Renewable Energy Roadmap for Central America: Towards a Regional Energy Transition

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SPEAKERS

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REmap Central America (CA)
Assessing the roadmap – An analysis in joint effort with key stakeholders of the region

1. Case study by country
   - Definition of energy scenarios → BES, PES, TES, DES
   - End-use sectors modelling → REmap Activity Tool
   - Power sector modelling → MESSAGE
   - Flexibility analysis → FlexTool
   - Slide deck with results by sector

2. Country engagement
   - Feedback from the country's technical team
   - Model adjustments based on feedback
   - Final validation

3. Regional analysis
   - Analysis of energy supply and demand
   - Investment analysis
   - Final report, dashboard and other deliverables

2 face-to-face meetings
   - Kick off meeting in Panama
   - Costa Rica Energy Transition workshop

~3 virtual meetings for each of the 7 countries in the region

Representatives by country + IRENA technical team

Participation in regional events (COREN 2021, IDB, UNFCCC, OLADE)
The roadmap brings benefits to the region that would help address major challenges at similar costs as current plans

- Universal access to electricity and clean cooking technologies and carriers
- Increase of the use of local renewable resources, and energy security
- Reduction of CO₂ emissions and local pollution
- Reduction of fossil fuel imports and related payments
- Increase of investment and stimulus to the economy
The 5 key pillars of the energy transition in Central America

An integrated planning of the regional energy transition is key

Expansion of renewables in electricity generation

Expansion of the interconnection grid

Sustainable mobility

Modern cooking technologies

Energy efficiency

Disclaimer: This map is provided for illustration purposes only. Boundaries and names shown do not imply the expression of any opinion on the part of IRENA concerning the status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.
The electrification of the fleet will be crucial to reduce the transport sector emissions by ca. 70% compared to the effect of current plans.

- By 2050, ≈ 80% of the passenger fleet and ≈ 54% of the cargo fleet is electrified under DES, from ≈ 0% in 2018.
- Cumulative costs of 486 billion USD is needed, covering fleet acquisition (82%) and infrastructure (18%).

**Additional Solutions**

- Biofuels
- Modal change (bicycles and electric buses)
- Green hydrogen (heavy cargo road transport)

**Action plan for investment in sustainable mobility**

- Development of infrastructure of charging points for electric vehicles at national and regional level.
- Programs for the promotion of electric vehicles, both public and private.
- Design of solutions and tariff schemes for smart charging and regional regulation.
Provision of universal access to clean cooking technologies and fuels thanks to the introduction of electric stoves and improved cooking stoves

- Increase of electric and improved stoves by around 9 times in 2050 with respect to 2018
- Average annual investment in electric and improved stoves of USD 395 million/year
- Deployment of electric stoves
  - 230 000 units/year during 2021-2030 and 330 000 units/year during 2030-2050

Action plan for investment in modern cooking technologies

- Regional plan for the promotion of improved cookstoves
- Regional plan to promote electric cooking
- Financing for the acquisition of more efficient equipment
The cumulative costs of energy efficiency measures would be 8.3 billion USD to reduce energy intensity in 43% by 2050

- New regional energy efficiency standards ("RTCAs") for high consumption equipment and sustainable building codes
- Increase in current energy efficiency indexes in DES
- Average energy efficiency costs of around USD 260,000 per year are required in DES

Regional action plan for promoting energy efficiency

- Labelling and minimum standards for electrical equipment, particularly for air conditioners and refrigerators
- Financing for the acquisition of more efficient equipment
- Characterization of the industry sector and promotion of energy efficiency and direct use of renewables solutions
- Minimum standards and emission limits for vehicles
The annual deployment of renewables of 1.4 GW will increase the share of renewables by 2050 to 90%, compared to 67% in 2018.

- **Cumulative investment** in new installed capacity in the DES scenario is expected to be 75 billion USD.
- **Average annual investment** in installed capacity during the period 2021–2050 (600 million USD estimated between 2015-2020, of 1.3 billion USD in PES and 2.6 billion USD in DES).
- **Solar PV rooftop electricity generation** covers 10% of buildings electricity demand by 2050 in DES.

### Action plan to scale-up investment in renewables

- Financing of feasibility studies for the development of a portfolio of renewable-based generation and transmission projects.
- De-risking and adjusted contract models to reduce the cost of capital and promote investment attraction.
The regional integration of the power system could be fostered to further exploit the total renewable potential of around 180 GW.

Expansion of the interconnection grid

- Increase of the interconnection capacity: 300 MW → ~2 GW by 2050
- Higher deployment of renewables (share of 86% → 90%)
- Emissions reduction: 8.9 MtCO₂/year → 2.6 MtCO₂/year
- Flexibility solutions (i.e., smart EV charging, storage) allow reduction of renewable spillage (7 TWh → 1.5 TWh) and avoids loss of load
- Robust system even with low hydro availability
- Decrease in marginal cost and total system costs

Regional action plan for the expansion of the interconnection network

- Financing of studies and the expansion of the interconnection among the countries of the region
- Regional projects for the integration of energy storage solutions in the grid
- Closer integration of the functioning of the market and the regional dispatch

Reduction of the marginal price in the increased interconnection scenario

- Power Sector - DES
- Cumulative investment in grids 2021 - 2050
- ~ 27 billion USD
- T&D: 1%
- SIEPAC expansion: 6%
- Storage: 93%
The installation of energy storage as well as flexible charging of electric vehicles could further foster renewables.

**Expansion of the interconnection grid**

- Higher deployment of renewables
- Emissions reduction
- Loss of load reduced to zero, and spillage only at less than 1% of renewable potential
- Robust system operation with low hydro availability
- Decrease in the average marginal price of the system in both SIEPAC and Belize

**Regional action plan to increase the flexibility of the system**

- Development of strategies for smart charging of electric vehicles
- Installation of energy storage systems to integrate renewables, especially solar
- Enabling of demand flexibility through time-of-use rates and aggregators
The combination of Flexibility resources paves the way for solar energy

Helping balance supply and demand with flexibility

- **Hydropower** ramping requirements: **coordination of 20-40 plants** (300-600 MW) increasing/decreasing power at the same time
- **Storage** complements **absorbing overgeneration and decoupling solar** supply and demand. Yet, there may be cost-effective curtailment amounts
- **Smart charging** of electric vehicles and **demand flexibility** could **alleviate** peak hours and **displace** demand by the availability of energy

![Diagram showing Flexibility from hydropower and Curtailment](image-url)
Final remarks

• **Strong country engagement during the process**
  - Analysis results used as inputs for national plans

• **Data driving concrete actions**
  - Perceived as data rich analysis
  - Supported concrete objectives and plans definition

• **Access to finance is still a key challenge**
  - Availability of funds for pilot projects

• **Regional collaboration can play a key role**
  - To further exploit local resources and look for complementarity
  - To promote regional collaboration and sharing of good practices

• **Next steps**
  - Collaboration with IDB to promote analysis outcomes
  - Participation in regional events to keep the discussion open

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Power BI online dashboard

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**INTERACTIVE DATA SETS**

IRENA INNOVATION & TECHNOLOGY CENTRE (IITC)
- Renewable Energy Roadmaps Team
- Power Sector Transformation Strategies Team

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Thank you!

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