Life Cycle Assessment of the framework of Cyprus Energy Policy

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PRESENTATION CONTENTS

1. PURPOSE
2. METHODS
3. RESULTS
4. CONCLUSIONS
• Energy is necessary for life and development
• Energy is connected to impacts to the environment and the society throughout its life cycle
• Energy is connected to economic growth and prosperity.
• Energy is a key element of sustainable development
• Energy policy is important to minimize negative impacts and maximize benefits.
• Cyprus faces challenges for its energy future
PURPOSE

➢ To investigate the Life Cycle framework of the Cyprus Energy Policy

➢ To detect suitable sustainability indicators for Life Cycle assessment of the island’s Energy Policy
LCA is a standardized technique that:

“addresses the environmental aspects and potential environmental impacts (e.g. use of resources and the environmental consequences of releases) throughout a product's life cycle from raw material acquisition through production, use, end-of-life treatment, recycling and final disposal (i.e. cradle-to-grave)” (ISO 14040:2006)
METHODS

Life Cycle Assessment (LCA)

Source: ISO 14040 : 2006
Widely used tools for sustainability measurements

Energy planning assessment tool

Able to cover

- economic,
- social and
- environmental issues
METHODS

LCIA

indicators

detection

method
LIFE CYCLE ASSESSMENT

Area under study

Source: Google maps and (PIO, 2019)
LIFE CYCLE ASSESSMENT GOAL AND SCOPE

System boundaries

Cyprus Energy Policy Framework

Energy sources supply / extraction  Energy production  Energy use
CYPRUS ENERGY POLICY LIFE CYCLE INVENTORY

Policy axes

- Healthy competition
- Energy supply ensuring
- Energy needs satisfaction with the minimum burden to economy and environment

- Electricity and gas market liberalization.
- Oil market liberalization
- Oil stock terminals creation.
- Development and use of energy saving technologies.
- Domestic Renewable Energy Sources exploitation.
- Protection of the environment from industrial pollution.
- Use of more friendly to the environment energy forms e.g. natural gas

source: EAC, 2019
Cyprus 2020 Energy targets

- 5% less greenhouse gas emissions compared to 2005 levels
- 2,2 Mtoe energy consumption reduction by energy efficiency
- 13% of gross final energy consumption from renewable sources

Source: EC, 2019
Cyprus Energy System

- Renewable energy
- Imported fuel transportation and supply
- Fuel storage
- Indigenous reserves exploration
- Infrastructure operation
- Indigenous fossil fuel reserves extraction and supply

Cyprus Energy System

- Electricity generation (fossil fuel)
- Buildings heating, water heating (fossil fuel)
- Industrial use (fossil fuel)
- Cooking (fossil fuel)
- Electricity generation (RES)
- Buildings heating, water heating (RES)
- Transportation and movements (fossil fuel)

Outputs:
- Power
- Waste
- Emissions
- Indigenous fossil fuel exports

Future options
CYCLE INVENTORY

Cyprus Energy balance 2017

source: EUROSTAT, 2019
Presentation and Geographical Distribution of Licences for RES Units by 2016 (CERA, 2017)
Sankey Diagram for the overall electricity generation in 2016 (CERA, 2017)
Hydrocarbons Exploration licenses and licensed companies map (Hydrocarbons Service, 2018)
Energy policy impacts

Social
- Employment
- Energy poverty
- Health and safety
- Security
- Social objections

Economic
- Economic growth
- Energy cost
- Dutch Disease
Environmental impacts of energy policy include:

- Air pollution
- Climate change
- Water / Soil contamination
- Dust
- Environmental accidents
- Visual nuisance
- Noise
- Waste (solid/liquid)
- Land use
- Smell
- Impacts on Flora & Fauna
- Use of sources

Energy policy impacts also affect:

- Flora & Fauna
- Environmental accidents
- Land use
- Smell

This diagram illustrates the various environmental impacts associated with energy policy and the need for a comprehensive inventory to assess these effects.
Energy policy impacts by axis

- Dutch disease
- Social objections
- Economic growth
- Water / Soil contamination
- Energy poverty
- Security
- Dust
- Waste (solid/liquid)
- Environmental accidents
- Health and safety
- Energy needs ensuring with the minimum burden to economy and environment
- Healthy competition
- Energy cost
- Employment
- Land use
- Smell
- Impacts on Flora & Fauna
- Visual nuisance
- Air pollution
- Noise
- Use of sources
<table>
<thead>
<tr>
<th>Impact category</th>
<th>Indicator</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate change</td>
<td>Carbon Dioxide mass emitted</td>
<td>CO₂ Kg MWh⁻¹</td>
</tr>
<tr>
<td>Pollution (Air pollution &amp; water / soil contamination)</td>
<td>Emissions total mass</td>
<td>Kg MWh⁻¹</td>
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<tr>
<td>Waste (solid/sludge)</td>
<td>Total waste (solid/sludge) mass produced</td>
<td>Kg MWh⁻¹</td>
</tr>
<tr>
<td>Dust</td>
<td>Dust mass emitted</td>
<td>Kg MWh⁻¹</td>
</tr>
<tr>
<td>Smell</td>
<td>Smell related complaints</td>
<td>no MWh⁻¹</td>
</tr>
<tr>
<td>Land use</td>
<td>Occupied land for infrastructure</td>
<td>m² MWh⁻¹</td>
</tr>
<tr>
<td>Visual nuisance</td>
<td>Plant area</td>
<td>m² MWh⁻¹</td>
</tr>
<tr>
<td>Noise</td>
<td>Noise related complaints</td>
<td>no MWh⁻¹</td>
</tr>
<tr>
<td>Use of sources</td>
<td>Water use</td>
<td>m³ MWh⁻¹</td>
</tr>
<tr>
<td></td>
<td>Oil use</td>
<td>ltr MWh⁻¹</td>
</tr>
<tr>
<td>Impacts on flora and fauna</td>
<td>Species impacted</td>
<td>no MWh⁻¹</td>
</tr>
<tr>
<td>Environmental accidents</td>
<td>Number of environmental accidents</td>
<td>no MWh⁻¹</td>
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</tbody>
</table>
## LIFE CYCLE ASSESSMENT SUSTAINABILITY INDICATORS

<table>
<thead>
<tr>
<th>Impact category</th>
<th>Indicator</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>Employment</td>
<td>Work MWh⁻¹ positions</td>
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<tr>
<td>Employment</td>
<td>Employment needs*</td>
<td>Work MWh⁻¹ positions</td>
</tr>
<tr>
<td>Health and Safety issues</td>
<td>Health and Safety incidents</td>
<td>no MWh⁻¹</td>
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<tr>
<td>Social objections</td>
<td>Total number of complaints by the society</td>
<td>no MWh⁻¹</td>
</tr>
<tr>
<td>Energy poverty</td>
<td>No of electricity interruptions to households</td>
<td>no MWh⁻¹</td>
</tr>
<tr>
<td>Security</td>
<td>Energy by domestic sources *</td>
<td>MWh of domestic resources MWh⁻¹</td>
</tr>
<tr>
<td>Economic</td>
<td>Annual GDP difference*</td>
<td>€ MWh⁻¹</td>
</tr>
<tr>
<td>Economic growth</td>
<td>Mean price of energy</td>
<td>€ MWh⁻¹</td>
</tr>
<tr>
<td>Dutch disease</td>
<td>Domestic energy business sector turnover</td>
<td>€ MWh⁻¹</td>
</tr>
</tbody>
</table>

* The higher is preferable
CONCLUSIONS

- Cyprus is depended to energy imports
- The island has indigenous energy resources
- There are options for alternative energy policy scenarios
- Energy policy can be assessed by life cycle impact indicators
- Policy formulation could be based on this assessment results and connected targets
- Further work: LC indicators to be calculated for current and alternative policy scenarios
THANK YOU