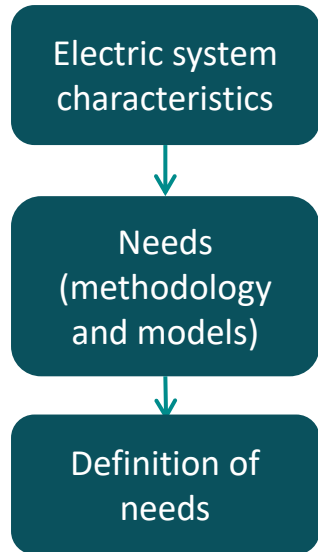


# GRID PLANNING - NEEDS AND SOLUTIONS

Separation of system needs and solutions for technology neutral and socio-economic efficient solutions

Assumptions for energy system development, Danish Energy Agency (2050, annually)

## NEEDS (SoS criteria)



## SOLUTIONS (cost effective)



*Only to be used by emergency situations or no bids on markets*

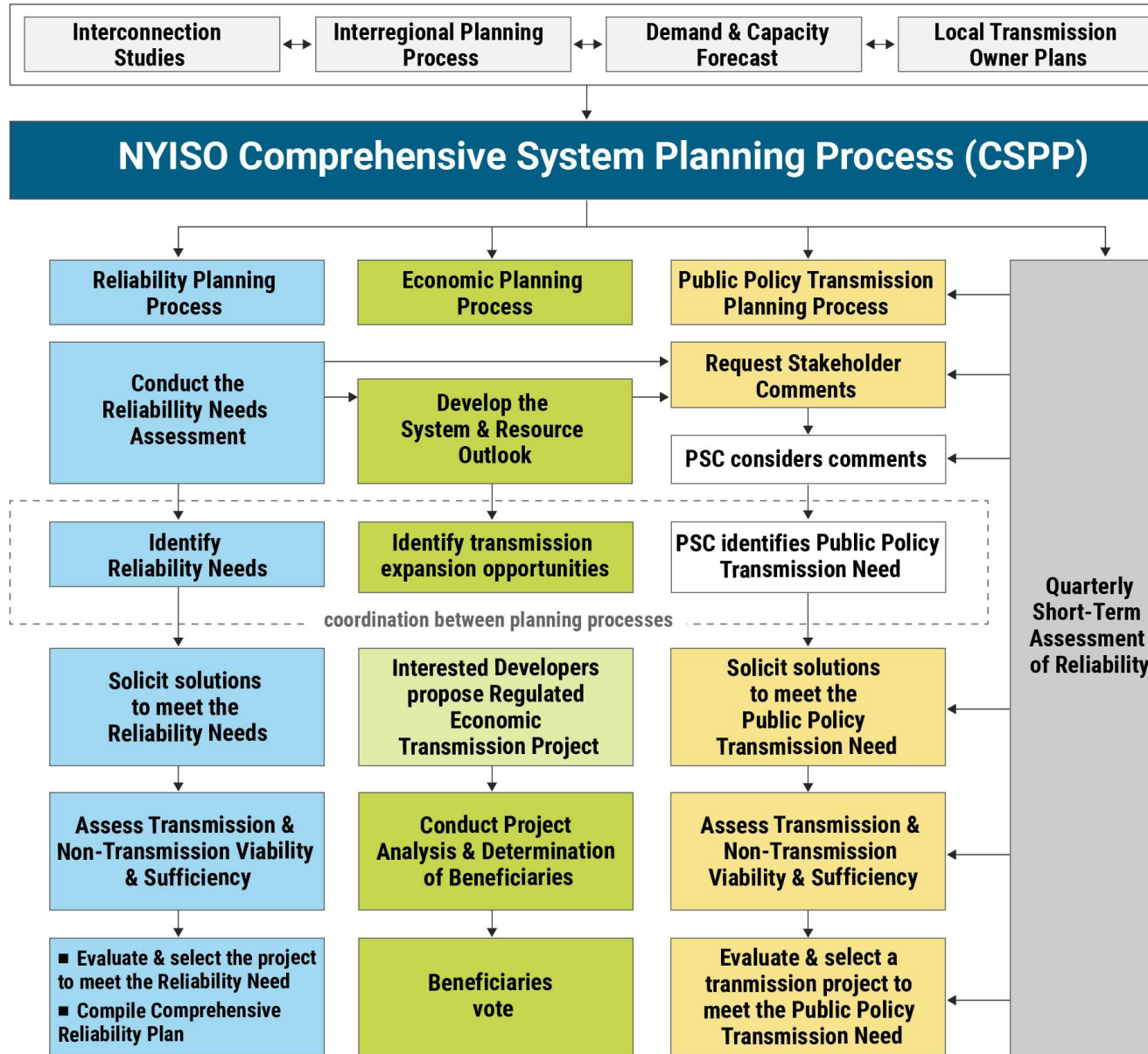
## Challenges (examples)

- How to define requirements?
- Only apply for new connections?
- DSO: complex regulation
- Cross border TSO: establish cooperation and regulatory approval
- Integrate in grid, system planning and models
- Establish/change control systems to manage components (SynCon, HVDC, SVC, STATCOM)
- Fulfill conditions for efficient market: competition, liquidity and reliability
- Intermediate solution

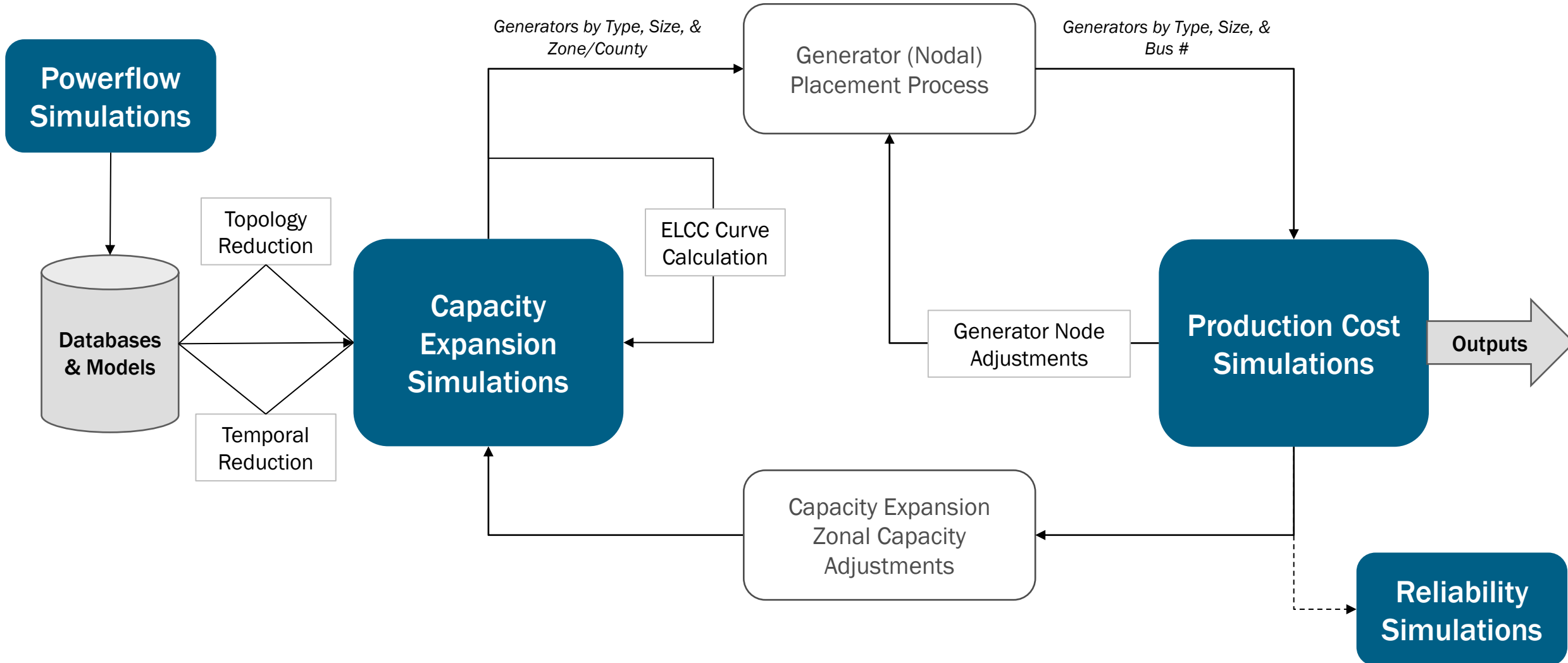
## TSO ANALYSIS (not exhaustive)

- Long term development plan (to 2050, bi-annual)
- Security of supply analysis (10 years, annually)
- Ancillary service outlook (10 years annually)
- Grid plan, 10 years, (bi-annually/annually)
- *IT-OT/system strategy*
- *System strength strategy*
- *Nordic/European coordination*
- *Grid technology strategy*

Business cases (socio economic)

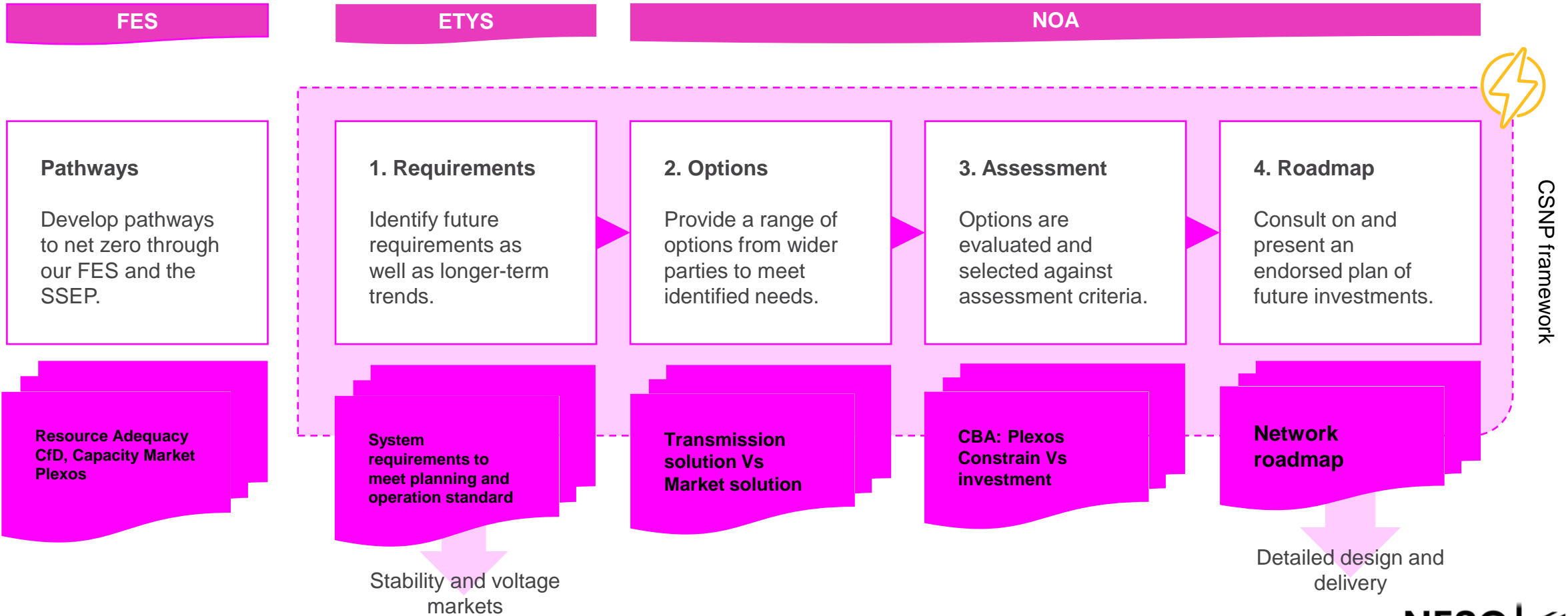


# Planning Simulation Framework



# GB Transmission Investment Planning

What are the steps of our current transmission network planning approach?



# SPP TRANSMISSION EXPANSION PLANNING (STEP)

## Regional Planning

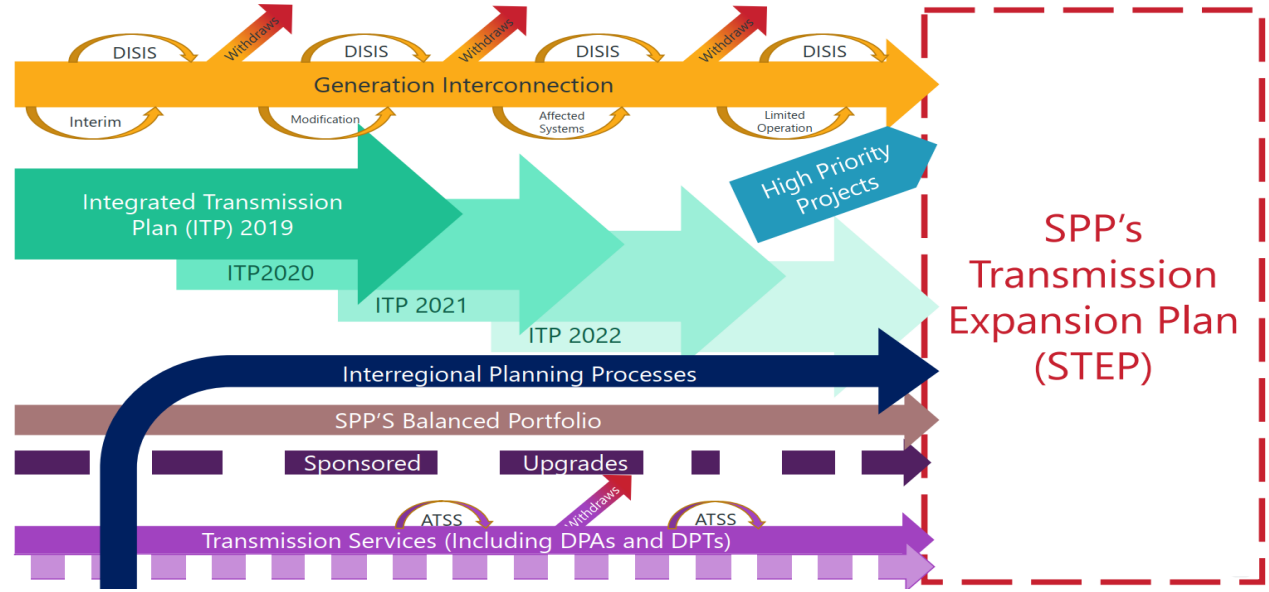
- Integrated Transmission Planning (ITP)
- Compliance, Reliability, Economic, Scenario Planning
- High Priority Studies

## Interregional Planning

## Generator Interconnection

## Load Interconnection

## Transmission Services



## ITP Assessment

- Study scope, including futures, resiliency scenarios, and other study assumptions
- Powerflow and economic model build

Scoping and Model Build

Assessments

- Constraint Assessment
- Transmission Needs Assessments (reliability, economic, operational, and public policy)
- Target Areas, Resiliency

- Stakeholder Detailed Project Proposal (DPP) Submission Window
- Solution Evaluation/Selection
- Portfolio Development

Transmission Portfolio Development

Reporting and Final Assessments

- Benefit Metrics
- Customer Rate Impacts
- Final Reliability Assessment

## Benefit Metrics

- Adjusted Production Cost
- Reduction of Emission Rates and Values
- Savings due to Lower Ancillary Service Needs and Production Costs
- Capacity Cost Savings due to Reduced On-Peak Transmission Losses
- Avoided or Delayed Reliability Projects
- Assumed Benefit of Mandated Reliability Projects
- Mitigation of Transmission Outage Costs
- Marginal Energy Losses
- Increased Wheeling Through and Out Revenues
- Benefit of Meeting Public Policy Goals