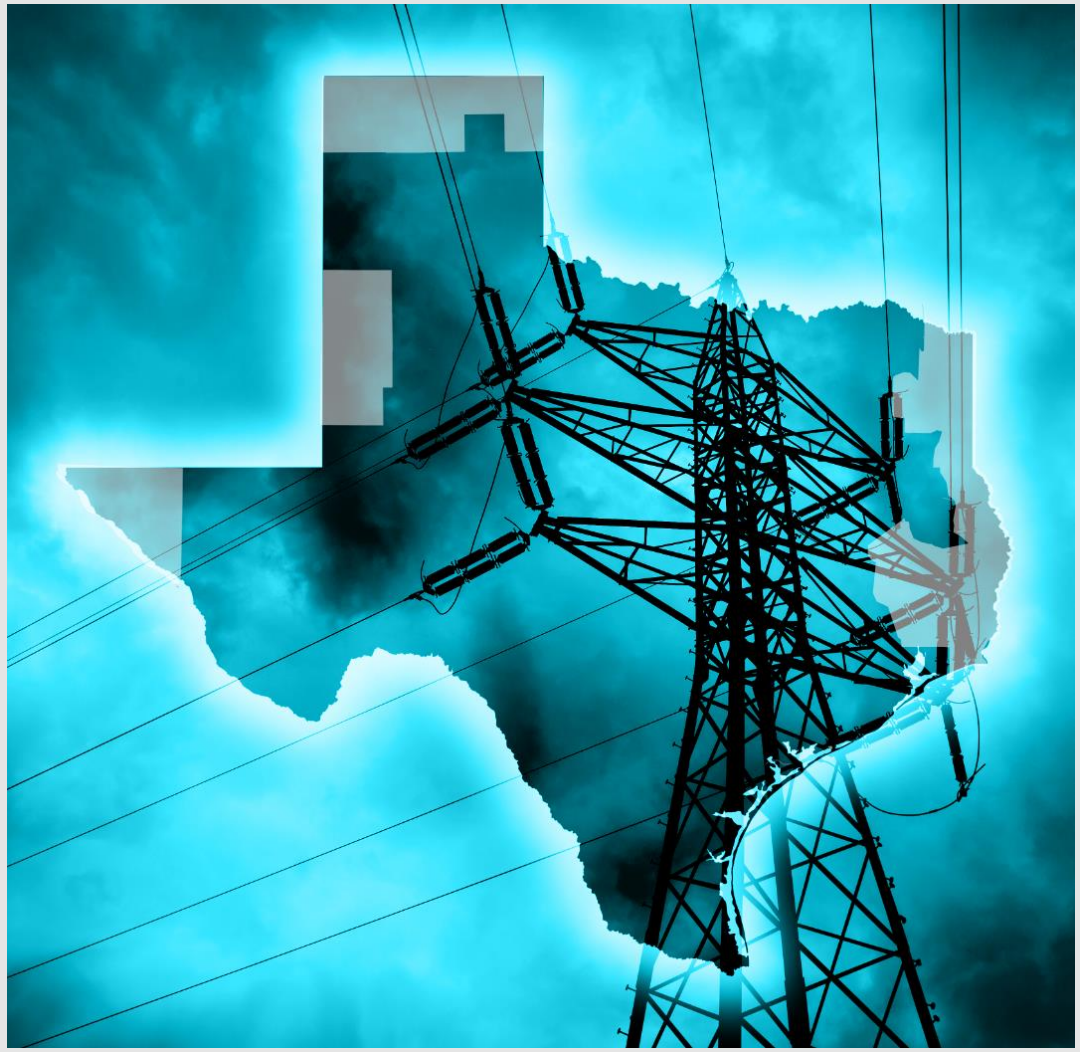
ERCOT Grid Research, Innovation, and Transformation

Prashant Kansal
Director, Grid Transformation

Overview

- **Purpose**
  Provide an update on ERCOT's Grid Research, Innovation, and Transformation (GRIT) initiatives

- **Requests**
  Review and provide feedback on the GRIT process and initiatives



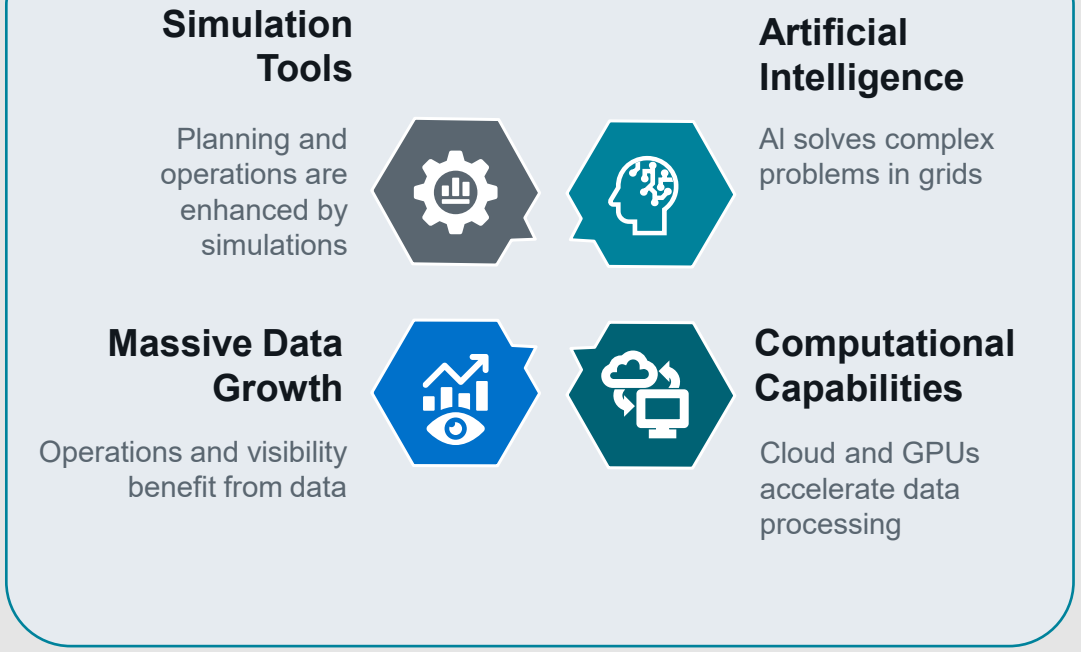
Key Takeaways

- The goal of GRIT is to address emerging grid challenges through cutting-edge research and innovation.
- GRIT initiatives are aligned with ERCOT's strategic objectives.

Grid Transformation: Unprecedented Confluence of Many Change Drivers

Grid Evolution

Operation Technologies Evolution



The grid and its supporting operational technologies are evolving rapidly, necessitating deliberate focus and specialized expertise to ensure future readiness.

Grid Research, Innovation, and Transformation (GRIT)

Purpose

Advance research and prototyping of emerging concepts and solutions to deeply understand the implications of rapid grid and technology evolution, positioning ERCOT to lead in the future energy landscape

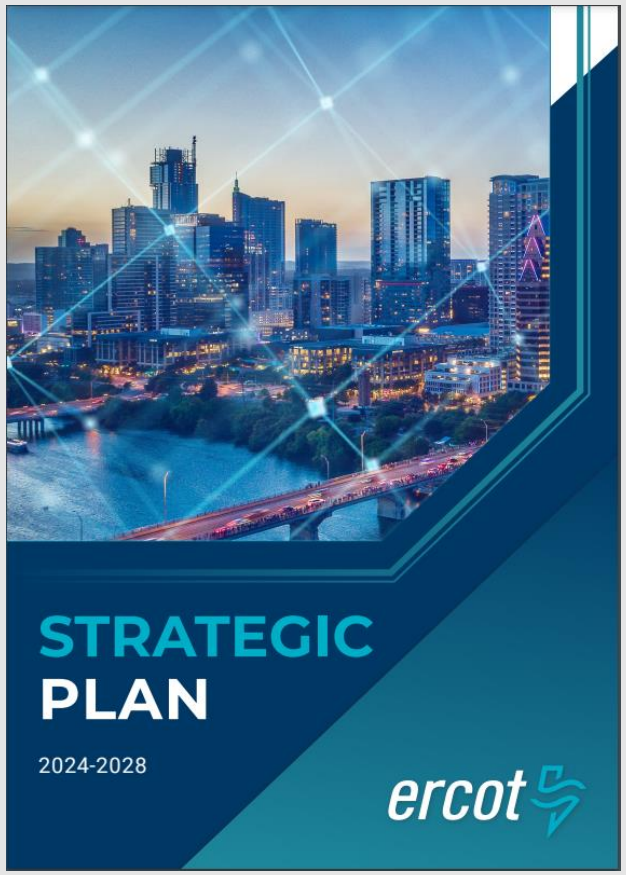
Vision

To be a world-class innovation team that enables ERCOT to lead the power grid transformation and deliver strategic impact in a rapidly changing energy environment

Mission

Drive cross-functional coordination, foster internal and external partnerships, develop proofs-of-concept, build expertise, and deliver a unified perspective on emerging innovations to proactively lead industry transformation

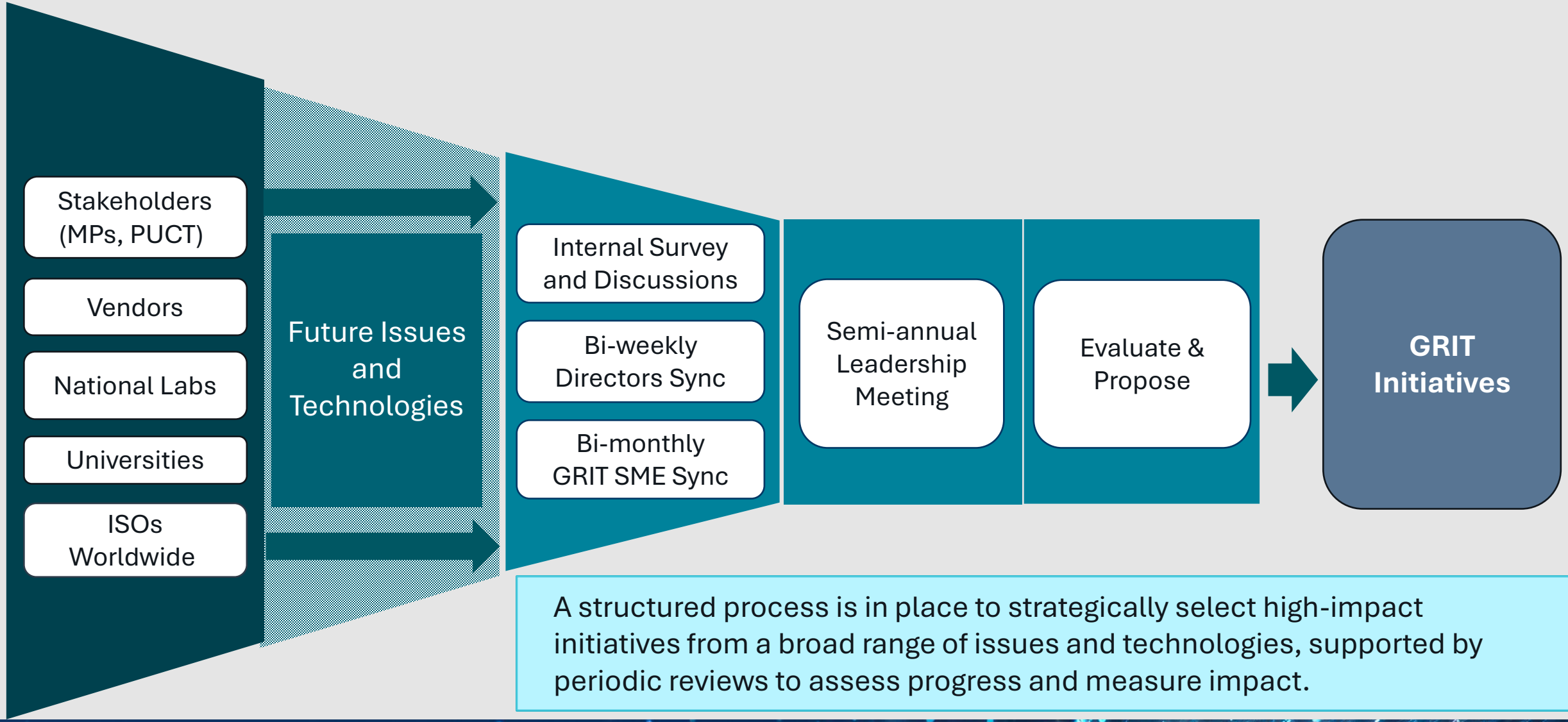
GRIT Function Serves ERCOT's Strategic Objectives



- Be an industry leader for grid reliability and resilience
- Enhance the ERCOT Region's economic competitiveness with respect to trends in wholesale power prices and retail electricity rates to consumers
- Advance ERCOT Inc. as an independent leading industry expert and an employer of choice by fostering innovation, investing in our people, and emphasizing the importance of our mission

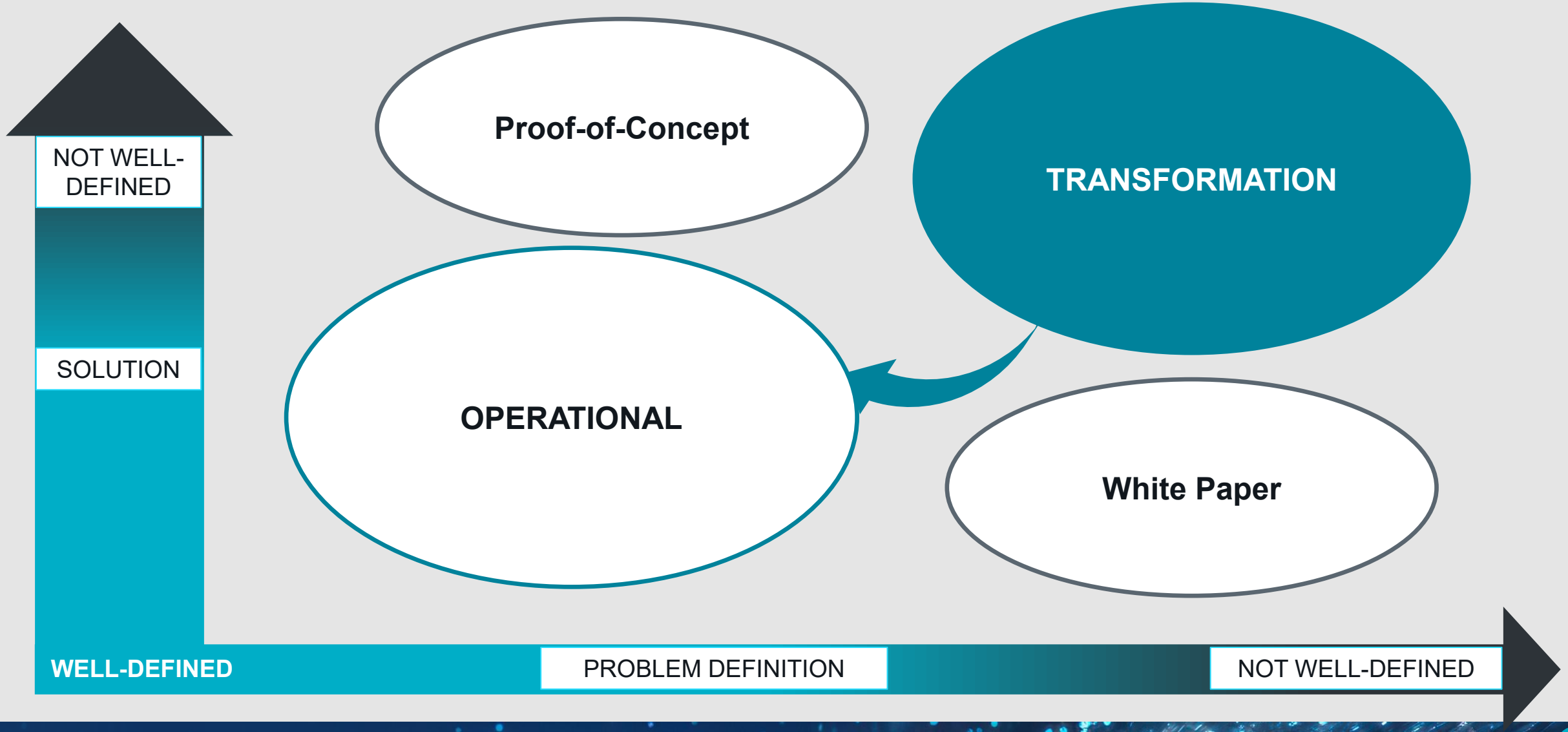
GRIT's purpose, vision, and mission are fully aligned with ERCOT's strategic objectives — driving innovation that enhances grid reliability, improving market efficiency, and ensuring readiness for a rapidly evolving energy landscape.

GRIT Initiatives – Stage Gate Process for Identification

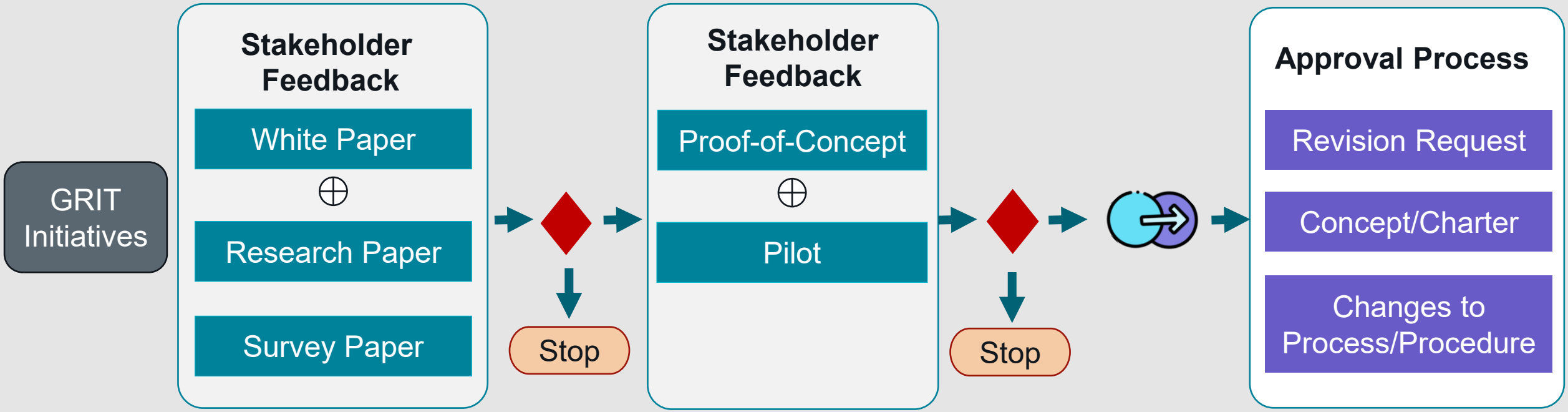


A structured process is in place to strategically select high-impact initiatives from a broad range of issues and technologies, supported by periodic reviews to assess progress and measure impact.

GRIT Initiatives – Operational vs. Transformational



GRIT Initiatives – Process Flow



Stakeholder Feedback: Feedback on white papers and POCs solicited using GRIT webpage and TAC meetings
Approval Process: ERCOT stakeholder or internal ERCOT process

Case Study 1: Look-Ahead Reactive Power Optimization

Problem:

- With growing penetration of Inverter-Based Resources (IBRs), changing load profiles, and variations in software-based controls, there can be challenges in maintaining voltage stability and reactive power balance across the grid.
- Without a robust look-ahead voltage optimization, there can be blind spots with risk of insufficient reactive power leading to voltage violations or inefficient switching of reactive devices.

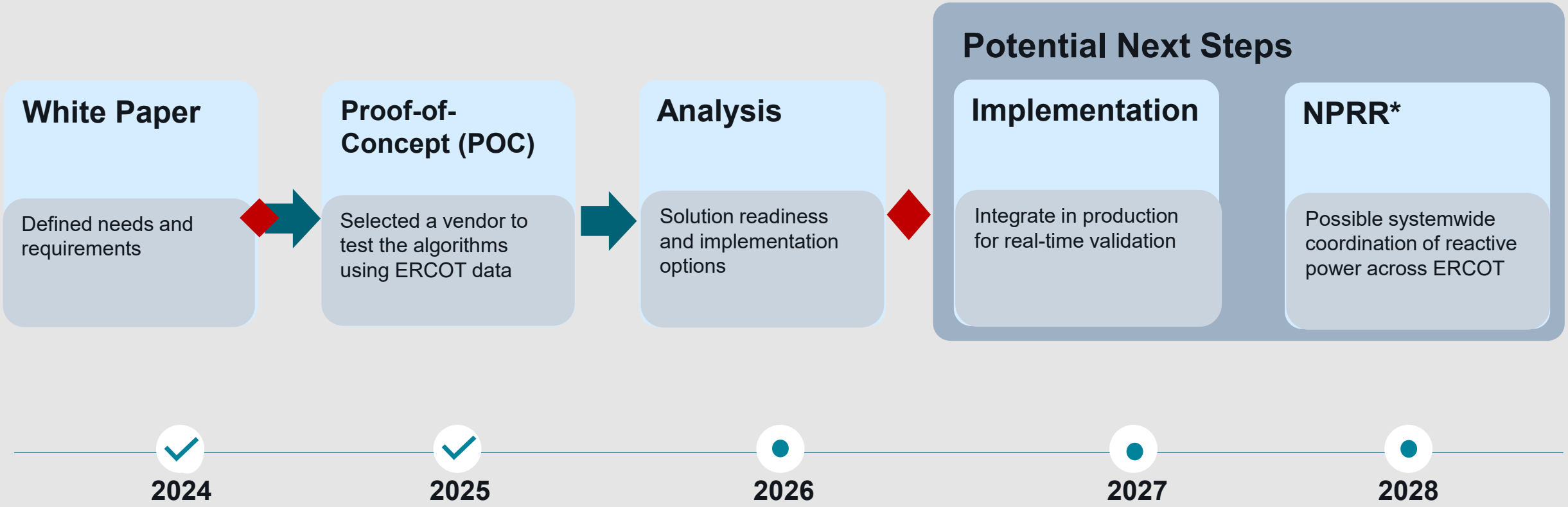
Solution:

- A tool that can optimally schedule reactive power resources and voltage set points over future time horizons (8- to 24-hour look ahead) using advanced optimization strategies with configurable control priorities (shunts, transformers, static var compensator (SVC), generators)

Benefit:

- Improving grid reliability and operational efficiency using optimal control strategy

Case Study 1: Look-Ahead Reactive Power Optimization



***NPRR** - Nodal Protocol Revision Request

Transition Decision

Case Study 2: Receive Operational Info from Distributed Energy Resources (DERs)

Problem:

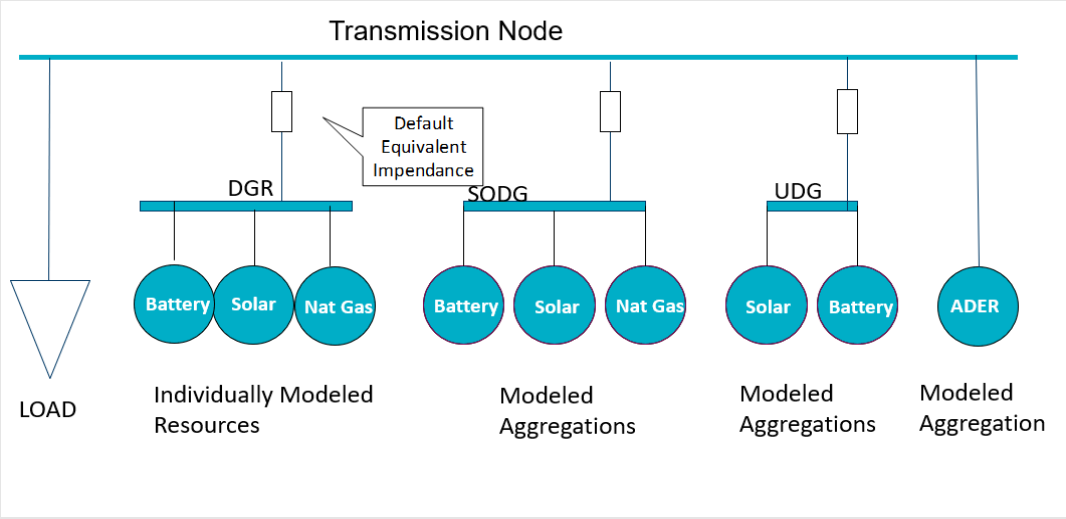
- Distributed Energy Resources (DERs), like rooftop solar and batteries, are increasing
- Currently, for ERCOT's grid studies, DERs are netted out of the load forecasting with no visibility of separate generation/load at the distribution level
- As DER penetration increases, planning and operations will become challenging without the ability to forecast and model the impact of distributed load and generation separately
- Mechanism to get DER information will be different from transmission-connected resources due to the volume and cost of sending the data using transmission protocols

Potential Solution:

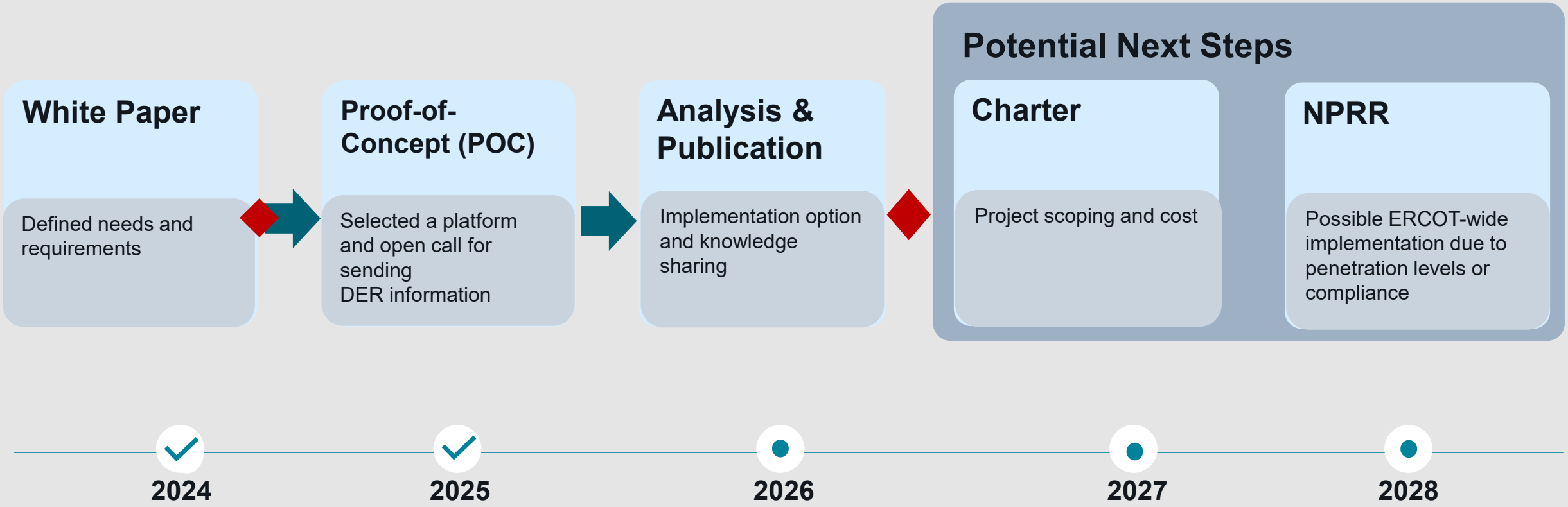
- Build a technology platform with an innovation partner to communicate with DERs with low-cost, API-based solutions that can manage volume
- Use the platform to improve forecasts and situational awareness

Benefit:

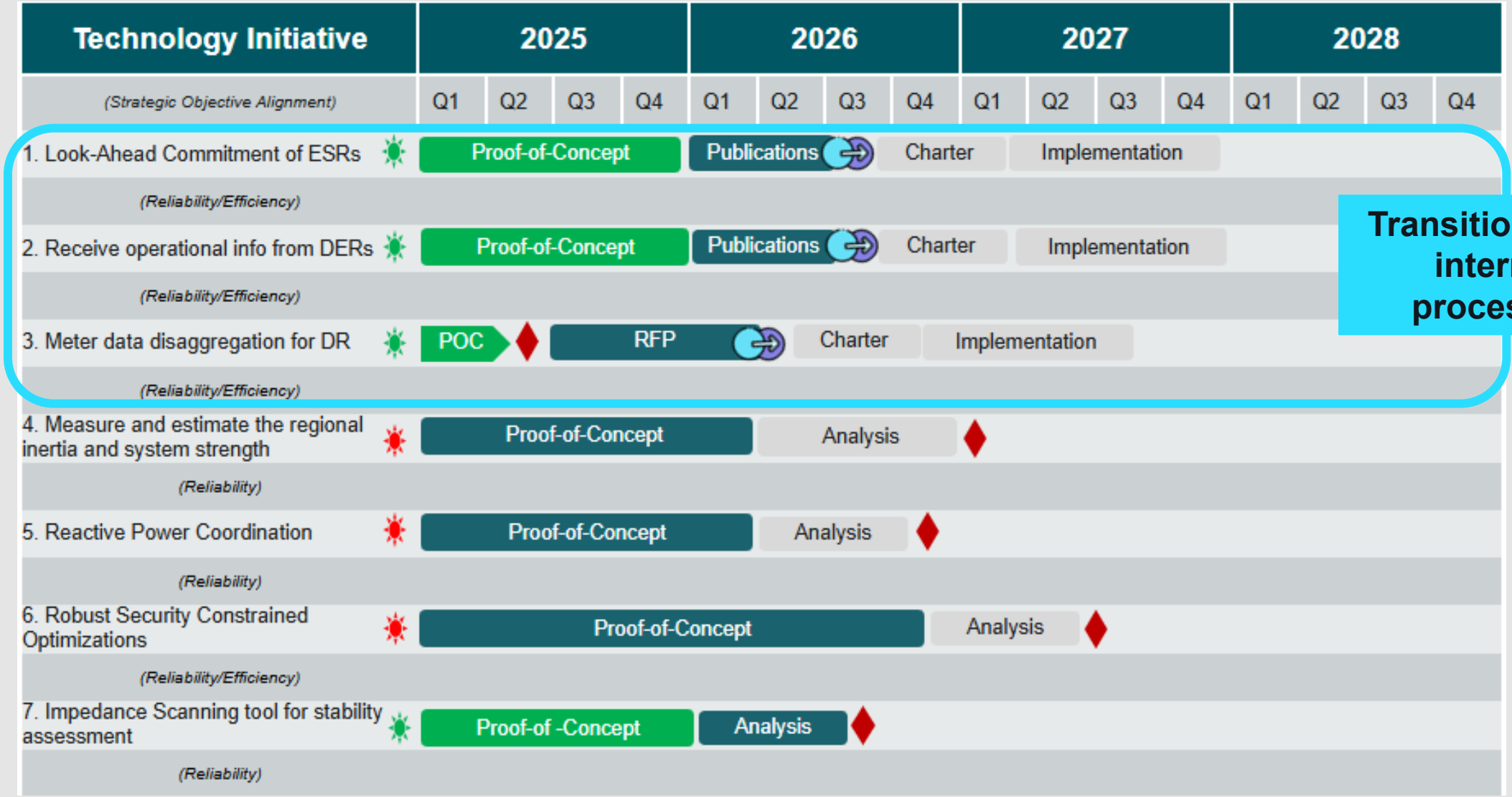
- Grid reliability and infrastructure planning



Case Study 2: Receive Operational info from Distributed Energy Resources (DERs)



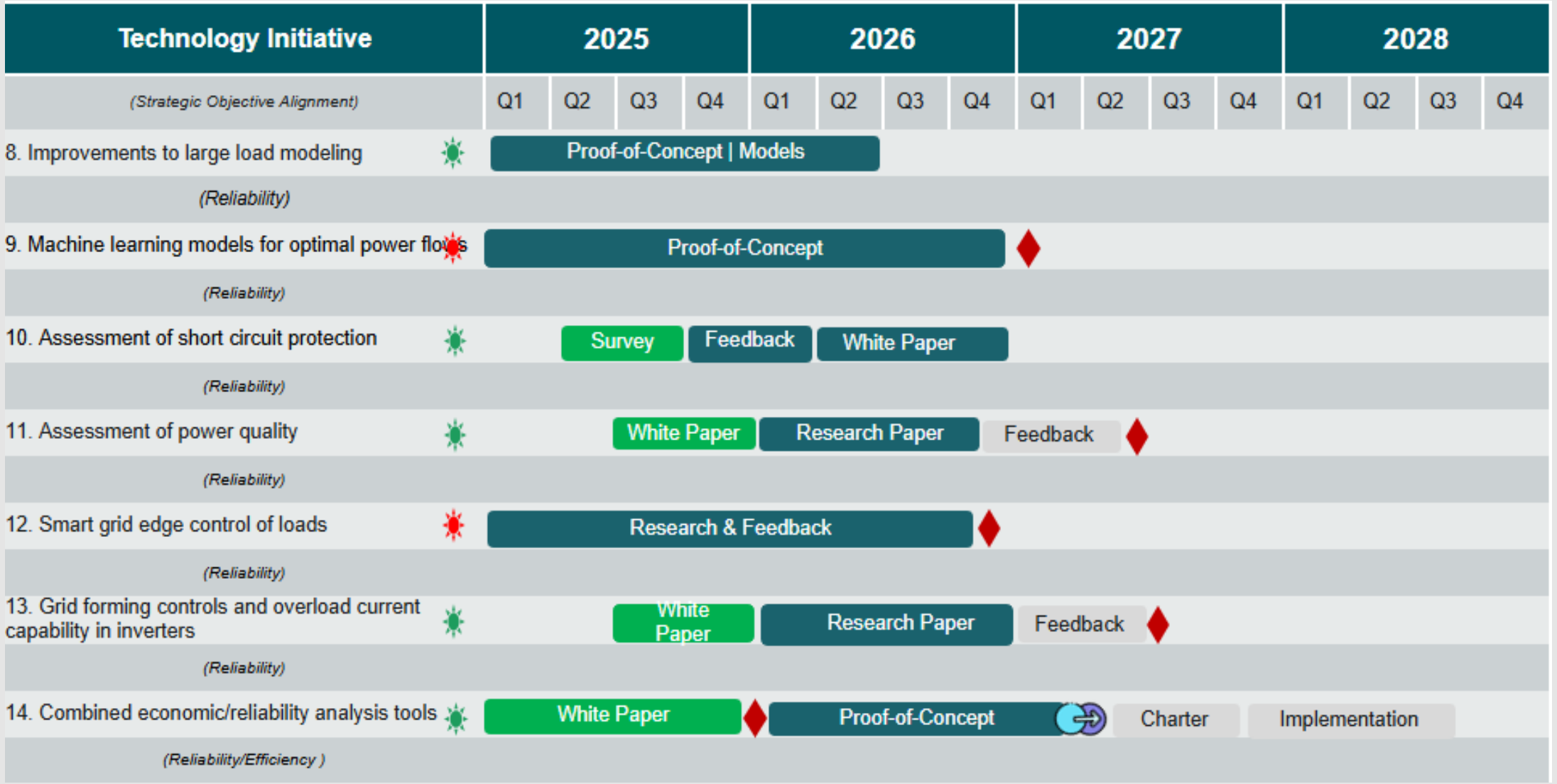
GRIT Roadmap



Transitioning to internal processes

Legend: Complete | In-Progress | Potential Next Steps | On Track | Transition | Decision

GRIT Roadmap



Legend: Complete | In-Progress | Potential Next Steps | On Track | Transition | Decision

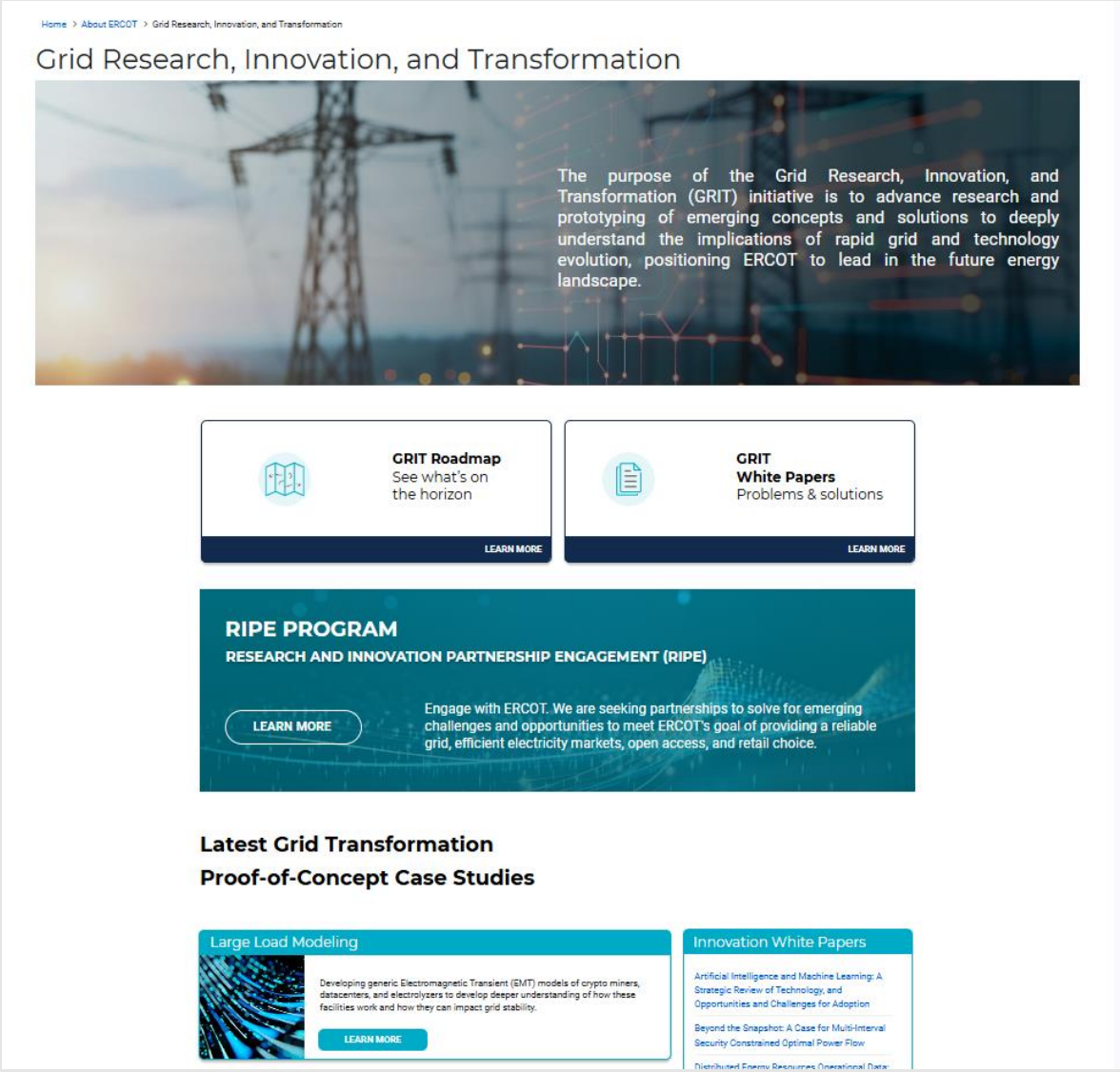
GRIT Roadmap

Technology Initiative	2026				2027				2028				2029			
(Strategic Objective Alignment)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
15. Dynamic Ancillary Services	White Paper				Implementation											
(Reliability/Efficiency)																
16. Large scale EMT need and strategy	White Paper				POC				Charter				Implementation			
(Reliability)																
17. Open-source data and models	Synthetic network				Data sets											
(Reliability)																
18. Topology Optimization	Proof-of-Concept				Implementation											
(Reliability/Efficiency)																

Legend: Complete | In-Progress | Potential Next Steps | On Track | Transition | Decision

GRIT Webpage Updates

GRIT Webpage



Research & Innovation Partnership Engagement (RIPE)

The **RIPE program** was launched on September 4, 2025.
40 requests have been received so far.

Emerging technologies: Some proposals involve novel technologies requiring significant evaluation effort and may not be time aligned with the current priorities

Multi-party coordination: Several proof-of-concept proposals involve TSP dependencies.

Endorsement: Some requests are about endorsement and less about technology proof-of-concept

ERCOT is developing screening criteria to identify the highest value opportunities and continue monitoring the activity.