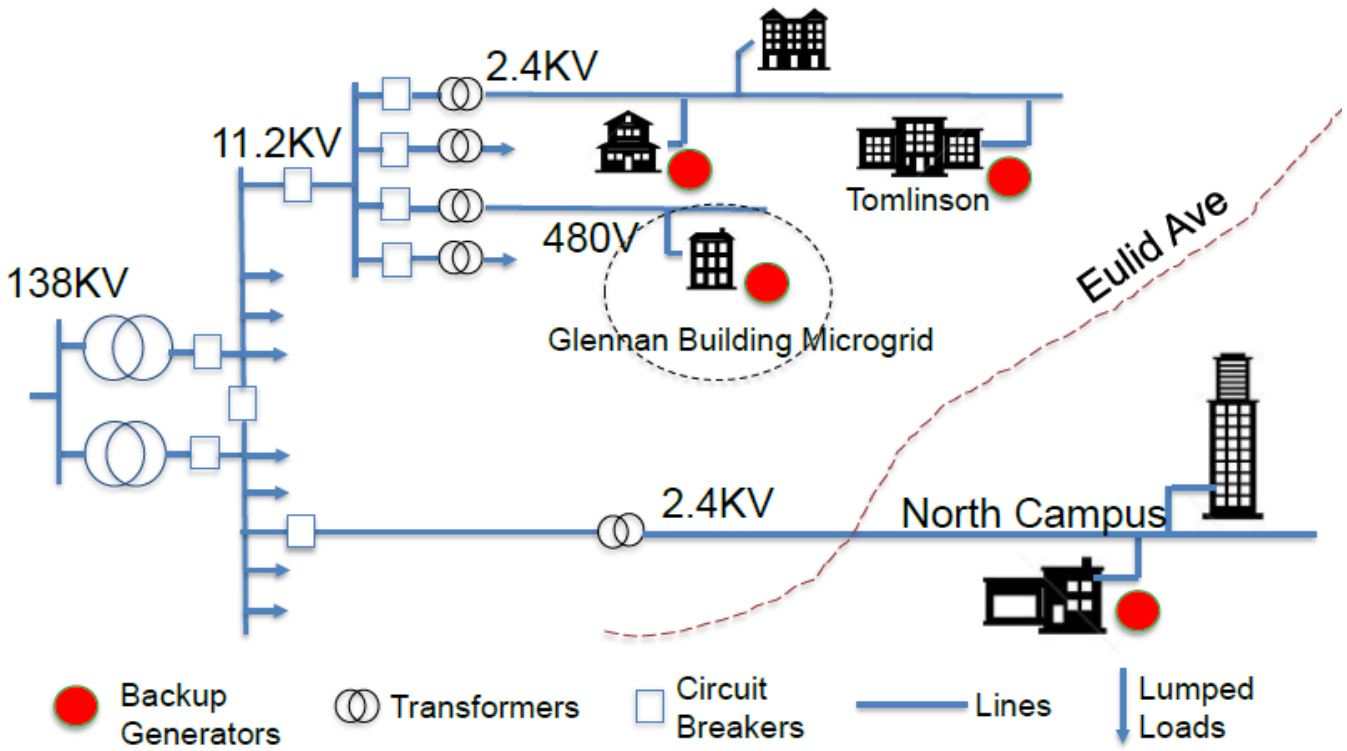
IPF: candidate technology owner decision process



Future work

- Who is optimizing, what and at which level?
- What are the objectives?
- What is the minimum set of information to support proposed algorithm?

CWRU campus grid



100 kW wind

60 kW solar

Jointly owned and managed by Medical Center Company (MCCo) and CWRU facilities department

Summary

- Traditional planning, using only centralized power plant, will soon become obsolete as the new distributed energy resources become readily available
- Different entities need to be inter-contextually, inter-temporally and inter-spatially coordinated to enable maximum system performance
- In order to reconcile the distributed sub-objectives of different decision makers with system-wide sustainability objectives, a new concept of distributed interactive planning is proposed
- The proposed framework enables for the best technology to be selected and reduces a risk in the long-term planning

Questions?