Long Range Transmission Planning - Preparing for the Evolving Future Grid
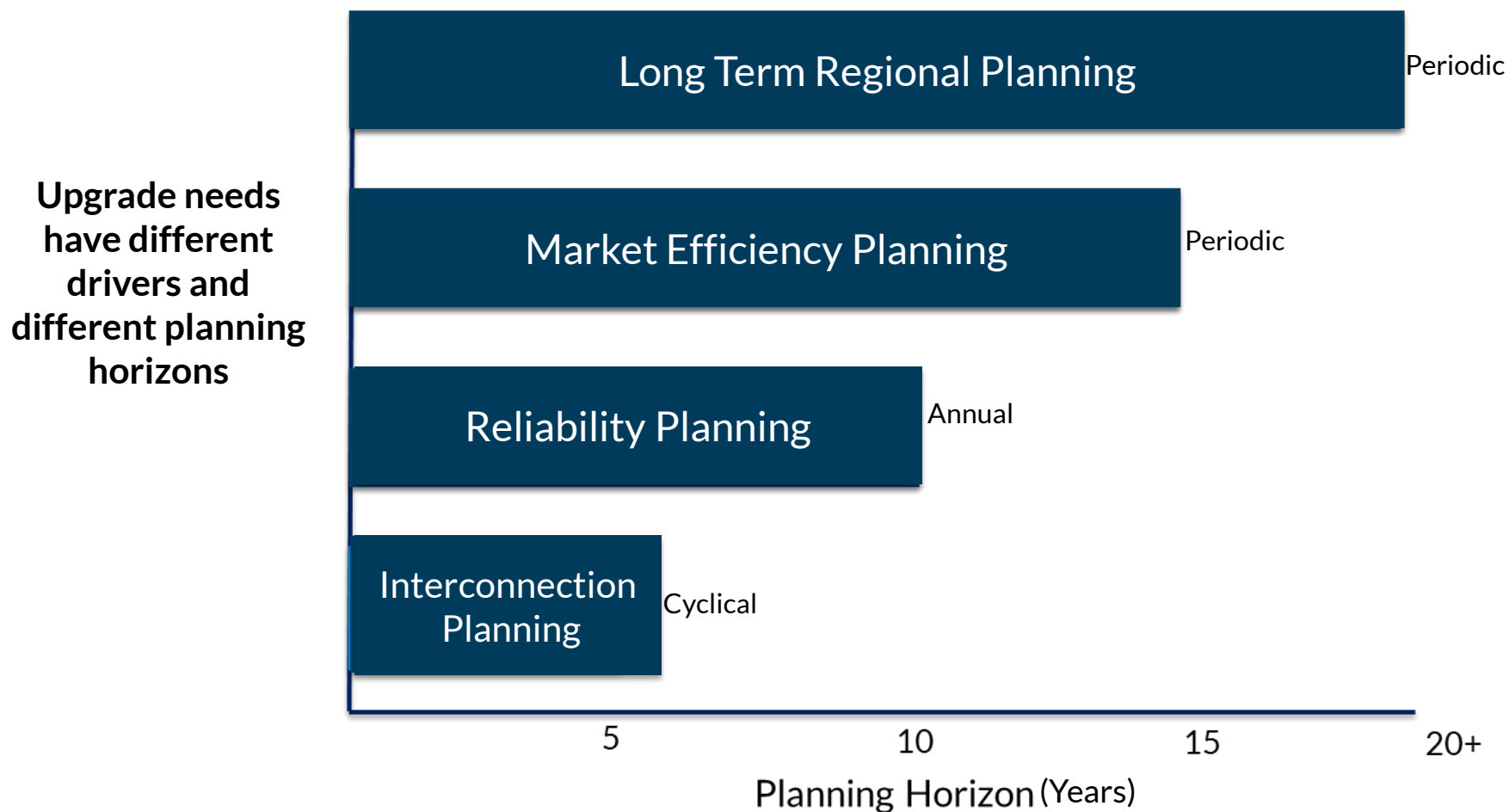
Planning Advisory Committee
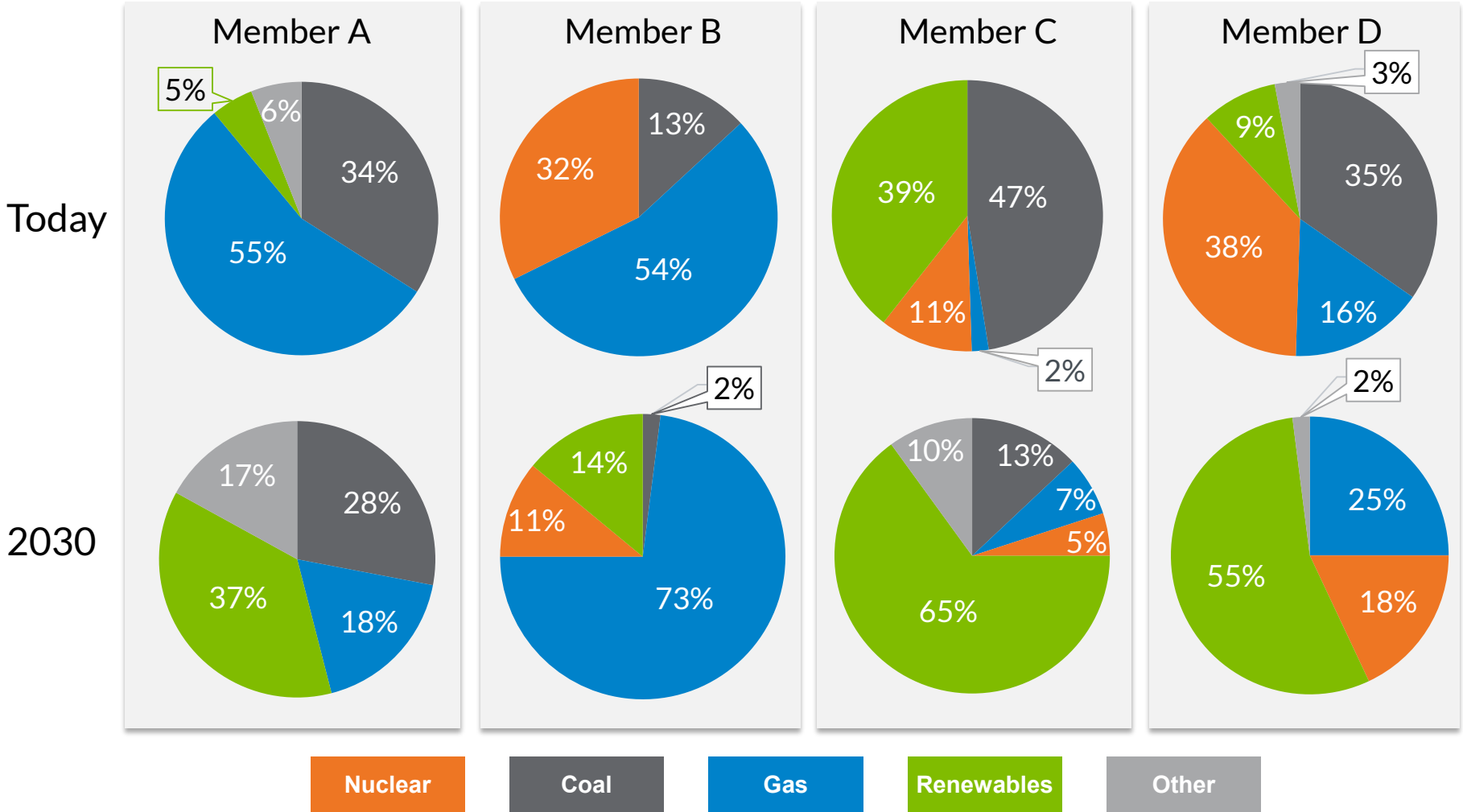
August 2020

Executive Summary

- Industry trends are driving MISO members to make significant changes to their portfolios including retirements of aging units and integration of increased levels of renewables

- MISO must focus now on solutions that anticipate and adapt to those rapid changes

- Long Range Transmission Planning is necessary to ensure a reliable and efficient regional and interregional transmission system that enables the changing portfolio across the near and long term

- MISO plans to be creative in identifying transmission planning / interconnection solutions that can more holistically address emerging regional needs

Transmission planning provides a comprehensive approach that covers short and long term needs to address generation additions, ongoing reliability, market efficiency and policy trends

Upgrade needs have different drivers and different planning horizons

Long Term Regional Planning	Periodic
Market Efficiency Planning	Periodic
Reliability Planning	Annual
Interconnection Planning	Cyclical

Planning Horizon (Years)

5   10   15   20+

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Member plans project a significant portfolio shift; differences across individual member portfolios present additional challenges and opportunities

Member A

Today
- Coal: 34%
- Gas: 55%
- Renewables: 5%
- Other: 6%

2030
- Coal: 28%
- Gas: 18%
- Renewables: 37%
- Other: 17%

Member B

Today
- Coal: 13%
- Gas: 54%
- Nuclear: 32%

2030
- Coal: 2%
- Gas: 73%
- Nuclear: 11%
- Renewables: 14%

Member C

Today
- Coal: 47%
- Gas: 2%
- Nuclear: 11%
- Renewables: 39%

2030
- Coal: 13%
- Gas: 7%
- Nuclear: 5%
- Renewables: 65%
- Other: 10%

Member D

Today
- Coal: 35%
- Gas: 16%
- Nuclear: 38%
- Renewables: 9%
- Other: 3%

2030
- Gas: 25%
- Nuclear: 18%
- Renewables: 55%
- Other: 2%

Legend: Nuclear · Coal · Gas · Renewables · Other

These figures show utilities' total energy generated by fuel type, in megawatt-hours. Current figures compiled by S&P Global Market Intelligence. 2030 projections compiled from IRPs, investor reports, and other sources.
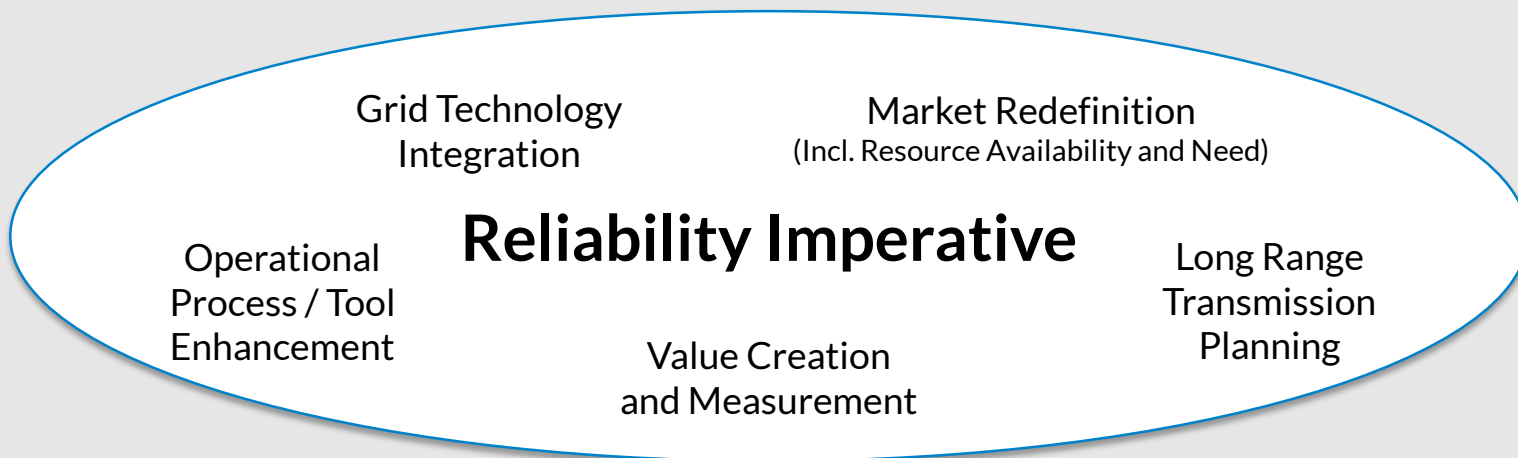
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MISO's Regional Reliability Imperative will help ensure ongoing, efficient reliability as members evolve their resource fleets

Members' resource fleets have changed and will continue to change at an accelerated rate.

The fleet changes are resulting in substantially more grid diversity and volatility.

MISO is actively pursuing multiple workstreams to ensure on-going reliability and value creation. This requires visibility of the volatility, the availability of flexible resources and the ability to both manage and move those resources to where they are needed.

Grid Technology Integration

Market Redefinition
(Incl. Resource Availability and Need)

Reliability Imperative

Operational Process / Tool Enhancement

Long Range Transmission Planning

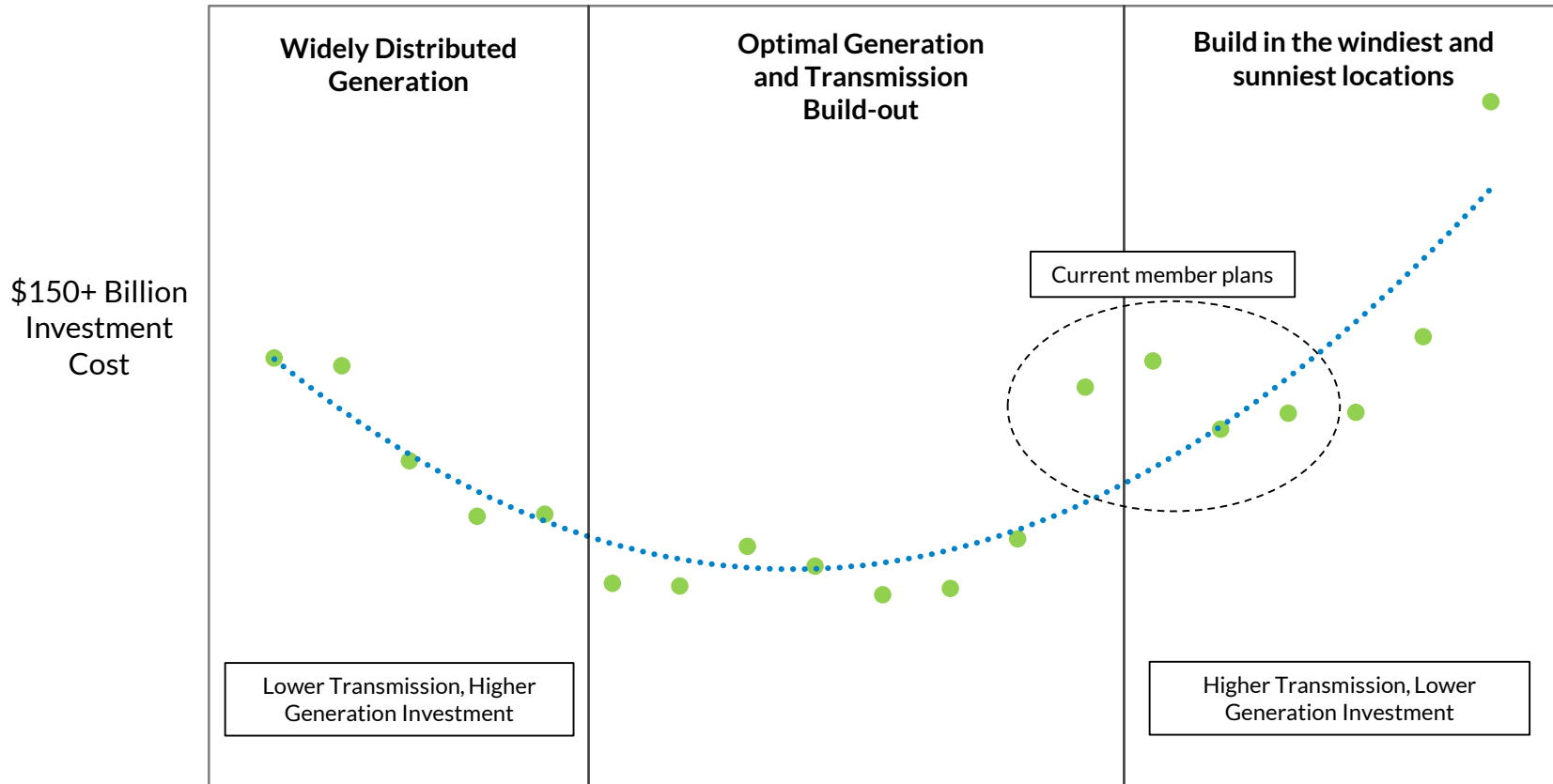Value Creation and Measurement

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Work to-date indicates expected portfolio changes will cause significant grid and stability issues requiring increased transmission investment
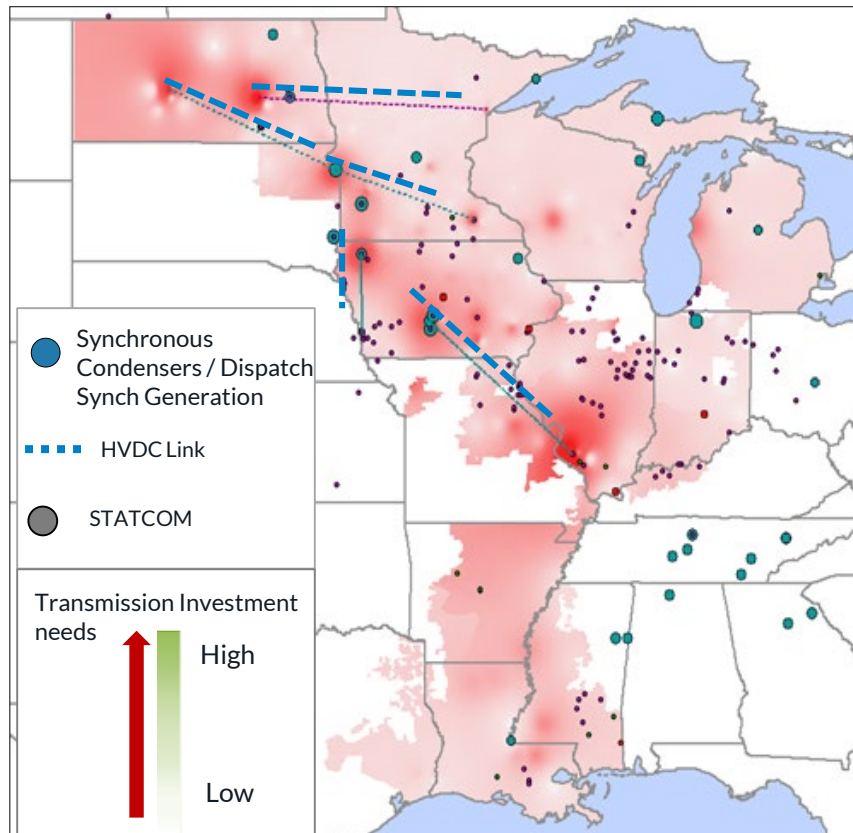
- Issues are driven by reduction in conventional generation and the increase in inverter based (i.e. wind/solar/battery) generation

- Regional energy transfer increases in magnitude and becomes more variable leading to a need for increased extra high-voltage line thermal capabilities

- Increase in renewable penetration causes different dispatch patterns of conventional generators, leading to several dynamic issues

- Power delivery from weaker areas may need transmission technologies equipped with dynamic-support capabilities

Transmission needs, overall transmission costs and generation costs can change based on where renewables are sourced, but planned generation costs will far outweigh transmission costs in any case

Total MISO Projected Generation and Transmission Cost

$150+ Billion Investment Cost

Widely Distributed Generation

Optimal Generation and Transmission Build-out

Build in the windiest and sunniest locations

Current member plans

Lower Transmission, Higher Generation Investment

Higher Transmission, Lower Generation Investment

There are conditions precedent for longer-term transmission plans to be approved and successfully developed

Policy Consensus

Consensus that transmission is required to address the subregional and collective needs of the footprint

Robust Business Case

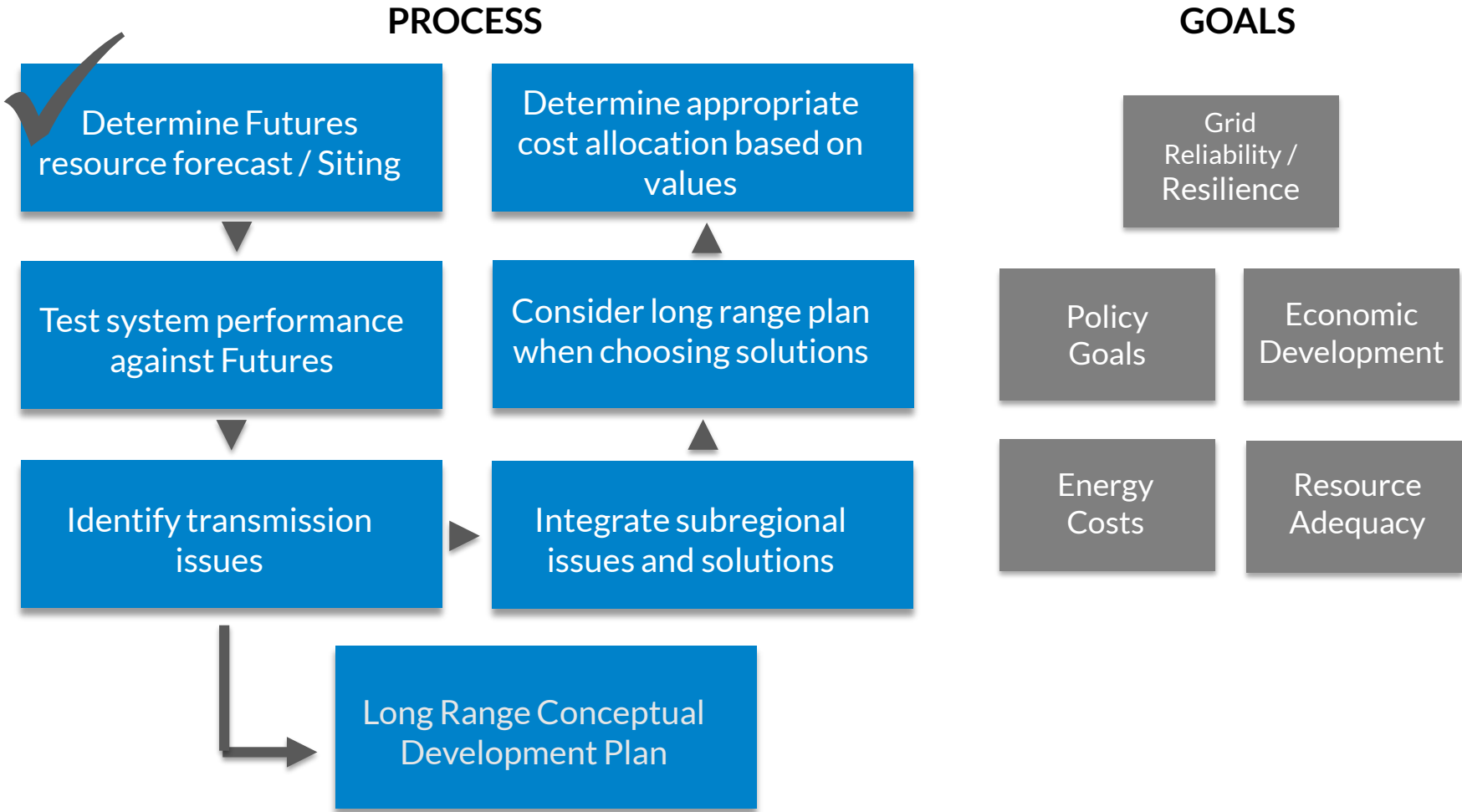Analysis of subregional issues and solutions compatible with regional reliability and market operations needs
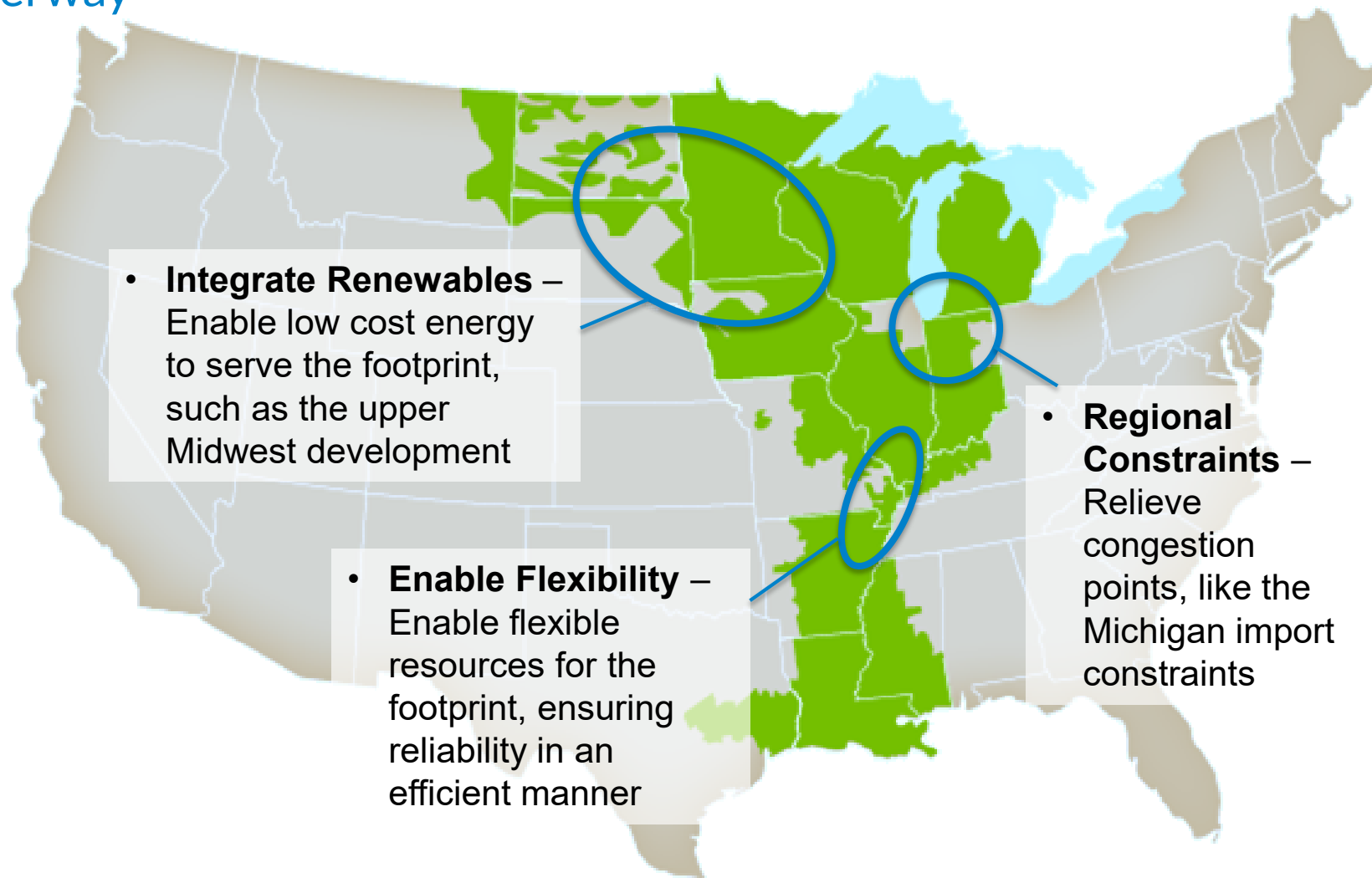
Cost Allocation & Recovery

Costs assigned roughly commensurate with benefits to each area

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Long Range Planning identifies grid needs based upon Futures, is multi-step, and considers subregional needs and solutions

PROCESS

Determine Futures resource forecast / Siting

Test system performance against Futures

Identify transmission issues

Long Range Conceptual Development Plan

Integrate subregional issues and solutions

Consider long range plan when choosing solutions

Determine appropriate cost allocation based on values

GOALS

Grid Reliability / Resilience

Policy Goals

Economic Development

Energy Costs

Resource Adequacy

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Long Range Transmission Planning will solve multiple problems in a cost-efficient manner; some of the subregional work is already underway

- **Integrate Renewables** – Enable low cost energy to serve the footprint, such as the upper Midwest development

- **Enable Flexibility** – Enable flexible resources for the footprint, ensuring reliability in an efficient manner

- **Regional Constraints** – Relieve congestion points, like the Michigan import constraints

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The Long Range Planning Process will continue in an iterative fashion, with logical groupings of transmission projects coming forward over multiple MTEP cycles

| Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |

Futures Complete

Model Development

Analyses:
Continue Issue identification by each subregion

Initial Recommend-ations

MTEP 21

Solution development and testing

Evaluation of benefits and cost allocation options
reliability, access value, production cost, other

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Questions