Electricity in Vietnam: where does it come from, how to make it greener?

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Electricity in Vietnam: where does it come from, how to make it greener?

Dr. Minh Ha-Duong, CleanED/USTH, CIRED/CNRS

Officence, HCMC, July 2017
Clean Energy and Sustainable Development Lab

Founded in 2014, building a world-class interdisciplinary research team with the mission to contribute to the green growth of the energy sector in Vietnam and other South East Asian countries.

http://cleaned-usth.com
The University of Science and Technology of Hanoi

USTH created in 2010 with France

Vietnamese public New Model University

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1. Electricity in the energy system
2. Electricity and Sustainability
3. Renewable energies
1. Electricity in the energy system

Energy is the ability of a system to cause external action

- Energy can be converted to/from many forms
  - Mechanical energy - potential
  - Mechanical energy - kinetic
  - Thermal energy
  - Chemical energy
  - Nuclear energy
  - Solar energy
  - Electric energy
An energy carrier is a substance that could be used to produce useful energy, either directly or by one or several conversion processes.

Examples?
Primary energy carriers: substances which have not yet undergone any technical conversion.
Example: Crude oil. Wind. Incoming solar radiation.

Secondary energy carriers: produced from primary or other secondary energy carriers, either directly or by one or several technical conversion processes
Example: Gas, Electricity
Energy conversion chain

**Primary energy**
(e.g. hard coal, lignite, crude oil, natural gas, uranium, hydropower, solar radiation, forest wood)

- Conversion losses
- Distribution losses
- Self consumption
- Non-energetic consumption

**Secondary energy**
(e.g. coke, briquettes, gas, biodiesel, heating oil, power, wood logs, district heating)

- Conversion losses
- Distribution losses
- Self consumption
- Non-energetic consumption

**Final energy**
(e.g. briquettes, gas, heating oil, natural gas, power, wood chips, district heating)

- Conversion losses
- Distribution losses
- Self consumption
- Non-energetic consumption

**Useful energy**
(e.g. heat, power, light)

**Consumer losses**
Energy conversion in Vietnam (2014)
Power generation capacity of Vietnam by 2014

<table>
<thead>
<tr>
<th>Power source</th>
<th>Capacity (MW)</th>
<th>Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydropower</td>
<td>15,702.1</td>
<td>46.07</td>
</tr>
<tr>
<td>Coal fired power</td>
<td>9,759</td>
<td>28.64</td>
</tr>
<tr>
<td>Gas fired power</td>
<td>7,354.15</td>
<td>21.58</td>
</tr>
<tr>
<td>Oil fired power</td>
<td>1,154.5</td>
<td>3.39</td>
</tr>
<tr>
<td>Wind power and others</td>
<td>109</td>
<td>0.32</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34,080</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Development is sustainable when:
It meets the needs of the present generation without compromising the ability of future generations to meet their own needs
The three pillars: economy, environment, society

- **Economy.** Preservation of productive capacity for the foreseeable future.

- **Environment.** Biophysical sustainability means maintaining or improving the integrity of the life support system of earth

- **Society.** A dynamic harmony between the equitable availability of energy-intensive goods and services to all people and the preservation of the earth for future generations
Mauna Loa Observatory, Hawaii
Monthly Average Carbon Dioxide Concentration

Data from Scripps CO₂ Program   Last updated July 2017

CO₂ Concentration (ppm)

Year

Global carbon emissions

![Graph showing contributors to global carbon emissions over time. The graph illustrates the increase in emissions from different sources, including solid, liquid, gas, cement, and gas flaring.]

Global temperature change (1850–2017)

- 2.0°C
- 1.5°C
- 0.0°C

Baseline: 1850–1900

HadCRUT4.5
Global warming at your place

Daily temperature at TAN SON HOA VM (HCMC)

DATE

TAVG, degree C

How does energy use impact sustainability?

Some Benefits

- Energy is critical to human survival and development
- Fossil fuels are plentiful and convenient to use
- Energy is key to industrialization and transportation
- Energy facilitates economic growth and globalization

Some Problems

- Rapid growth in fossil fuel use raises concerns about:
  - Security of supply (over-dependence?)
  - Environmental impacts
  - Societal conflicts over inequitable distribution of resources
  - Depletion of critical resources
Global carbon emissions

Without more mitigation, global mean surface temperature might increase by 3.7° to 4.8°C over the 21st century.
Vietnam Generation Mix (SES, TWh)

- **SES Projection**

Graph showing the projected energy generation mix in Vietnam from 2010 to 2050, with categories including Coal, Diesel/FO, Hydro ROR, Hydro, Bio, Gas, Solar, Wind, and Ocean energy sources.
3. Renewable energies
Common aspects of renewable energy

- Wind, solar, geothermal and tidal energy are inexhaustible primary energy sources at the human timescale.

- The energy produced by the sun is responsible for most of other renewable energies (wind and hydropower) as well as renewable energy carriers (such as solid or liquid biofuels).

- Energy from waste is renewable only if it is of non-fossil origin (organic domestic waste, waste from the food processing industry).
Renewable energy: Advantages

• Non depletable
• Mostly everywhere
• Low CO2 and CH4 emissions
• Conserve water
Renewable energy: Disadvantages

- Variability (wind, solar)
- Low density, need space
- Capital-intensive, higher initial cost
- Visual, noise, smell impact
- Kills birds and bat (wind turbines, concentrated solar)
- Brine (geothermal energy)

- Wherever a large renewable facility is to be located, there will be perceived and real problems to the local people. There is the problem of “not in my backyard.”
By year’s end, renewables comprised an estimated 30% of the world’s power generating capacity and 24.5% of global electricity demand.
Solar potential 4-5 W / m²
Figure 3. Wind speed map of Vietnam for a height of 80 m.
What do you think about green electricity at Officience?