



Unidad de Planeación  
Minero Energética

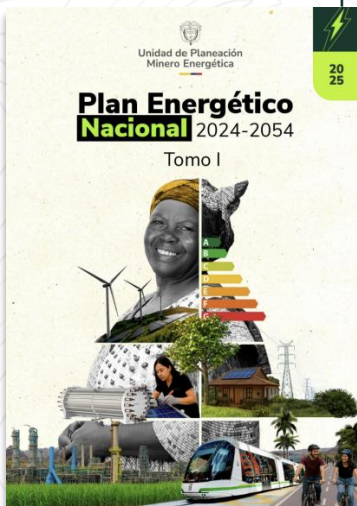
# Colombia National Energy Plan 2025-2055

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Oct 2025

# National Energy Plan (PEN)

## What does it include?



### Volume I Conceptualization

1. Colombia's energy system
2. Energy and climate change
3. Strategic planning approach for a **just transition**
4. PEN vision and pillars
5. Objectives
6. Strategic plans
7. Democratization of energy
8. Formulation of scenarios: Policies, regulations, roadmaps, and strategies
9. External factors analysis

### Volume II National PEN

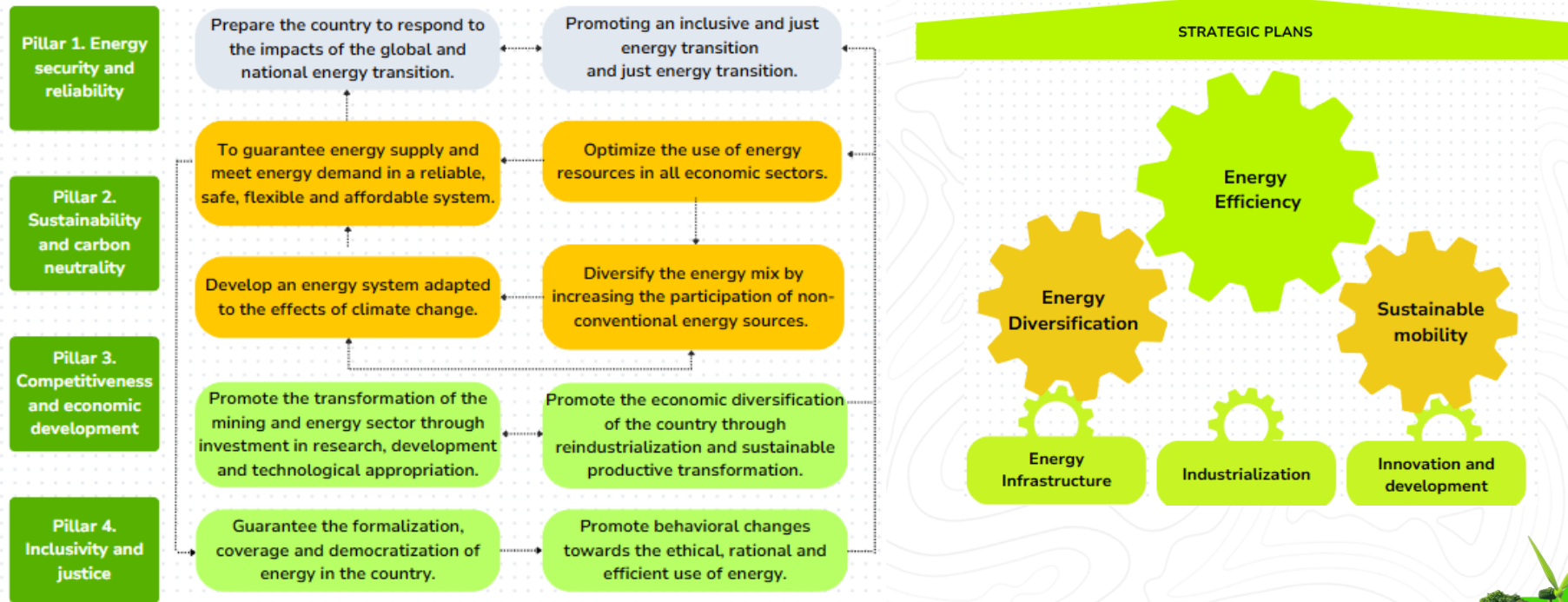
1. OSeMOSYS modified model (social and environmental variables)
2. National scenarios
3. National cost-Benefit analysis

### Volume III Regional PEN

1. OSeMOSYS modified model (social and environmental variables)
2. Regional scenarios (7 regions)
3. Regional cost-Benefit analysis



# Objectives and Pillars 2025-2025

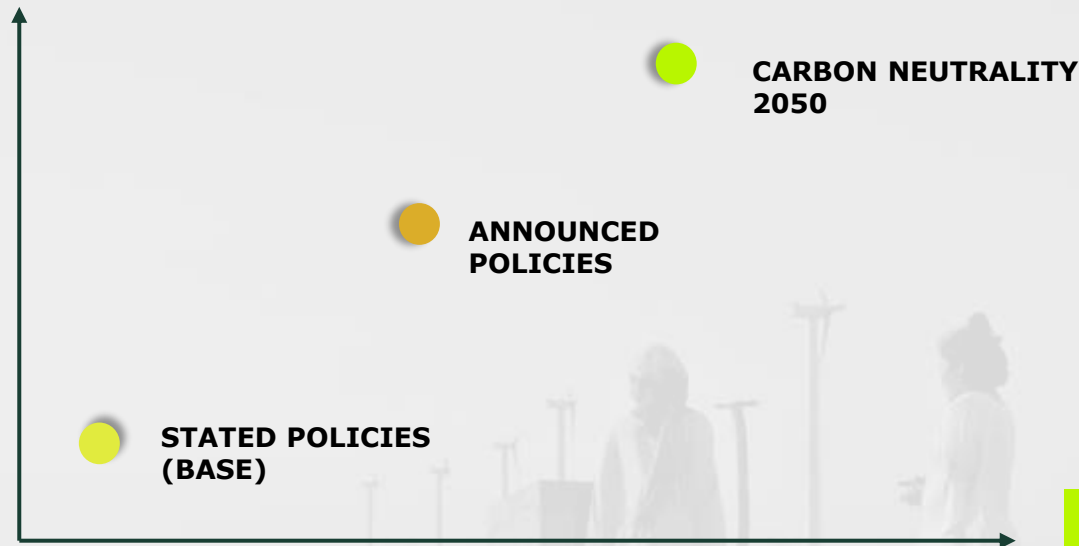


# Energy scenarios

**Favorable economic,  
social, regulatory,  
and environmental  
context**

*Level of development  
and feasibility of binding  
policies.*

*A more favorable  
context implies greater  
institutional support, an  
enabling regulatory  
framework, adequate  
financing, economic  
development, available  
technology, and social  
support.*

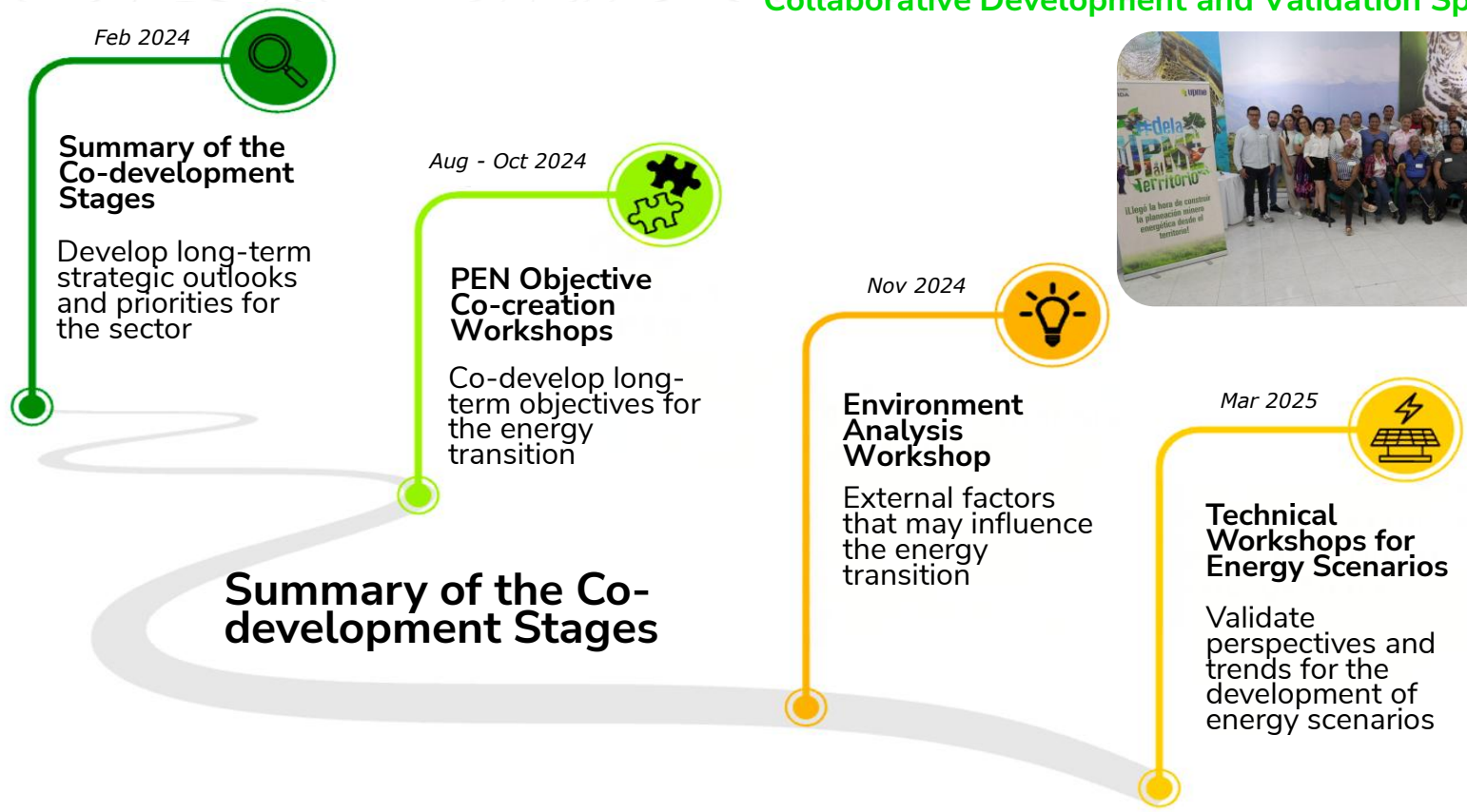


*Level of commitment from all stakeholders and scope of climate  
change mitigation goals.  
Greater ambition implies compliance with emission reduction  
and decarbonization goals.*

**Climate  
ambition**

# How has the process of gathering strategic priorities, objectives, and scenarios been?

## Collaborative Development and Validation Spaces



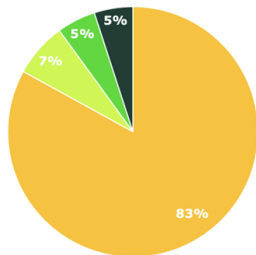
# How has the process of gathering strategic priorities, objectives, and scenarios been?

Feb 2024



## Summary of the Co-development Stages

Develop long-term strategic outlooks and priorities for the sector

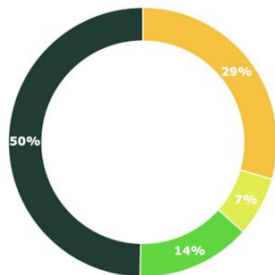


Aug - Oct 2024



## PEN Objective Co-creation Workshops

Co-develop long-term objectives for the energy transition



## Collaborative Development and Validation Spaces



Invitation sent to

**140**

stakeholders

Reception of a total of

**239**

proposals

from

**37**

instituciones

■ Private Sector ■ Academia ■ Public Sector ■ Civil society

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ACOLGEN, AGREMGAS., ANDEG, ANDI, ANH, ANM, ASOCAÑA, GASNOVA, ACP, CELSIA, CENICAÑA, CENIT, CIPAME, CREE, DNP, Ecopetrol, EIA, Enel Colombia, EPM, Fedebiocombustibles., Minambiente, Minenergía, Minhacienda, Mintransporte, Minvivienda, SENA, SER Colombia, Sintracarbón, Sintraelecol, SSPD, TGI S.A., Vanti y XM.

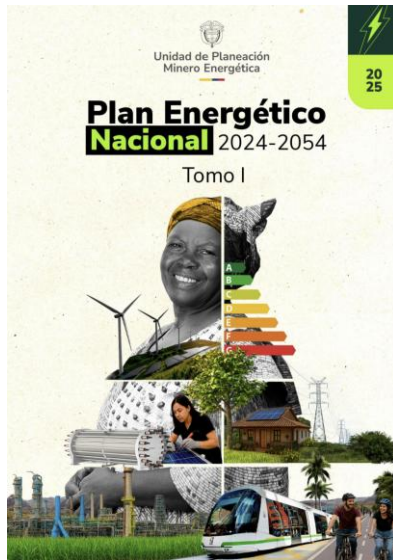




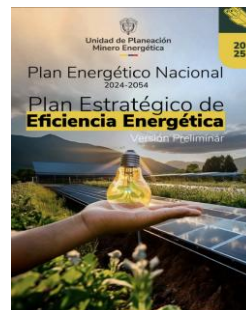
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# National Energy Plan (PEN) 2025-2055

## Volume I

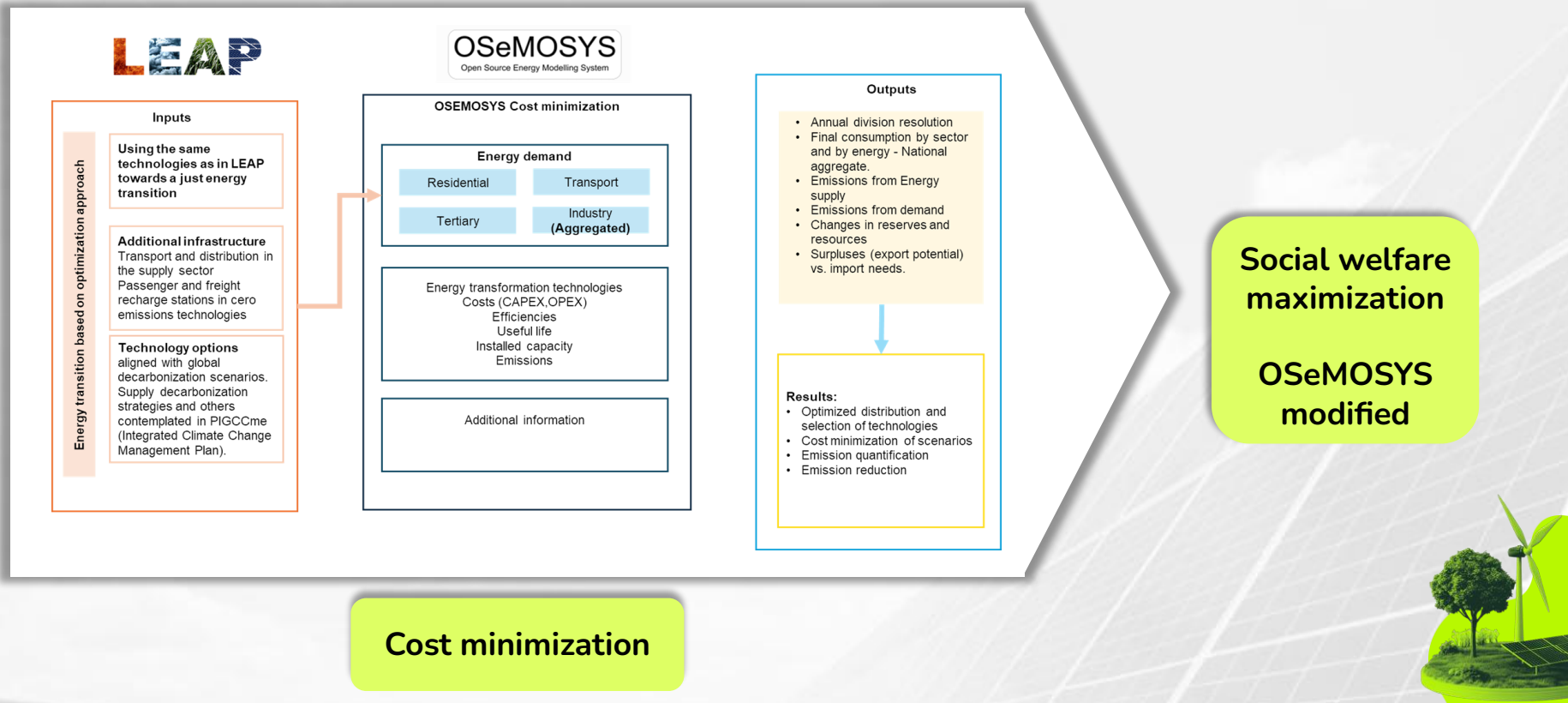


Main document



Strategic  
Plans

# From cost minimization to maximizing social and environmental benefits





# New national energy planning model







UPME is designing a **new national energy planning model**, built upon the OSeMOSYS foundation, that shifts the focus from cost minimization to the **maximization of social welfare**, while integrating end-of-life management, material recovery, environmental and social dimensions, and regional context into a comprehensive decision-support tool.

$$\begin{aligned} & \max \sum_{r \in \text{REGION}, y \in \text{YEAR}} \text{NetDiscountedSocialBenefit}_{r,y} \\ & \text{s. t.} \\ & \text{NetDiscountedSocialBenefit}_{r,y} \\ & \quad = \boxed{\text{DiscountedSocialBenefit}_{r,y}} - \text{TotalDiscountedCost}_{r,y} \end{aligned}$$

- ⚡ Energy balance and production/use
- ⚡ Capacities
- ⚡ Resource availability, annual activity, and period

- ⚡ Emissions and limits
- ⚡ Additional social and environmental factors

# New national energy planning model

-  **End-of-life management and material recovery: final disposal phase** of technologies, including recycling, reuse, and safe treatment of materials, to reflect their real environmental and economic costs.
-  **Refrigerant-related emissions** **greenhouse gases emitted by refrigerants** used in appliances - > more accurate lifecycle emissions assessment.
-  **Employment creation and loss**  
Socioeconomic dynamics -> **job creation or displacement** under different energy scenarios and technology transitions.
-  **Environmental impacts beyond CO<sub>2</sub>**  
Including land use, water consumption, and ecosystem impacts, not just CO<sub>2</sub> emissions.
-  **Social and territorial dimensions**  
Local social acceptance, equity aspects, and territorial context variables that may **affect renewable energy potential** or **cause delays in infrastructure deployment**.
-  **Realistic regional energy potential**  
Reflect geographical, environmental, and **social constraints**, providing more accurate estimates of exploitable resources.

- **62 demands** represented from the industrial, tertiary, residential, transport, agricultural, construction, coking, and refinery sectors, among others.

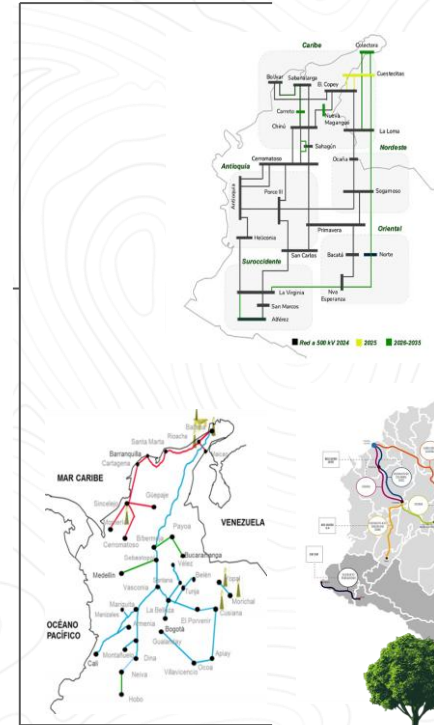
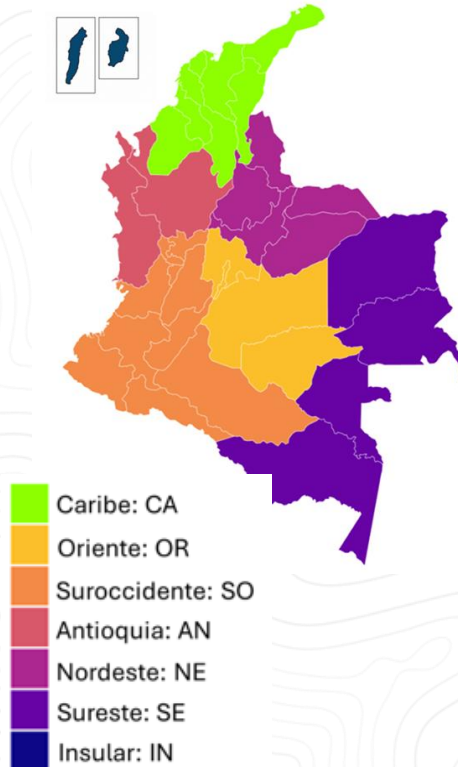


- **400 technologies** representing Colombia's energy production, transformation, transport, and end-use processes, as well as the potential to **transition toward higher efficiencies and/or different energy carriers**

# Regionalization

- The aim is to divide the model into 7 regions
- Consideration of energy balances by region, including limitations of energy transport infrastructure between regions
- It allows for regional differences in energy demand, fuel availability and prices by area, and specific energy resource potentials to be incorporated.

## Considering main Power and Oil and Gas transport infrastructure





# Environmental and social factors



Expand the model to include environmental variables (water consumption, greenhouse gas emissions, local pollutants) and social variables (land availability, job creation, location of industries), supporting analysis for a just energy transition.



It is proposed to integrate these variables using different approaches: monetization in the optimization problem; ex post calculations to estimate social impacts; or complementary models linked to the main energy model.



Define the final scope of the variables to be included based on the availability and quality of data for Colombia, adjusting the approach according to the progress of previous tasks and in coordination between UPME and DEA.



# ¡THANKS!



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