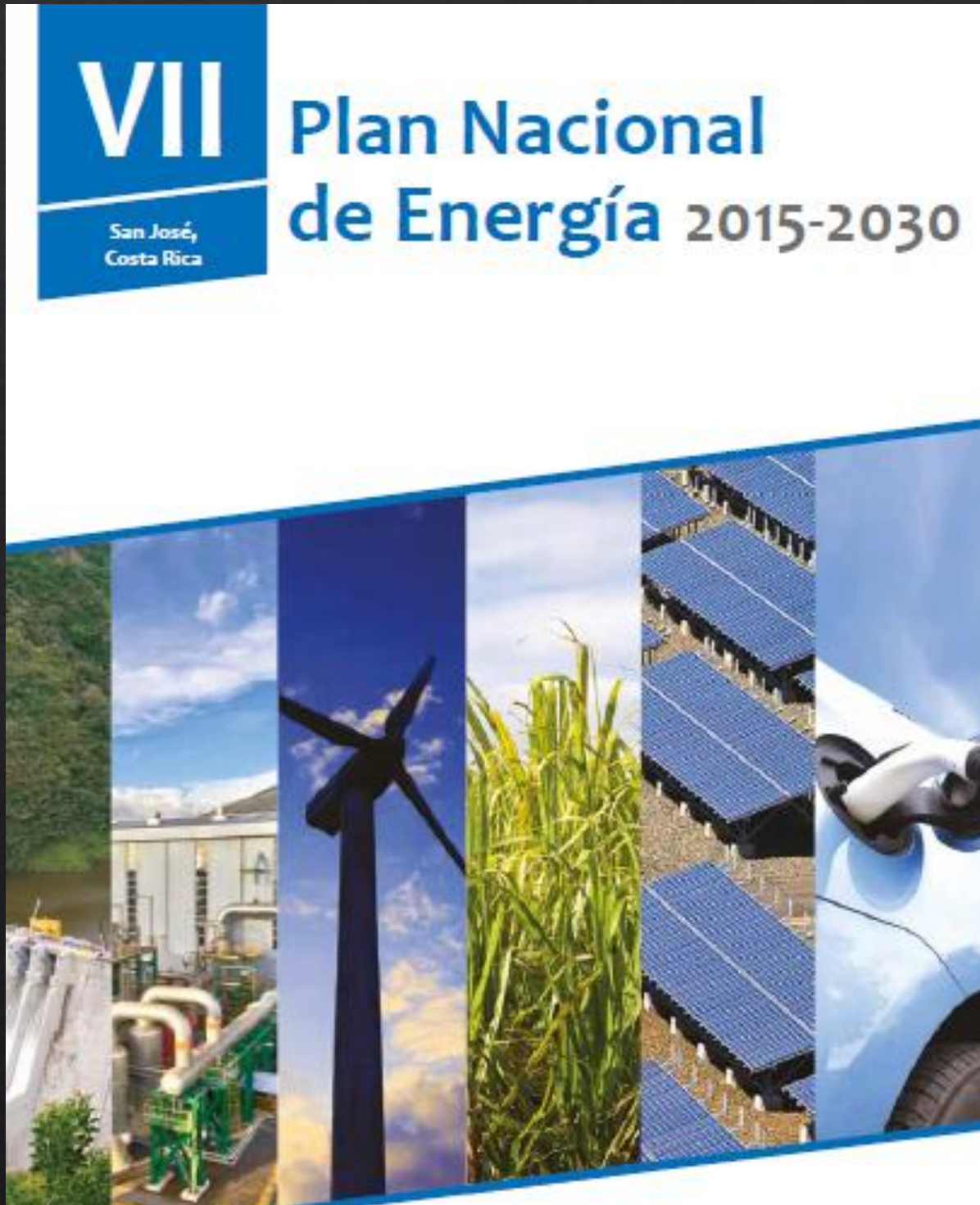


A photograph of a wind turbine on a grassy hill under a blue sky with white clouds. The turbine is white and stands prominently on the left side of the frame. The hill is covered in green grass, and there are some small structures or trees visible in the distance. The sky is a vibrant blue with scattered white clouds.

# Institutionalizing Modelling Tools in Costa Rica's Energy Planning

*How institutional design, legal mandates, and collaborative governance sustain technical capacity beyond project cycles in national energy planning.*

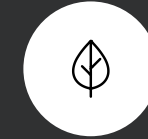


# Strategic Policy Framework



## VII National Energy Plan

*2015–2030 framework establishing efficiency, diversification, and citizen participation as strategic pillars of energy policy.*



## National Decarbonization Plan

*2018–2050 vision defining the pathway to a low-emission, electrified economy and carbon neutrality.*



## Evidence-Based Foundation

*Energy modelling and scenario analysis provide the analytical backbone for sustainable development objectives.*



# Institutional Governance Structure

## MINAE Directorate of Energy

- *Strategic policy formulation*
- *Data governance mandate*
- *National Energy Balance (BEN) preparation aligned with IEA/OECD standards*

## ICE Planning & Sustainability

- *Technical planning for generation and transmission*
- *Plan de Expansión de la Generación (PEG)*
- *Plan de Expansión de la Transmisión (PET) 2024–2034*

*Regional distributors—CNFL, ESPH, JASEC, CoopeSantos, and Coopelesca—collect granular consumption data, feeding a unified national model for bottom-up integration.*



# Modelling Tools & Integration

## Core Software Suite

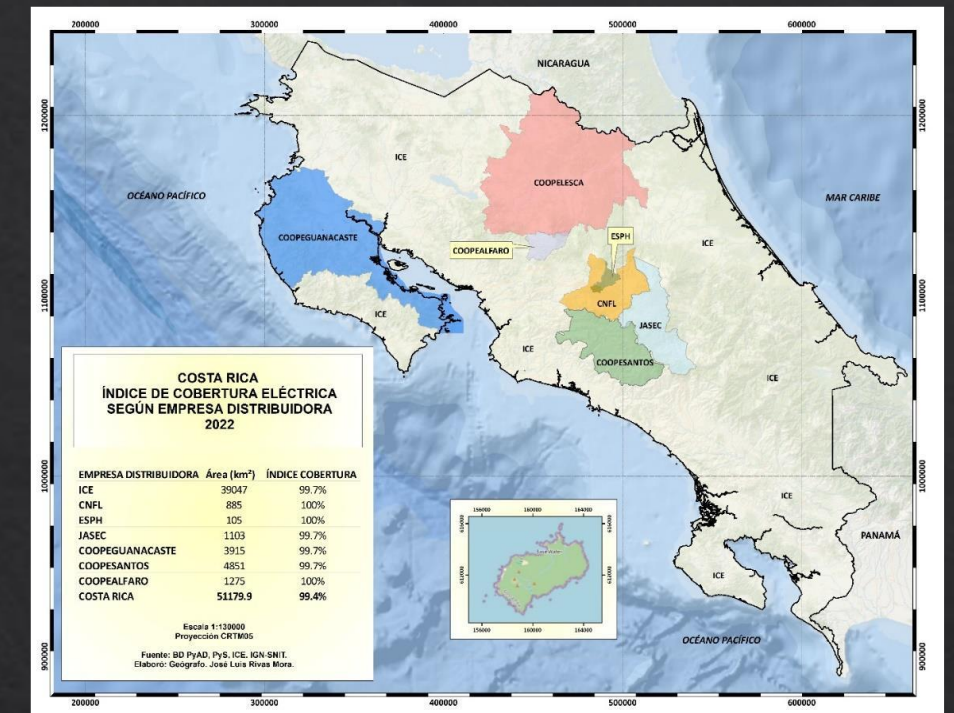
*PSS/E, TIMES-CR, and OSeMOSYS  
complemented by Python scripts for  
sensitivity testing and visualization.*

## Exploratory Demand Study

*2023–2028 analysis incorporating data  
from FIFCO, VICESA, Intel, and Cavendish,  
estimating 166 MW of emerging loads by  
2028.*

## Transport Electrification

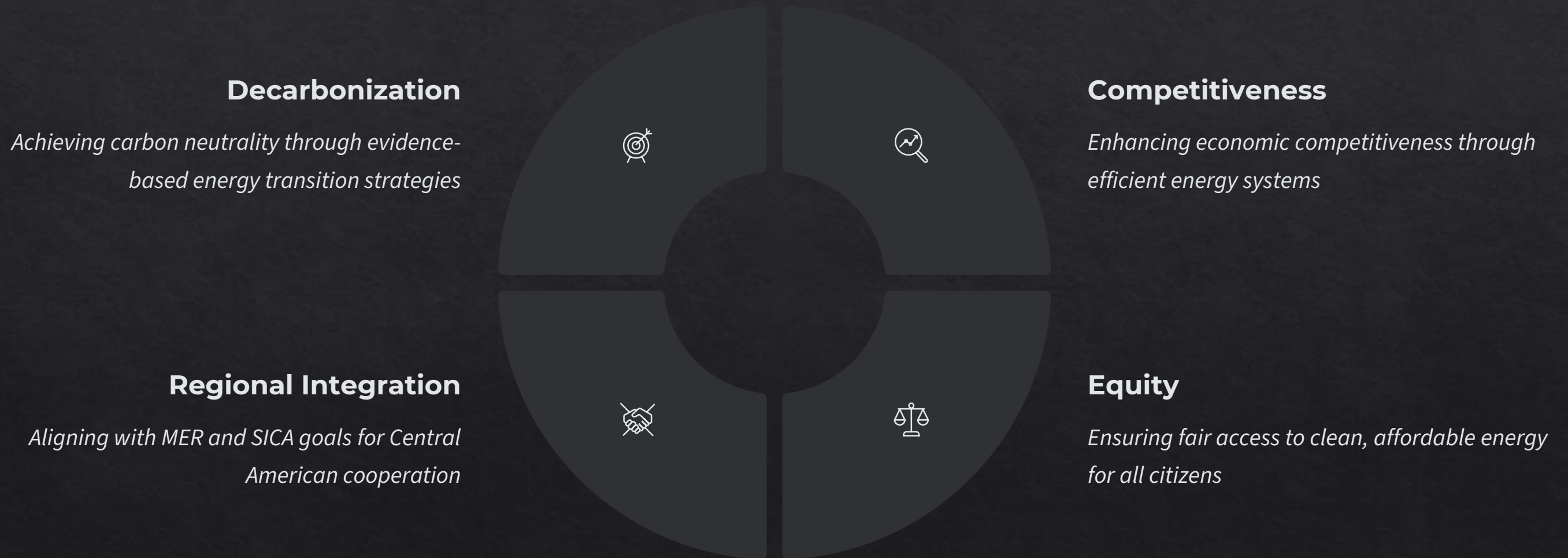
*UNDP/OET 2024 study modeling fleet  
scenarios (5%, 10%, 15% annual uptake)  
to estimate additional electricity  
demand.*





# Towards Sustainable and Adaptive Planning

*Costa Rica's shift toward indicative planning represents a broader ambition: to create a resilient, adaptive, and transparent planning system capable of steering the country's long-term energy transition. By linking modelling, data governance, and participatory foresight, MINAE seeks to turn planning into a strategic public function that supports both national priorities and regional integration goals.*



*In this way, indicative planning becomes not only a technical innovation but a democratic exercise in foresight, ensuring that Costa Rica's energy future is built on shared knowledge, institutional stability, and open dialogue with society.*

# A New Paradigm for Energy Governance

*Costa Rica's journey toward indicative planning and institutional learning represents a fundamental reimagining of energy governance. By embracing open-source tools, transparent methodologies, and participatory frameworks, the country has transformed energy planning from a technical exercise into a democratic process of collective foresight.*

## Open Knowledge

*Democratized access to modelling tools and data empowers stakeholders and builds public trust*

## Adaptive Governance

*Flexible, iterative planning responds to changing technologies, markets, and social needs*

## Regional Leadership

*Costa Rica's model offers a blueprint for Latin America's energy transition*

*The overarching goal is a resilient, adaptive, and transparent planning ecosystem in which open-source tools and indicative planning become central to national governance—ensuring Costa Rica's energy future is built on shared knowledge, institutional stability, and open dialogue with society.*

# Transmission Expansion Roadmap

## Stage 1: National Reinforcements

*Sustaining the minimum operational exchange capacity (COIIM) of 300 MW through targeted national infrastructure improvements and grid strengthening projects across all six countries.*

## Costa Rica Infrastructure

*Expansion of 230 kV lines and substations to support higher north-south flows and integrate distributed renewable projects throughout the national grid system.*

1

2

## Stage 2: Regional Projects

*Exceeding the COIIM with target capacity of 450 MW, leveraging the planned second SIEPAC circuit and complementary reinforcements to enable greater cross-border energy flows.*

3

4

## Cross-Border Connections

*Reinforcement of interconnections with Nicaragua and Panama, critical to regional power stability and enabling efficient energy exchange during peak demand periods.*

*Overall, 212 transmission interventions are planned regionwide between 2024–2033, including 21 projects in Costa Rica, primarily at 230 kV level, with comprehensive environmental and social assessments ensuring compliance with regional standards.*



# Conclusions

**Strategic  
Integration of  
National and  
Regional Planning**

**Costa Rica as a  
Technical and  
Policy Anchor**

**Institutionalization  
of Open-Source  
Modelling**

**From Technical  
Modelling to  
Policy Decision-  
Making**

**Indicative Planning  
as Governance  
Innovation**

**Regional  
Expansion and  
Interconnection  
Resilience**

**Economic and  
Environmental  
Benefits**

**Transparency and  
Public  
Accountability**

**Institutional  
Learning and  
Capacity Retention**

**From National  
Planning to  
Regional  
Leadership**

**Forward Vision**