

# Renewable Energy Development Strategy in Lao PDR



## Climate, Energy and Forest Inter- linkages in Green Growth

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# COUNTRY OVERVIEW

- **Terrain**
  - Land locked
  - 70% mountainous
  - Area of 236,800 km<sup>2</sup>; more than 90% located in Mekong river basin.
- **Population**
  - 6.2 million, 1.2 million HHs
  - 73% in rural areas
- **Energy Resources**
  - Hydropower (18,000 MW potential, excluding Mekong river)
  - Solar and biomass



# Government has systematically advanced the process of industrialization and modernization of Lao PDR following the liberation in 1975

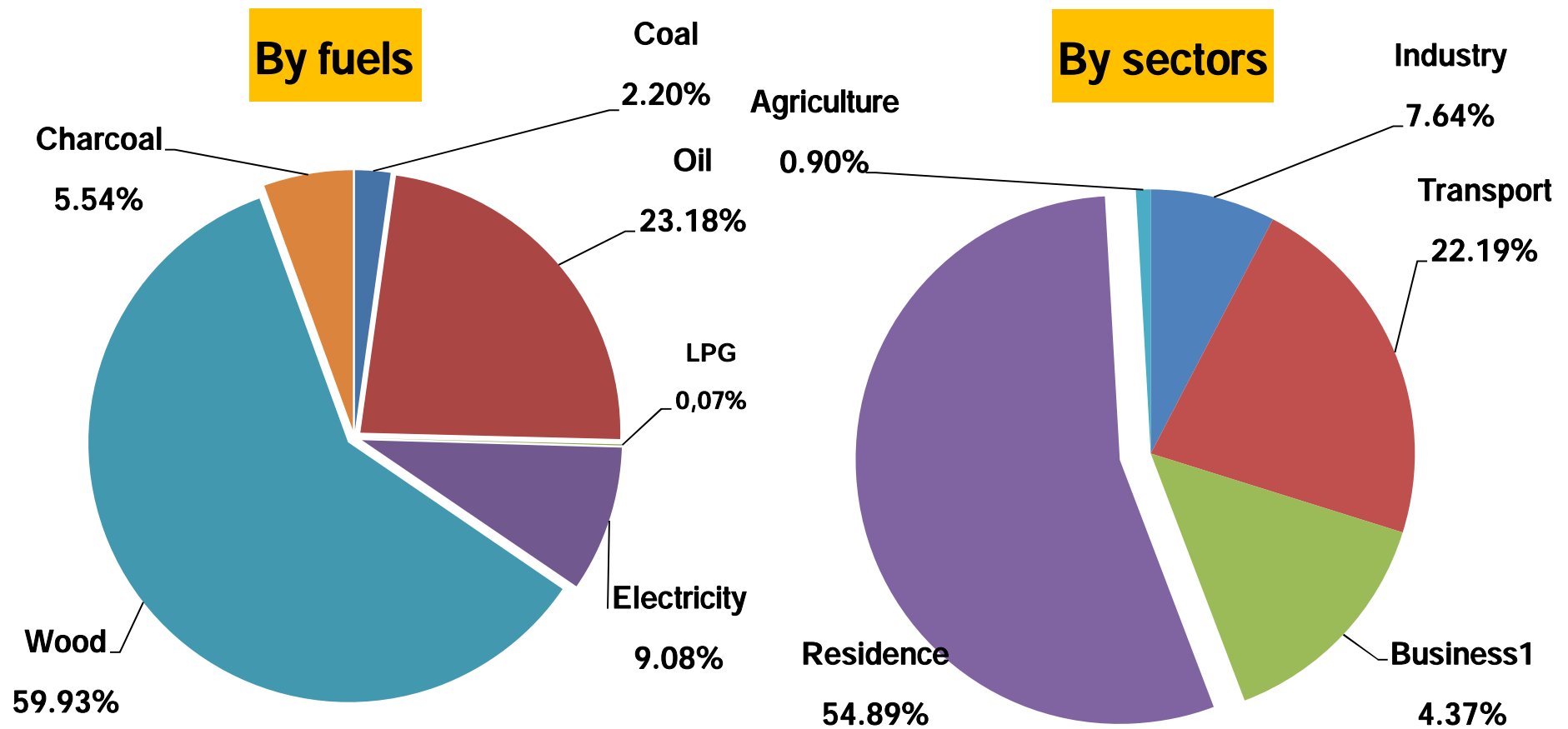
- 1986 - policy to steer from centrally planned system to market based economy. Subsequently Govt. introduced development programs anchored by ambitious targets
  - National Growth and Poverty Eradication Strategy (NGPES)
  - Periodic National Socioeconomic Development Plans (2001-2005-2010)
- Targeted poverty alleviation projects in 47 poorest districts
- Graduate from the least-developed country grouping by 2020



# Power Sector

- Electrification ratio reached 80% or 1,060,413 households in 2012, increased from 19% in 1996; *87% in 2014*
- Per Capita Electricity Consumption of 470 kWh/a but has been growing at an average rate of more than 10% in the last 15 years;
- Electricity export ~ 15% of total country's export revenues; Power sector's contribution to GDP is projected to increase to ~16% in 2020;
- Installed capacity is 3,200 MW in 2012 and will be 12,500 MW in 2020, substantially all hydro and about 85% is planned for export;

# Energy Consumption (2010): 2,313 KTOE





# Energy consumption trend

| Sector-wise Demand | 2010 | 2025 |
|--------------------|------|------|
| Total (M toe)      | 2.4  | 6.4  |
| • Industry         | 10%  | 31%  |
| • Transport        | 23%  | 29%  |
| • Residential      | 52%  | 29%  |
| • Commercial       | 14%  | 10%  |
| • Agriculture      | 1%   | 1%   |

## Primary Energy Supply Sources

|                     |     |     |
|---------------------|-----|-----|
| • Firewood/Charcoal | 47% | 26% |
| • Petroleum         | 19% | 18% |
| • Hydropower        | 19% | 12% |
| • Coal              | 11% | 38% |
| • Others            | 4%  | 6%  |

Remark: Domestic Power Demand in 2025 is estimated to be ~3,400 Mw while Export would be ~ 80% of total generation

# RE POTENTIAL AND PLANNED

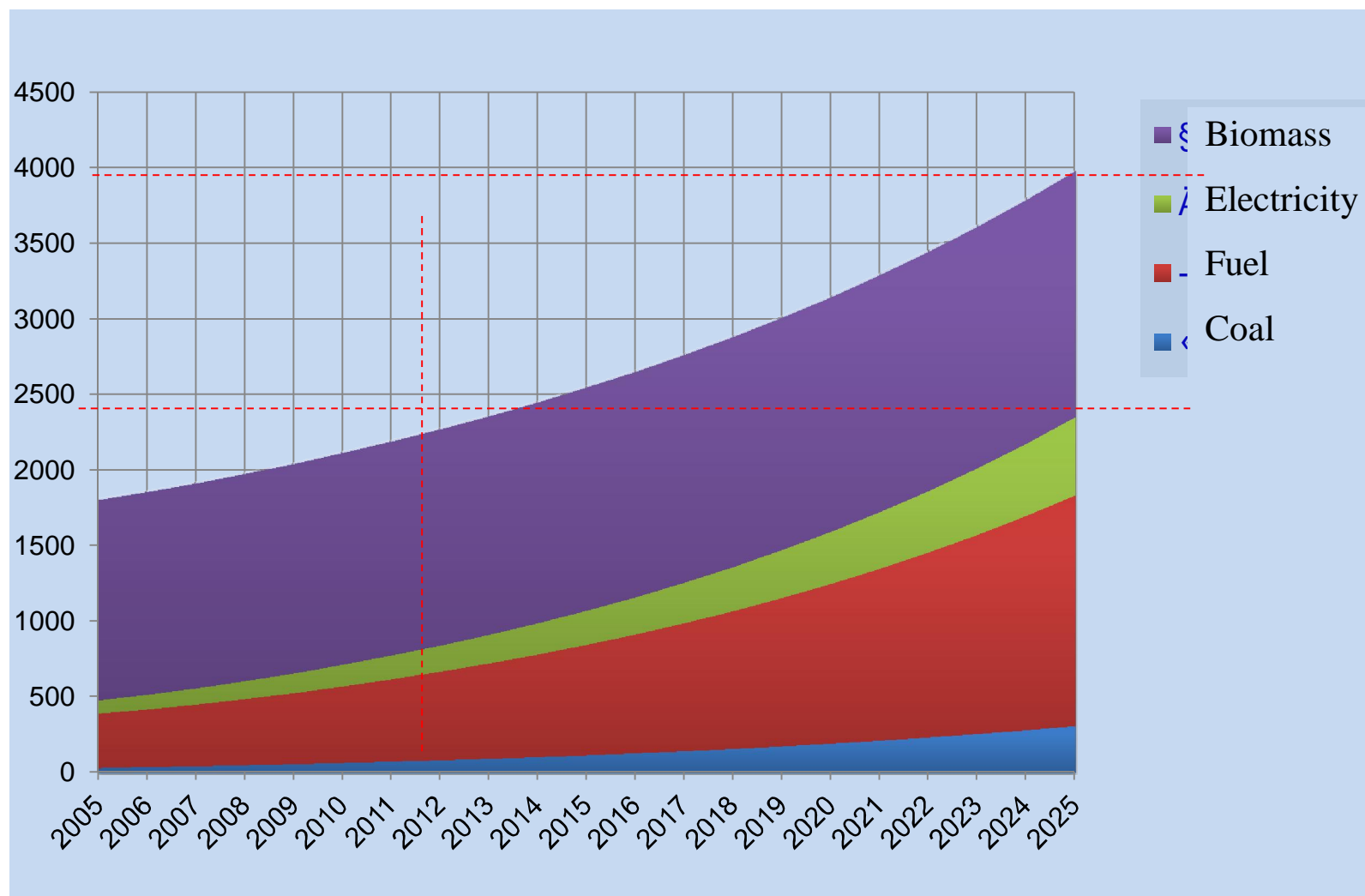
| No       | RE TYPE               | Potential   | Existing    | Target 2010-2015 |      | Target 2016-2020 |      | Target 2021- 2025 |            |
|----------|-----------------------|-------------|-------------|------------------|------|------------------|------|-------------------|------------|
|          |                       | MW          | MW          | MW               | Ktoe | MW               | Ktoe | MW                | Ktoe       |
| <b>A</b> | <b>Electricity</b>    |             |             | <b>140</b>       |      | <b>243</b>       |      | <b>728</b>        | <b>416</b> |
| 1        | Small Hydropower      | 2,000       | 12          | 80               | 51   | 134              | 85   | 400               | 256        |
| 2        | Solar                 | 511         | 1           | 22               | 14   | 36               | 23   | 33                | 21         |
| 3        | Wind                  | >40         |             | 6                | 4    | 12               | 8    | 73                | 47         |
| 4        | Biomass               | 938         |             | 13               | 8    | 24               | 16   | 58                | 37         |
| 5        | Biogas                | 313         |             | 10               | 6    | 19               | 12   | 51                | 33         |
| 6        | Municipal Solid Waste | 216         |             | 9                | 6    | 17               | 11   | 36                | 23         |
| 7        | Geothermal            | 56          |             |                  |      |                  |      |                   |            |
| <b>B</b> | <b>Biofuels</b>       | <b>ML</b>   | <b>ML</b>   | <b>ML</b>        |      | <b>ML</b>        |      | <b>ML</b>         |            |
| 1        | Ethanol               | 600         |             | 10               | 7    | 106              | 178  | 150               | 279        |
| 2        | Biodiesel             | 1,200       | 0.01        | 15               | 13   | 205              | 239  | 300               | 383        |
| <b>C</b> | <b>Thermal Energy</b> | <b>Ktoe</b> | <b>Ktoe</b> |                  |      |                  |      |                   |            |
| 1        | Biomass               | 227         |             |                  | 23   |                  | 29   |                   | 113        |
| 2        | Biogas                | 444         |             |                  | 22   |                  | 44   |                   | 178        |
| 3        | Solar                 | 218         |             |                  | 17   |                  | 22   |                   | 109        |



## 2. DEVELOPMENT TREND

- Energy demand increase at **3.6%** a year (**1.8 MTOE** in 2005 → **3.9 MTOE** in 2025)
- Traditional Biomass Consumption (Fuel Wood, Charcoal) declines from **77.8%** in 2005 and **38.5%** in 2025
- Energy demand in industrial sector increase at **8%** a year, from percent share **6.1%** in 2005 and **17%** in 2025
- Transportation sector grows at **6.8%**. Fuel demand increase **5%** a year which reach **1,174 million liters** in 2025 (**45%** gasoline).

# - Energy Demand Projection in Lao PDR by 2025 (kTOE)





## Energy consumption trend

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Remark: Domestic Power Demand in 2025 is estimated to be ~3,400 Mw while Export would be ~ 80% of total generation

# - CHALLENGES

- INDUSTRIALIZATION;
- URBANIZATION;
- EMPLOYMENT AND INCOME GENERATION;
- MILLENNIUM DEVELOPMENT GOALS;
- DEPENDENCY ON DONORS/FOREIGN INVEST;
- POLICY ISSUES AND STRATEGY;
- INSTITUTIONS AND CAPACITY BUILDING.

# - GOL POLICY APPROACHES

- PRIORITY TO ALTERNATIVE/RE ENERGY DEVELOPMENT FOR: SOCIAL ASPIRATIONS AND MICRO/ MACRO ECONOMIC DEVELOPMENT;
- MAINTAIN AND EXPAND AN AFFORDABLE, RELIABLE AND SUSTAINABLE ENERGY SUPPLY;
- PROMOTE ENERGY FOR EXPORT TO GENERATE REVENUE TO MEET DEVELOPMENT OBJECTIVES

# - OBJECTIVES OF RE STRATEGY

## 1. ADEQUATE ENERGY SUPPLY:

- Promote cultivation of fuel crops
- Production of bio-fuel as main energy (reduce imported fossil fuels)

## 2. BENEFITS FOR NATIONAL ECONOMY:

- Improve production;
- Increase income generation;
- Develop the renewable energy industry; and
- Create more employment opportunities .

# - OBJECTIVES (CONTD)

## **3. POVERTY ERADICATION**

- ensure social equality and enhance the equality of all ethnic groups
- decrease the disparity between those rural and urban people, and
- promote gender equality, especially for women in rural areas

## **4. ENVIRONMENTAL PROTECTION:**

- protect the environment
- reduce green house effects by replacing non-renewable energy with renewable and alternative sources.

## - GOALS

- INCREASE RE USE TO 30 % (OF NATIONAL DEMAND)BY 2025 (BIO-FUEL PRODUCTION TO ACCOUNT 10 %)
- ELECTRIFICATION OF HOUSEHOLDS TO ATTAIN 90 % BY 2020.



# - Renewable Energy Development Plan



Target: increase RE use to 30 % (of national demand) by 2025 (bio-fuel production to account 10 %)

| Solar+ Wind<br>106 MW |        | SHP      | Bio-Energy |       |           | Biofuels (ML) |  |
|-----------------------|--------|----------|------------|-------|-----------|---------------|--|
| Solar 33 MW           | 400 MW | Biomass  | Biogas     | Waste | Ethanol   | 150           |  |
| Wind 73 MW            |        | 58 MW    | 51 MW      | 36 MW | Biodiesel | 300           |  |
|                       |        | 113 ktoe | 178 ktoe   | -     |           |               |  |

# Renewable Energy Development Plan 2010-2025

## Short-Term: 2010-2015

- Develop legal documents (laws, regulations and guidelines);
- Study development models;
- Market assessment and energy source studies
- Integrated rural energy planning;
- Develop model projects, capacity building and raising awareness on renewable energy technology;
- Financing and marketing at both national and local levels.

# Renewable Energy Development Plan 2010-2025 (CONTD)

## Mid-Term: 2016-2020

- Formulate a **clear framework** for a midterm program (through focus on increased competition)
- Support the **full development** of renewable energy: biodiesel and bio-ethanol production from crops, production of biomass, biogas for household use and industrial purposes at community level;
- **Increased competition** and reduced dependency

# Renewable Energy Development Plan 2010-2025 (CONTD)

## Long Term: 2021-2025

- Promote new, economically viable, renewable energy technologies and encourage full competition based on equality;

# ESTIMATED INVESTMENTS

| ITEM                                | PHASE                           | 2015       |                | 2020       |                 | 2025       |                 |
|-------------------------------------|---------------------------------|------------|----------------|------------|-----------------|------------|-----------------|
|                                     | DESCRIPTION                     | MW         | Mil.US         | MW         | Mil.            | MW         | Mil.            |
| <b>1</b>                            | <b>ELECTRICITY</b>              | <b>140</b> | <b>491</b>     | <b>243</b> | <b>1105</b>     | <b>725</b> | <b>1799</b>     |
| 1.1                                 | Small hydropower                | 80         | 288            | 134        | 629             | 400        | 1010            |
| 1.2                                 | Solar                           | 22         | 41             | 36         | 90              | 48         | 144             |
| 1.3                                 | Biomass                         | 13         | 24             | 24         | 52              | 58         | 72              |
| 1.4                                 | Biogas                          | 10         | 21             | 19         | 45              | 51         | 192             |
| 1.5                                 | Municipal Solid waste           | 9          | 48             | 17         | 105             | 36         | 168             |
| 1.6                                 | Wind                            | 6          | 55             | 12         | 120             | 73         | 168             |
| <b>2</b>                            | <b>Biofuels</b>                 | <b>ML</b>  | <b>Mil.USD</b> | <b>ML</b>  | <b>Mil. USD</b> | <b>ML</b>  | <b>Mil. USD</b> |
| 2.1                                 | Ethanol                         | 2          | 5              | 41         | 33              | 79         | 63              |
| 2.2                                 | Biodiesel                       | 2          | 9              | 50         | 33              | 79         | 63              |
| <b>3</b>                            | <b>Research and Development</b> |            | <b>56</b>      |            | <b>10</b>       |            | <b>17</b>       |
| <b>Total</b>                        |                                 |            | <b>491</b>     |            | <b>1105</b>     |            | <b>1799</b>     |
| <b>Public Investment</b>            |                                 |            | <b>5</b>       |            | <b>10</b>       |            | <b>17</b>       |
| <b>Public Enterprise Investment</b> |                                 |            | <b>10</b>      |            | <b>22</b>       |            | <b>36</b>       |
| <b>Business Investment</b>          |                                 |            | <b>476</b>     |            | <b>1073</b>     |            | <b>1746</b>     |

# BENEFITS

## Economic

- reduction of fossil fuel imports;
- promotion of private sector investments;
- creation of employment opportunities in related industries
- generation of added income through carbon financing
- reduction of public investments
- increased economic growth from development of the industrial biofuels sector.

# BENEFITS (CONTD)

## Social

- additional job opportunities in rural areas resulting in less migration into cities;
- improvement in living standards.

## Environment

- reduced emissions of environmental pollutants
- reduce emission of green house gases.

# BENEFITS (CONTD)

| Item | Description  | 2010-15 | 2016-20 | 2021-25 | Total |
|------|--|---------|---------|---------|-------|
| I    | <b>Total Investment (Mil. USD)</b>                     | 262     | 743     | 1693    | 2698  |
| 1.1  | Public   | 3       | 7       | 15      | 25    |
| 1.2  | Public Enterprise                                      | 5       | 15      | 34      | 54    |
| 1.3  | Private  | 255     | 472     | 1644    | 2619  |
| II   | <b>Financial benefits</b>                              |         |         |         |       |
| 2.1  | Reduction of fossil fuel imports (Ktoe)                | 61      | 105     | 199     | 365   |
| 2.2  | Reduction of fossil fuel purchase (Ktoe)               | 42      | 72      | 137     | 251   |
| III  | <b>Reduction of public investments on power sector</b> |         |         |         |       |
| 3.1  | Reduction in public expenditure (million dollars)      | 219     | 478     | 770     | 1468  |
| IV   | <b>Reduction of GHG</b>                                |         |         |         |       |
| 4.1  | Million Tons   | 5       | 31      | 73      | 109   |
| 4.2  | Value (Million dollars)                                | 19      | 125     | 291     | 436   |



# 3. IMPLEMENTATION MEASURES

## 1. INSTITUTIONAL ARRANGEMENT

- Ministry of Energy and Mines (MEM)
- Ministries Concerns;
- Local Authorities

## 2. Driving Measures To Kick-start Short Term Implementation

- Identify promotion policies (Establish appropriate incentive policies)
- Promotion on research and studies
- Human resource capacity building, awareness raising and public relations

# IMPLEMENTATION MEASURES (CONDT)

## 3. Important Factors For Successful Implementation

- Define renewable energy into national agenda (integrated into socio-economic development plan of the government...);
- Financial Appropriate Policy (Feed in Tariff, Risk Warranty, Loans, Tax...)

# 4. ROAD MAP

## Road Map for implementing up to 2025

- Promotion and Development of Biodiesel- B10
- Promotion and Development of Bio-ethanol - E10
- Promotion and Development of Small Hydropower-
  - Introduce simplified procedures for small hydropower below 15 MW.
  - Provide financial incentives to small hydropower investors
- Upscale grid connected solar PV program.
- Upscale medium and large scale biogas systems.
- Develop biomass-based IPPs.
- Develop Wind IPPs- Target development of 50 MW by 2025.

## 5. SUMMARY AND RECOMMENDATIONS

- Renewable Energy Development should focus on simple appropriate technology and utilize existing potential in country: Hydropower, Solar, Biomass, Wind Power;
- Create appropriate promotion policy and incentives for attracting investments;
- Provide investment risk warranty through a Renewable Energy Fund;

## SUMMARY AND RECOMMENDATIONS (CONTD)

- Encourage people to participate in the development, production, use and management;
- Establish standard prices of renewable energy, which correspond to economic and technological conditions;
- Support research and development of renewable energy through the allocation of a budget and cooperation with stakeholders or donors;
- Collaborate with stakeholders to amend laws/regulations that facilitate the investment in renewable energy.

# THANK YOU

