

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



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# 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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# Outline

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

# 1. Electricity in the energy system

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**Energy is the ability of a system to cause external action**

- Energy can be converted to/from many forms

Mechanical energy - potential

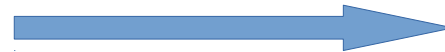
Mechanical energy - kinetic

Thermal energy

Chemical energy

Nuclear energy

Solar energy



Electric energy

# Energy carriers

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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 and secondary energy carriers

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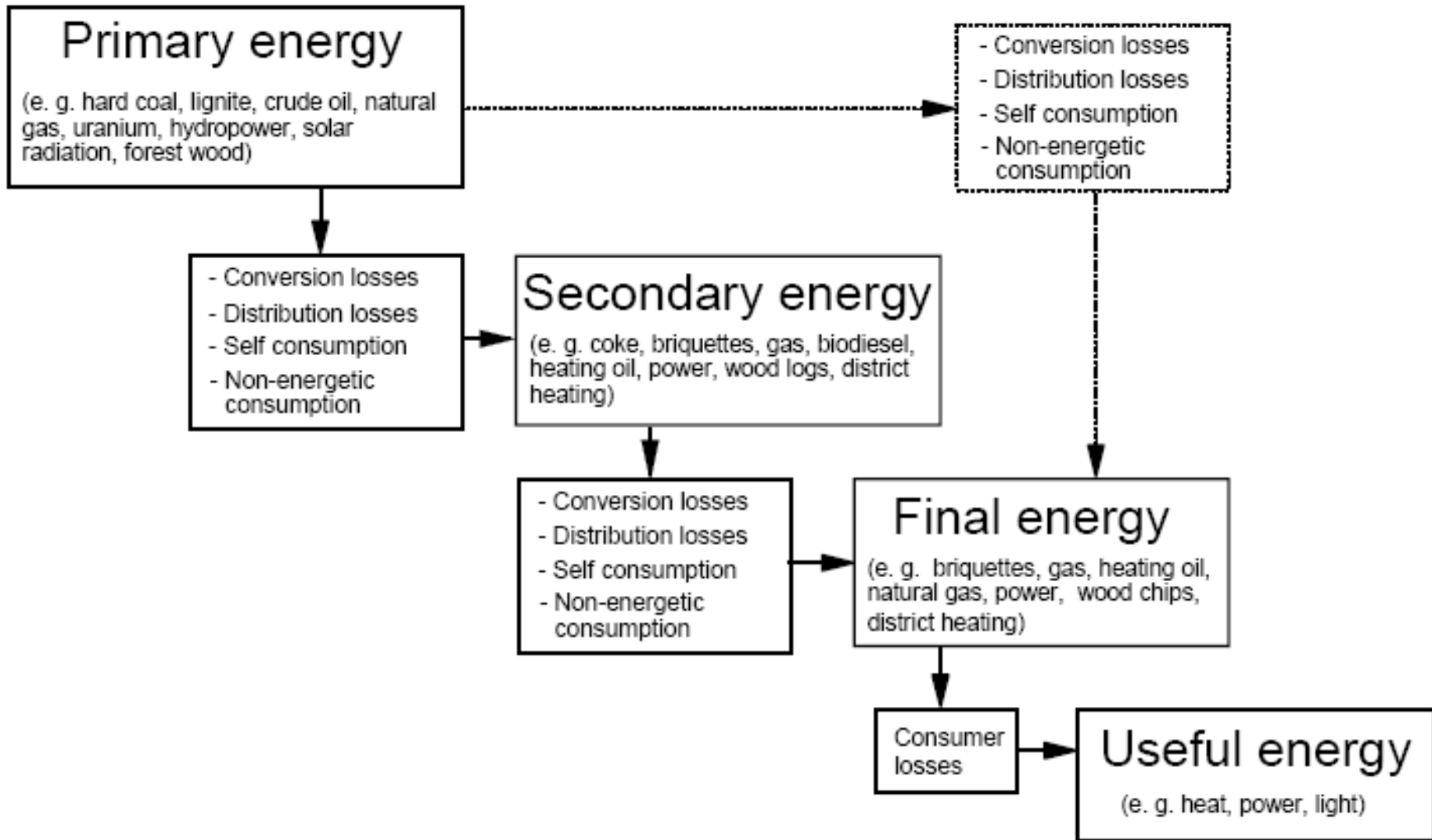
**Primary energy carriers:** substances which have not yet undergone any technical conversion.

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

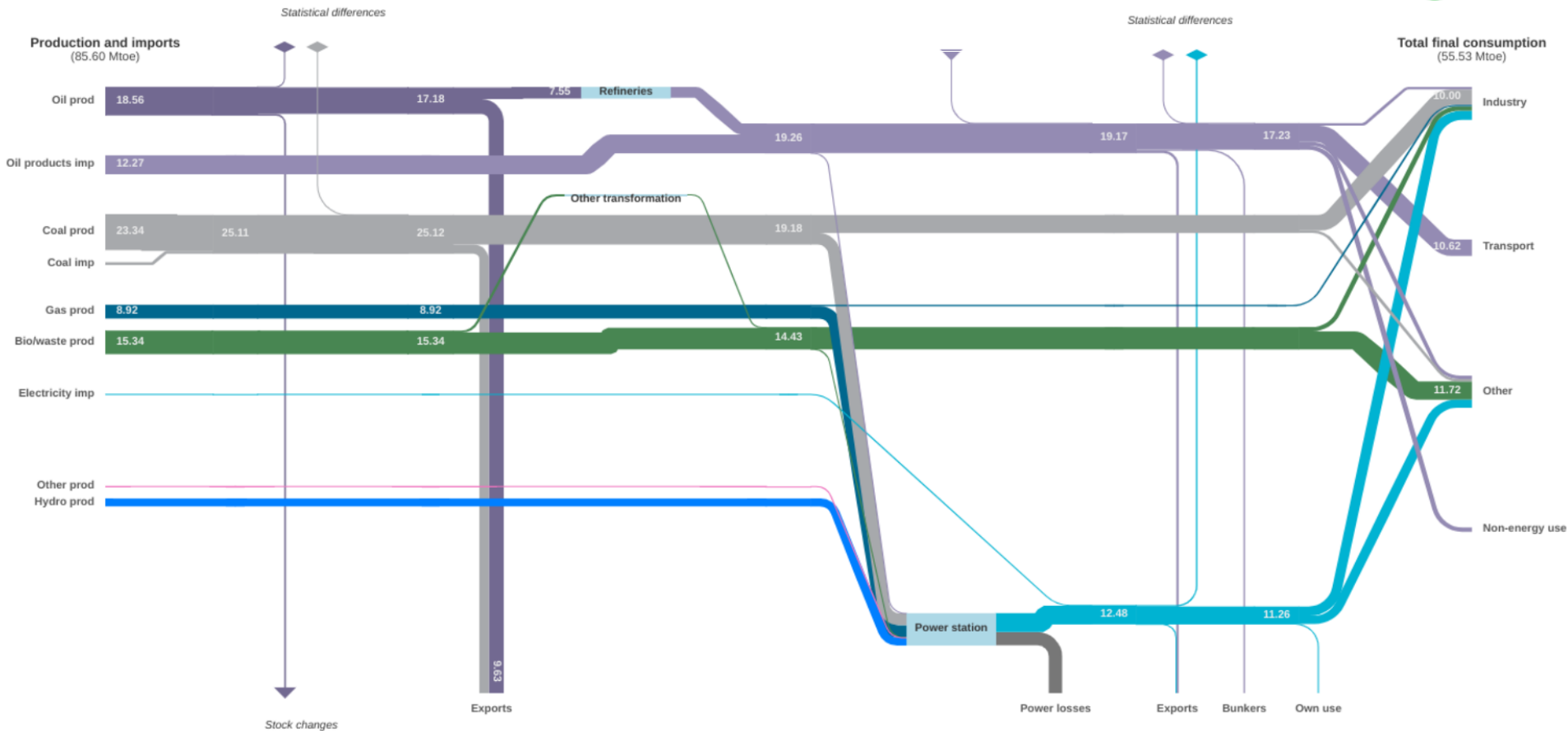
Example: Gas, Electricity

# Energy conversion chain



# Energy conversion in Vietnam (2014)

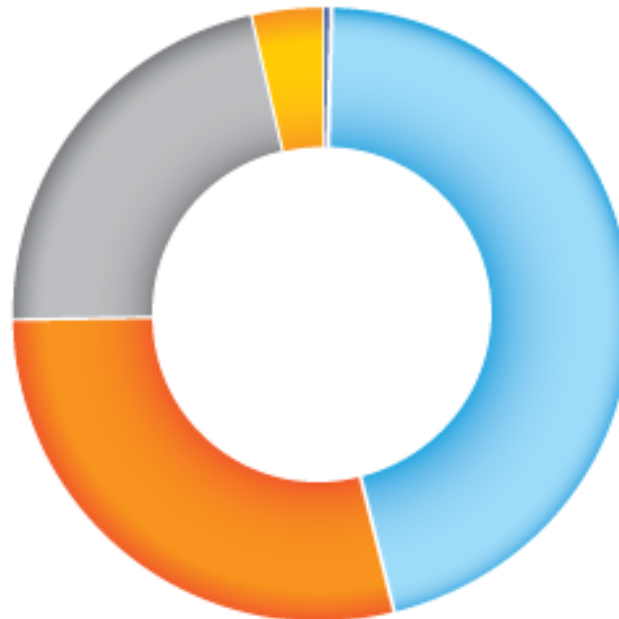
Millions of tonnes of oil equivalent ▼



# Power generation capacity of Vietnam by 2014

## Power generation by Installed Capacity

Power source	Capacity (MW)	Rate (%)
Hydropower	15,702.1	46.07
Coal fired power	9,759	28.64
Gas fired power	7,354.15	21.58
Oil fired power	1,154.5	3.39
Wind power and others	109	0.32
<b>Total</b>	<b>34,080</b>	<b>100</b>



## 2. Electricity and Sustainability

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Development is sustainable when:

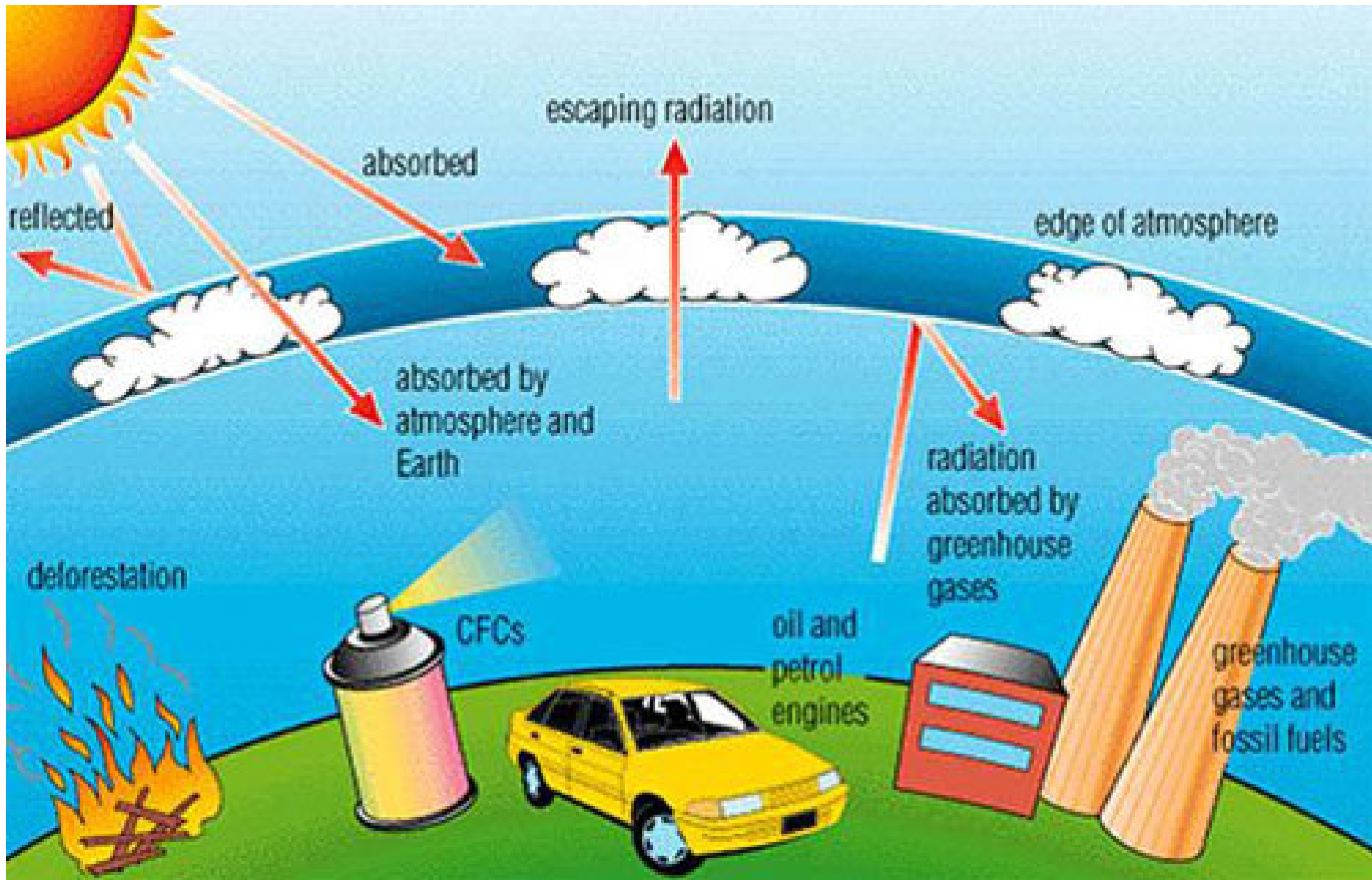
*It meets the needs of the present generation without compromising the ability of future generations to meet their own needs*

# The three pillars: economy, environment, society

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- **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

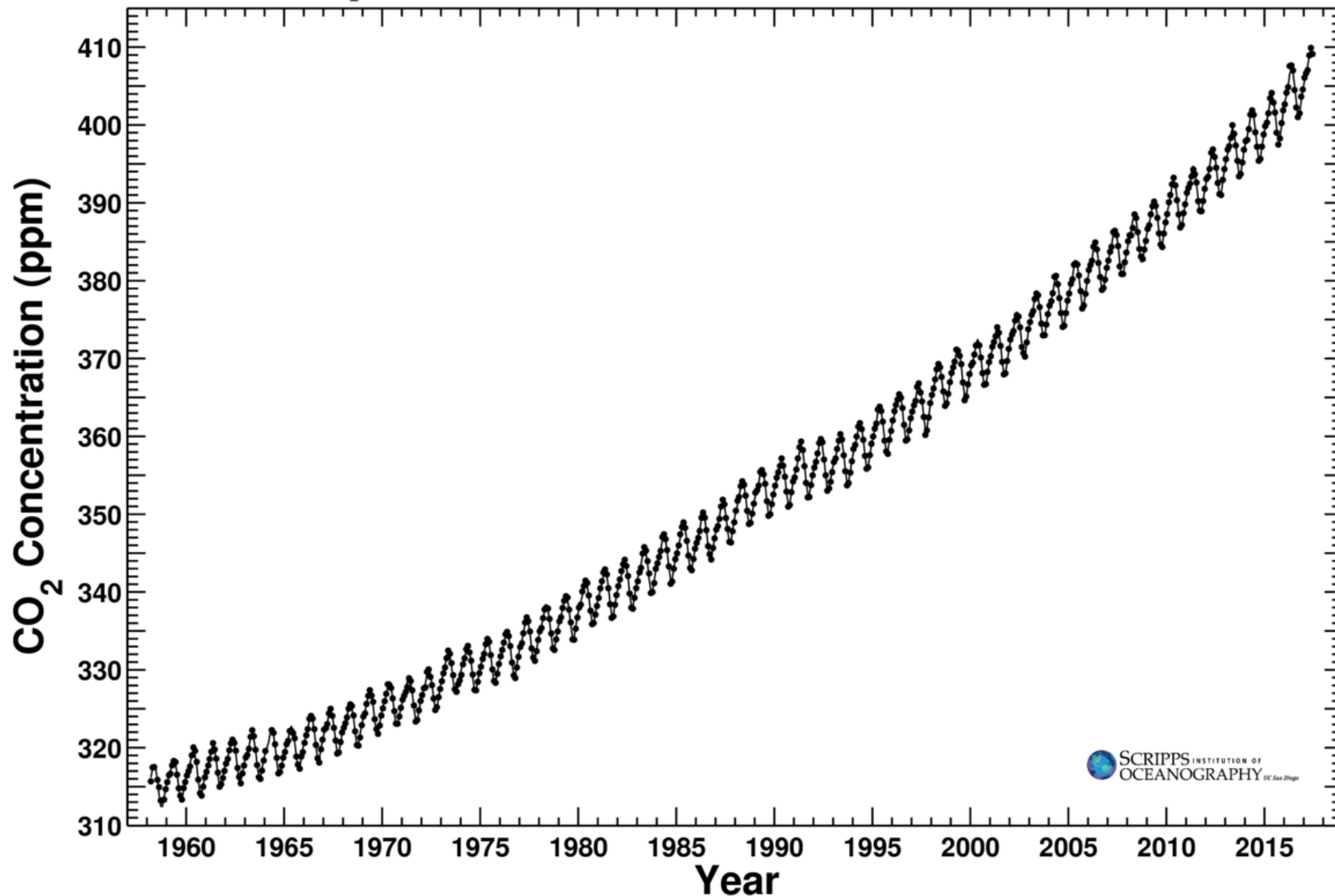
# Global warming



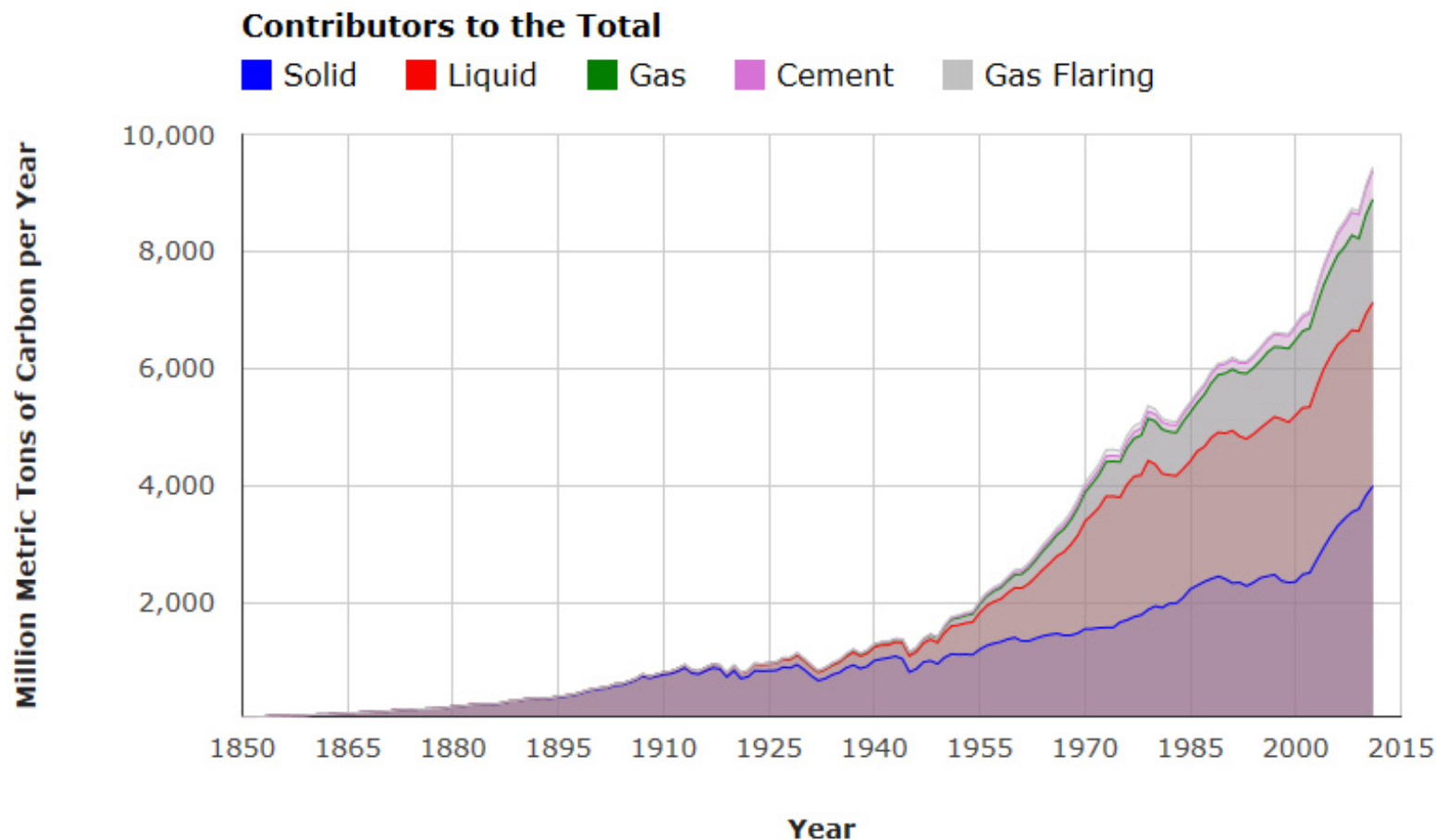
# Mauna Loa Observatory, Hawaii

## Monthly Average Carbon Dioxide Concentration

Data from Scripps CO<sub>2</sub> Program Last updated July 2017

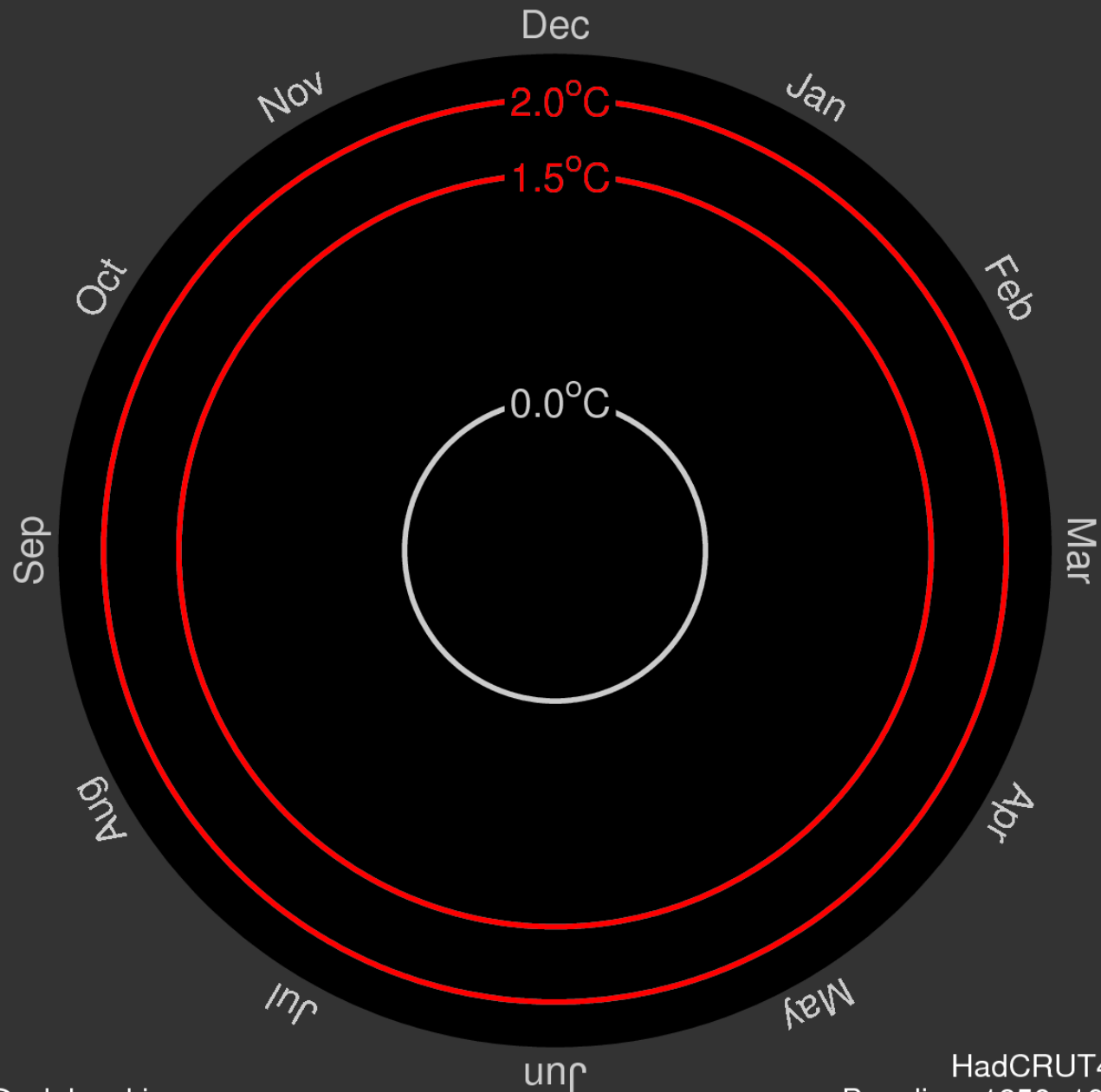


# Global carbon emissions

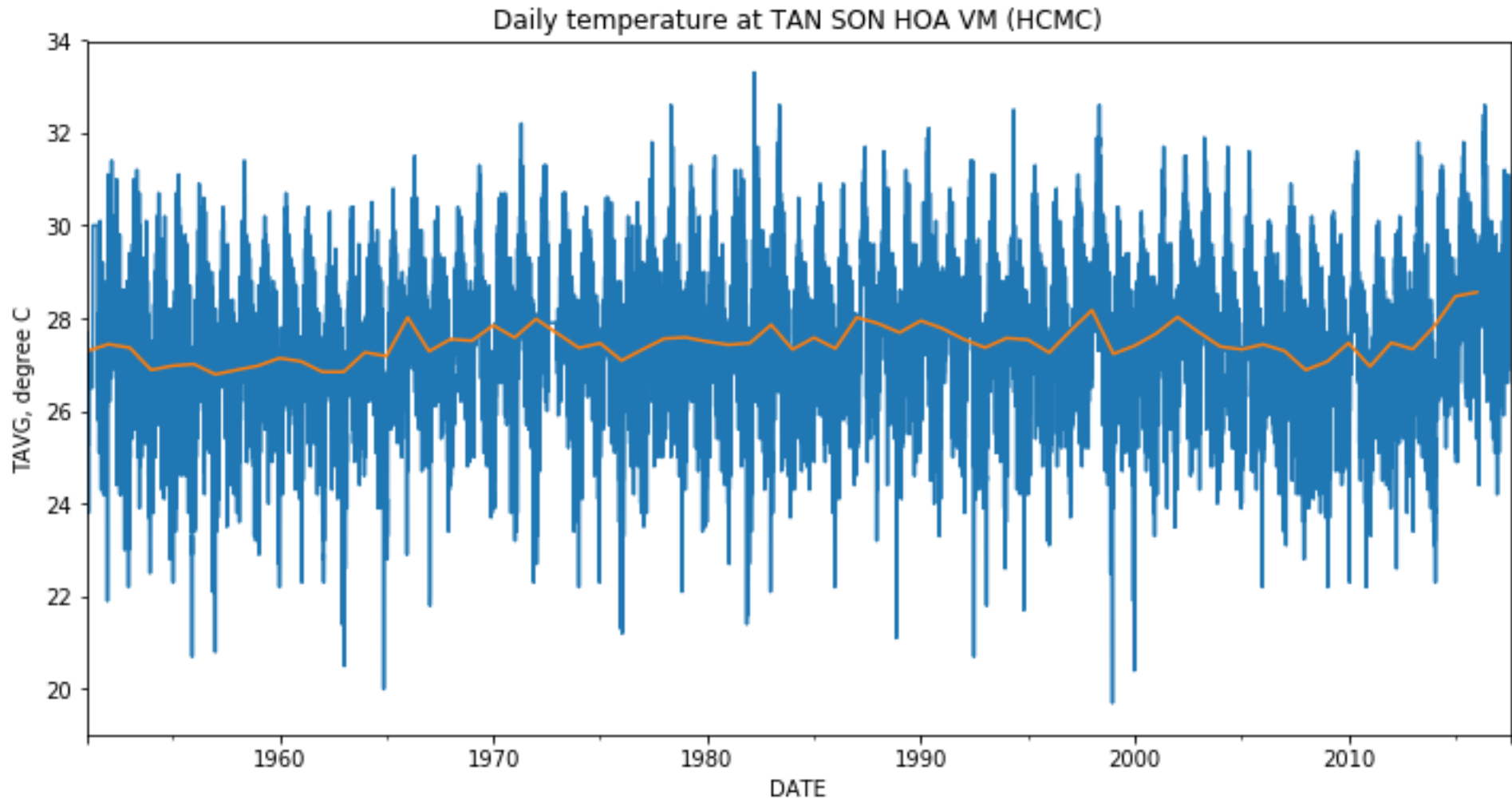


Source: Boden, T.A., G. Marland, and R. J. Andres. 2015. Global, Regional, and National Fossil-Fuel CO<sub>2</sub> Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A.  
doi: 10.3334/CDIAC/00001\_V2015.

# Global temperature change (1850–2017)



# Global warming at your place



# How does energy use impact sustainability?

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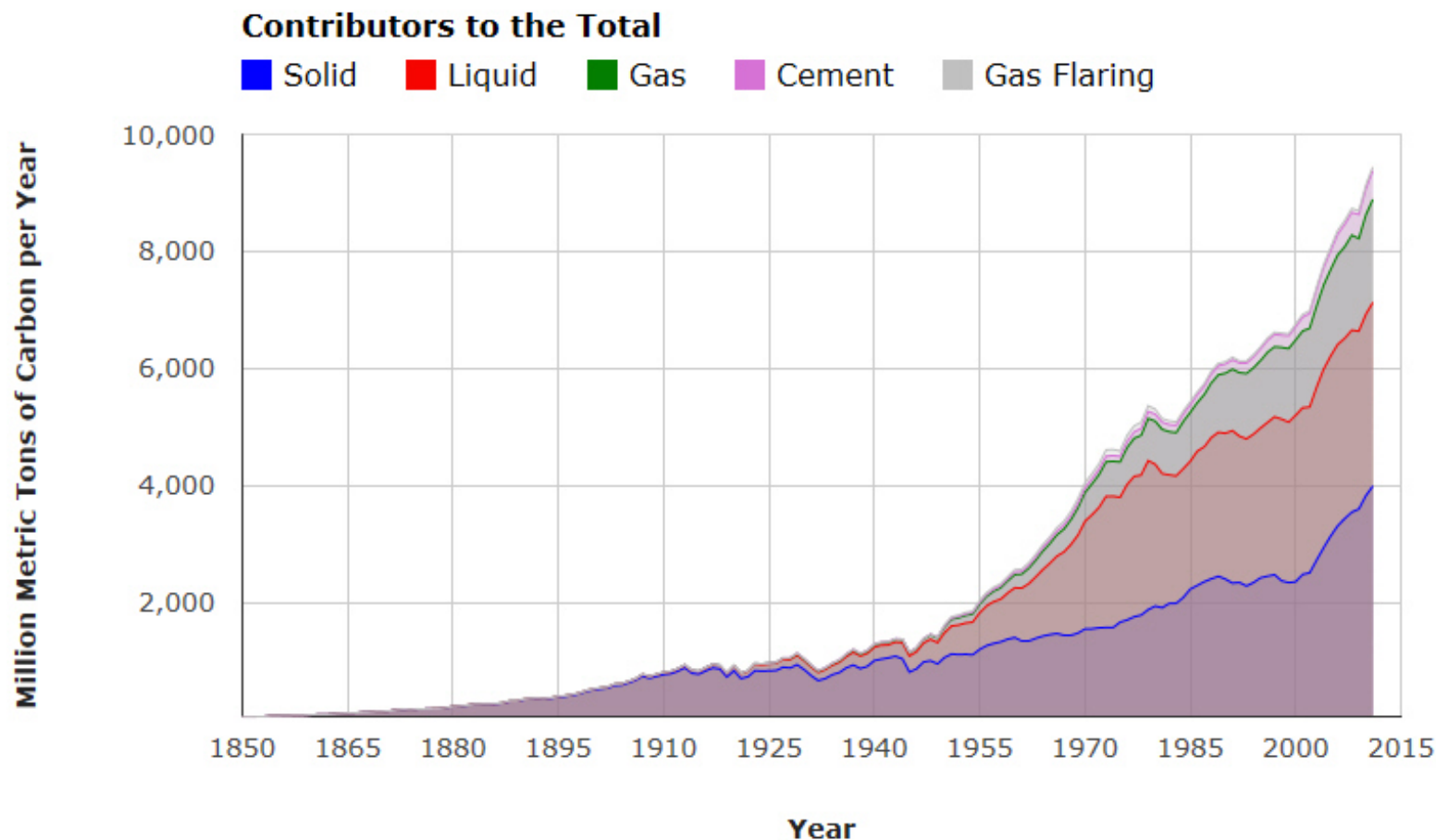
## **Some Benefits**

- 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

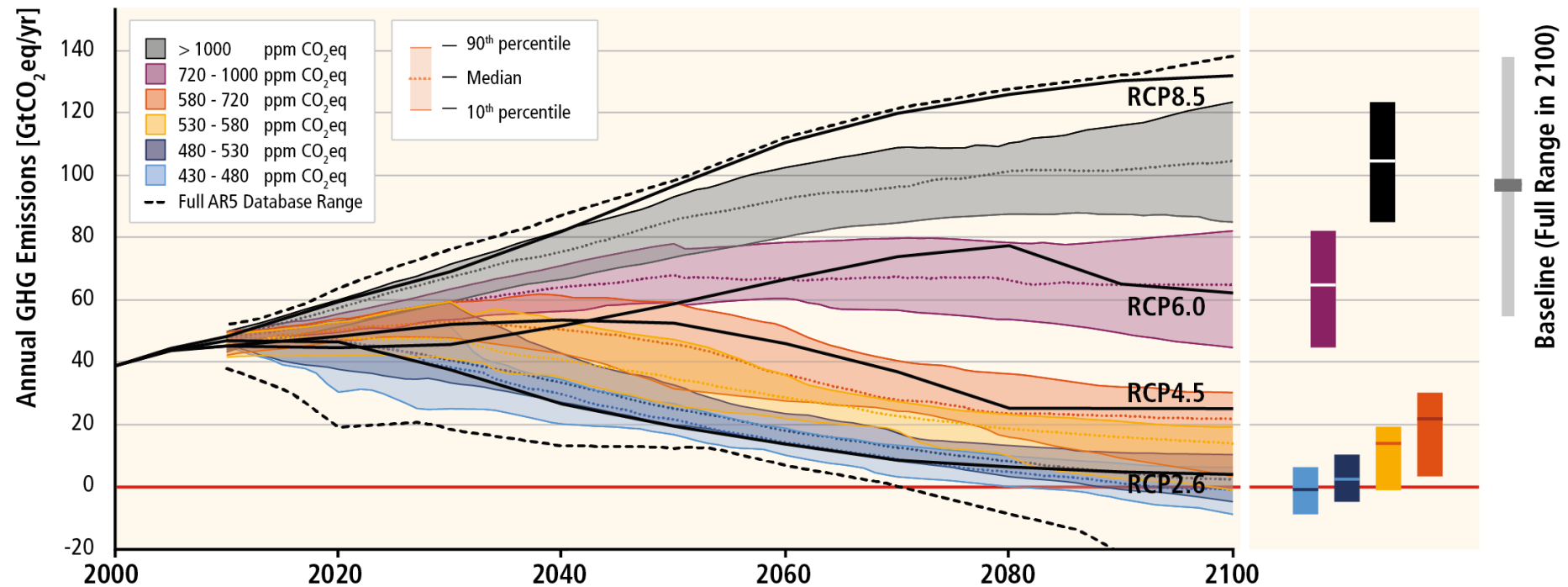
# Global carbon emissions



Source: Boden, T.A., G. Marland, and R. J. Andres. 2015. Global, Regional, and National Fossil-Fuel CO<sub>2</sub> Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A.  
doi: 10.3334/CDIAC/00001\_V2015.

# Without more mitigation, global mean surface temperature might increase by 3.7° to 4.8°C over the 21<sup>st</sup> century.

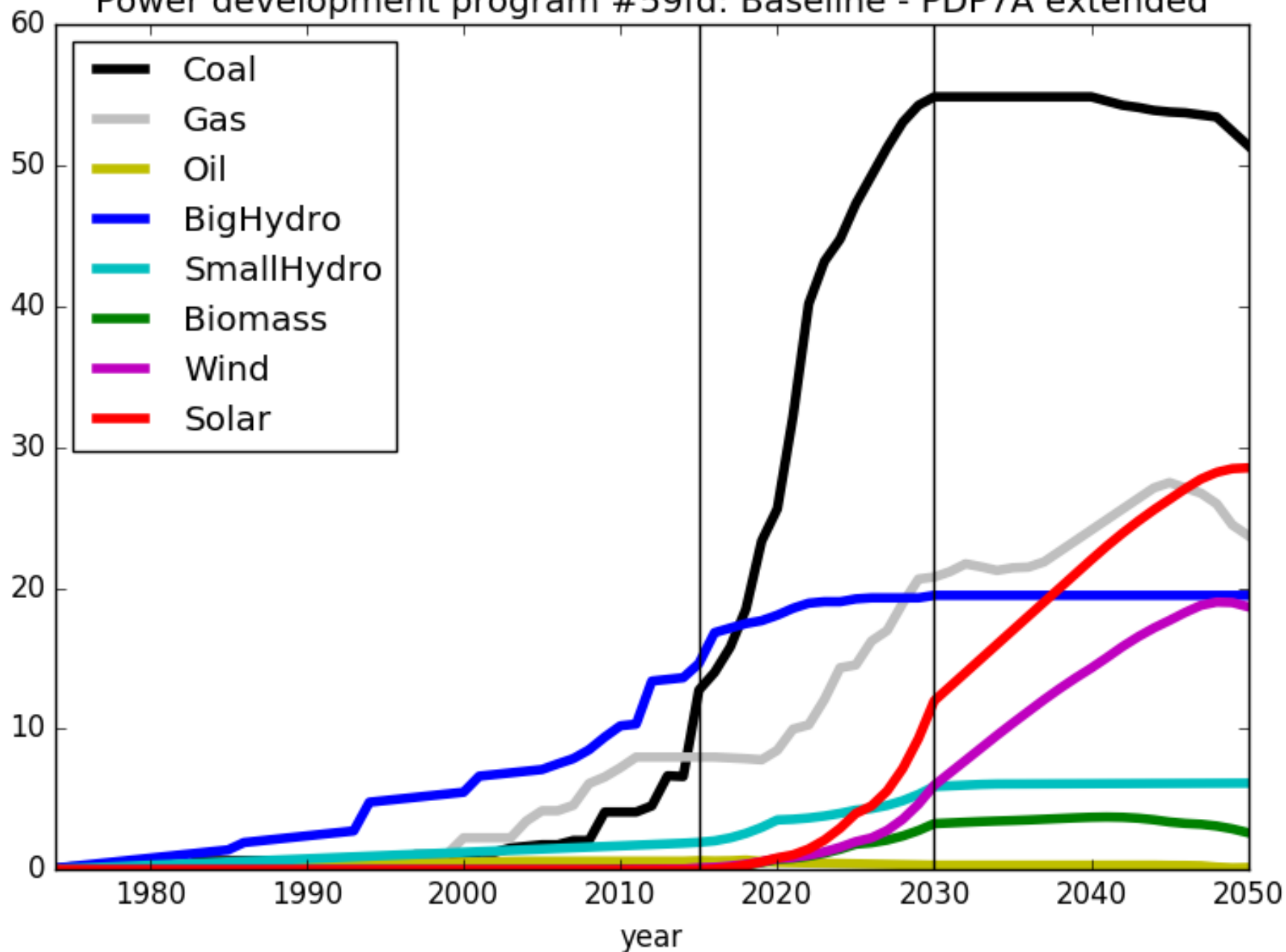
## GHG Emission Pathways 2000-2100: All AR5 Scenarios



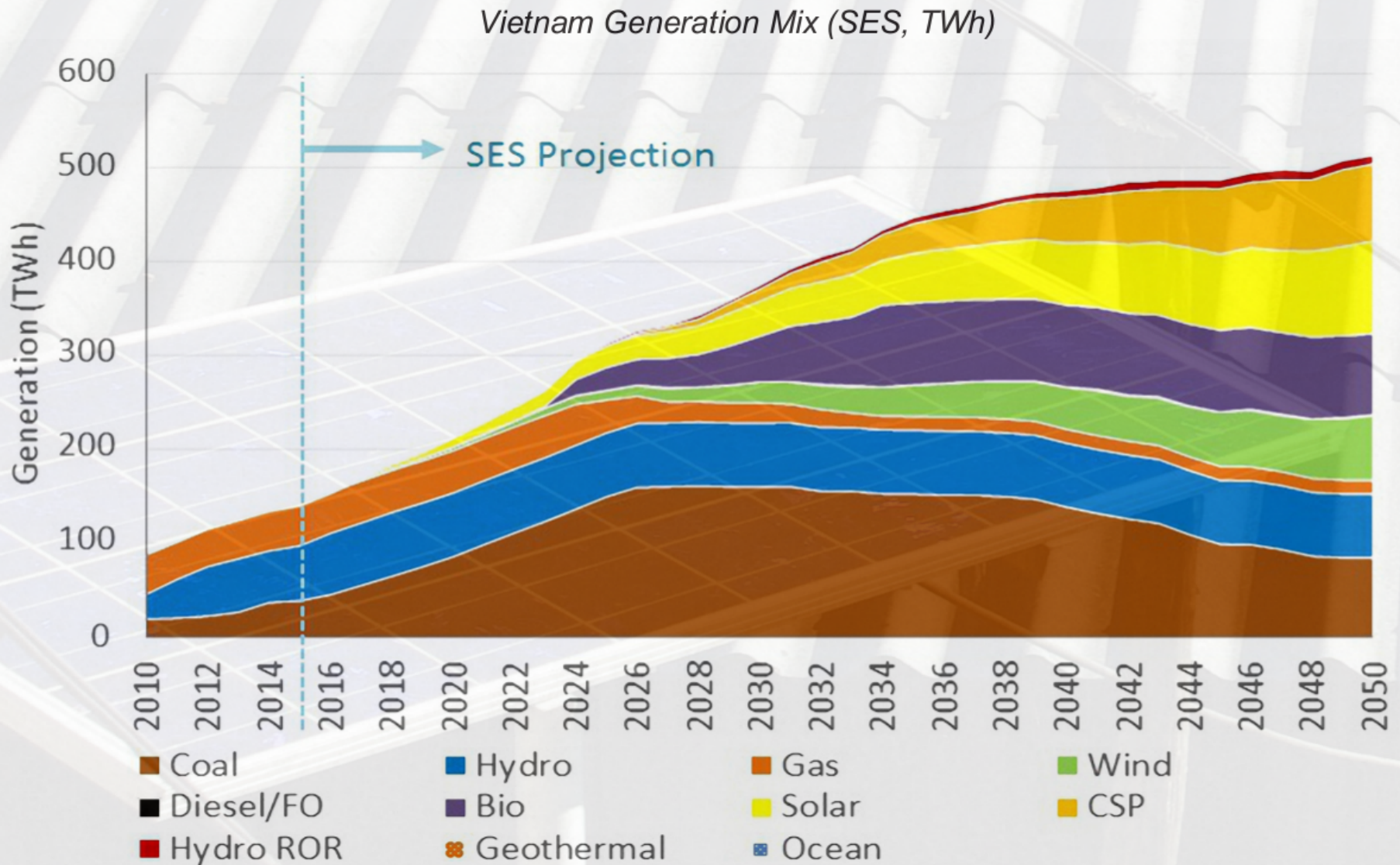
**Figure SPM.4.** Pathways of global GHG emissions (GtCO<sub>2</sub>eq/yr) in baseline and mitigation scenarios for different long-term concentration levels (upper panel) and associated upscaling requirements of low-carbon energy (% of primary energy) for 2030, 2050 and 2100 compared to 2010 levels in mitigation scenarios (lower panel). The upper and lower panels exclude scenarios with limited technology availability and the lower panel in addition excludes scenarios that assume exogenous carbon price trajectories. [Figure 6.7, Figure 7.16] [Subject to final quality check and copy edit.]

# Generation capacity by technology, 1975 - 2050

Power development program #59fd: Baseline - PDP7A extended

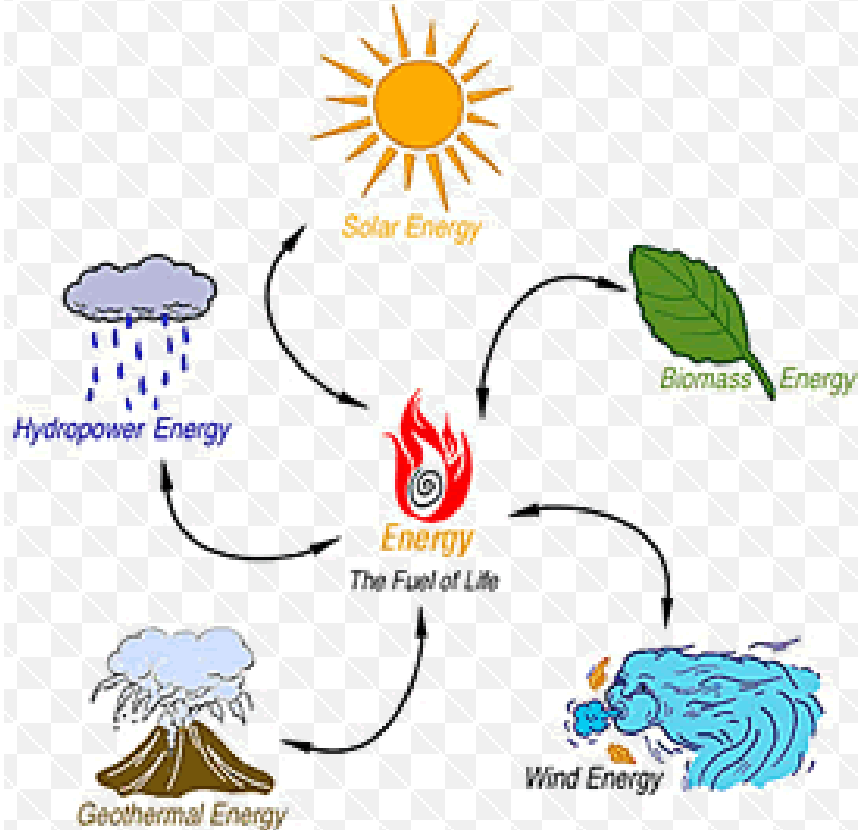


# WWF vision

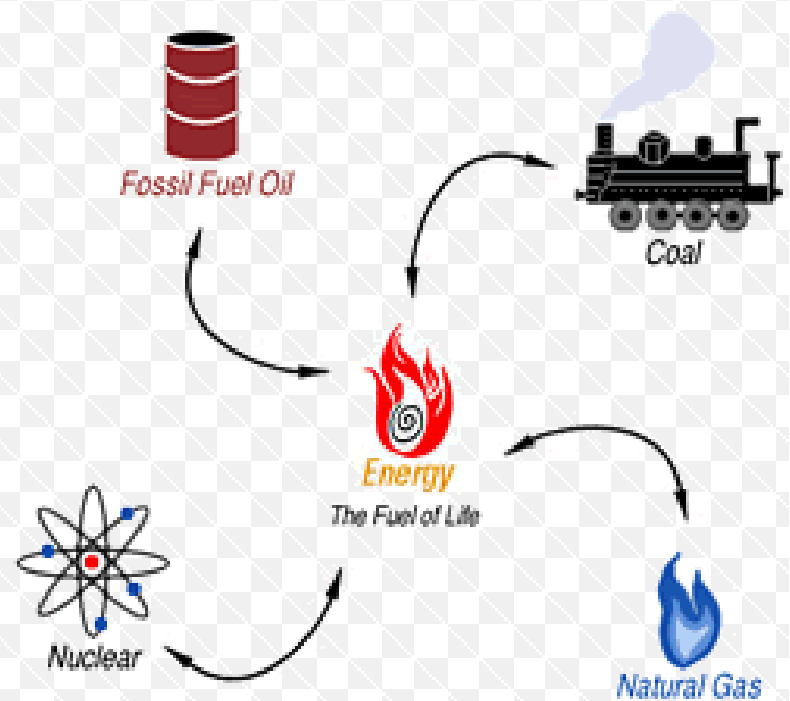


### 3. Renewable energies

#### Renewable Energy



#### Non-Renewable Energy



# Common aspects of renewable energy

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- 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

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- Non depletable
- Mostly everywhere
- Low CO<sub>2</sub> and CH<sub>4</sub> emissions
- Conserve water

# Renewable energy: Disadvantages

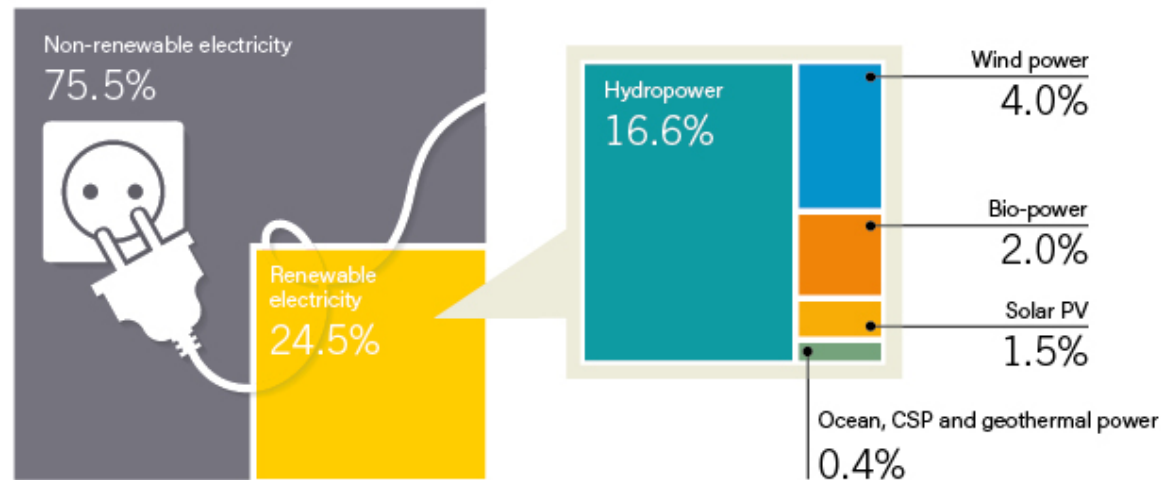
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- Variability (wind, solar)
  - Low density, need space
  - Capital-intensive, higher initial cost
  - Visual, noise, smell impact
  - Kills birds and bat (wind turbines, concentrated solar)
  - Brine (geothermal energy)
- 
- Wherever a large renewable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

# Renewables in electricity production – the World

By year's end, renewables comprised an estimated **30%** of the world's power generating capacity and **24.5%** of global electricity demand

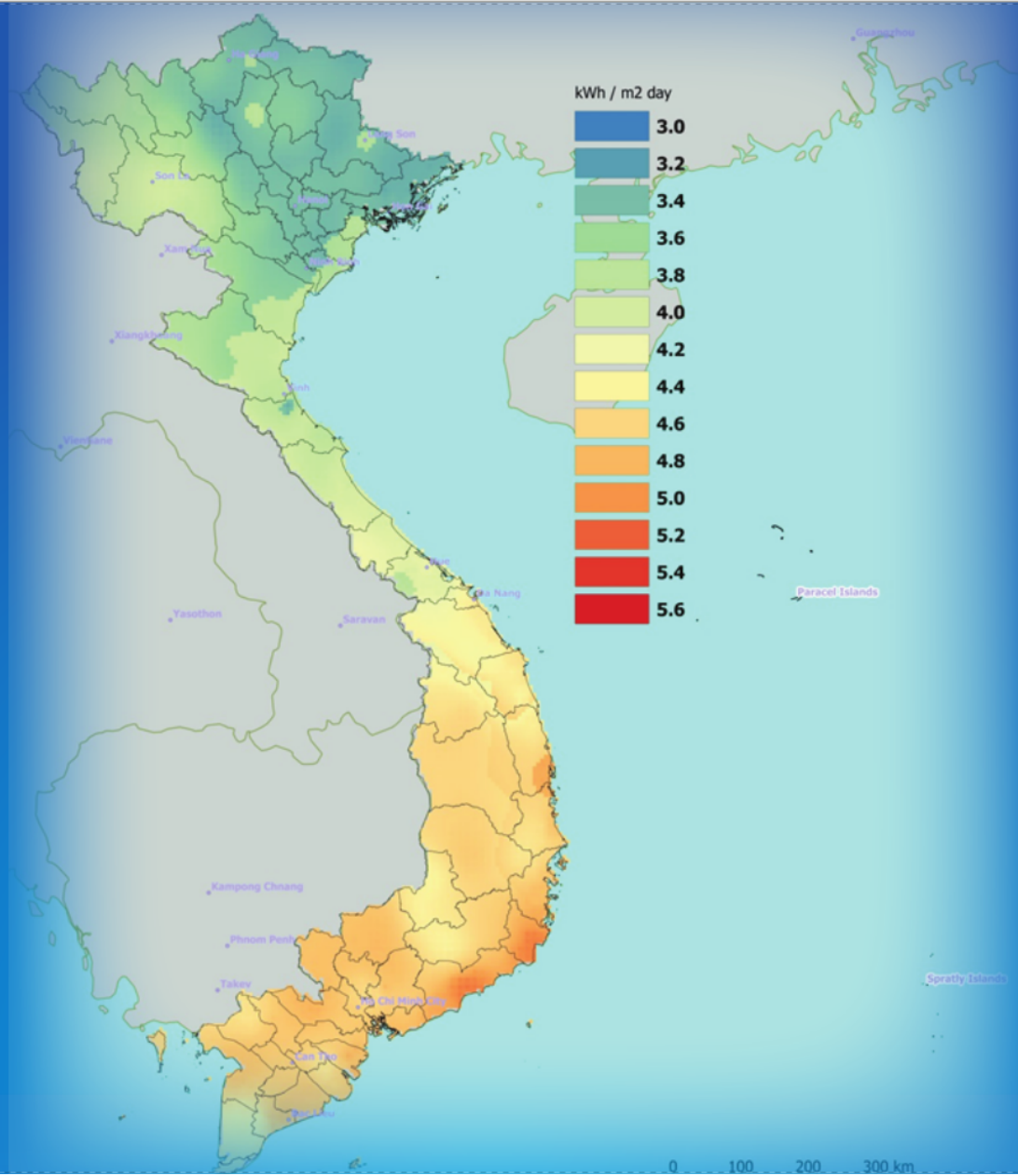
Estimated Renewable Energy Share of Global Electricity Production, End-2016



REN21 *Renewables 2017 Global Status Report*



# Solar potential 4-5 W / m<sup>2</sup>



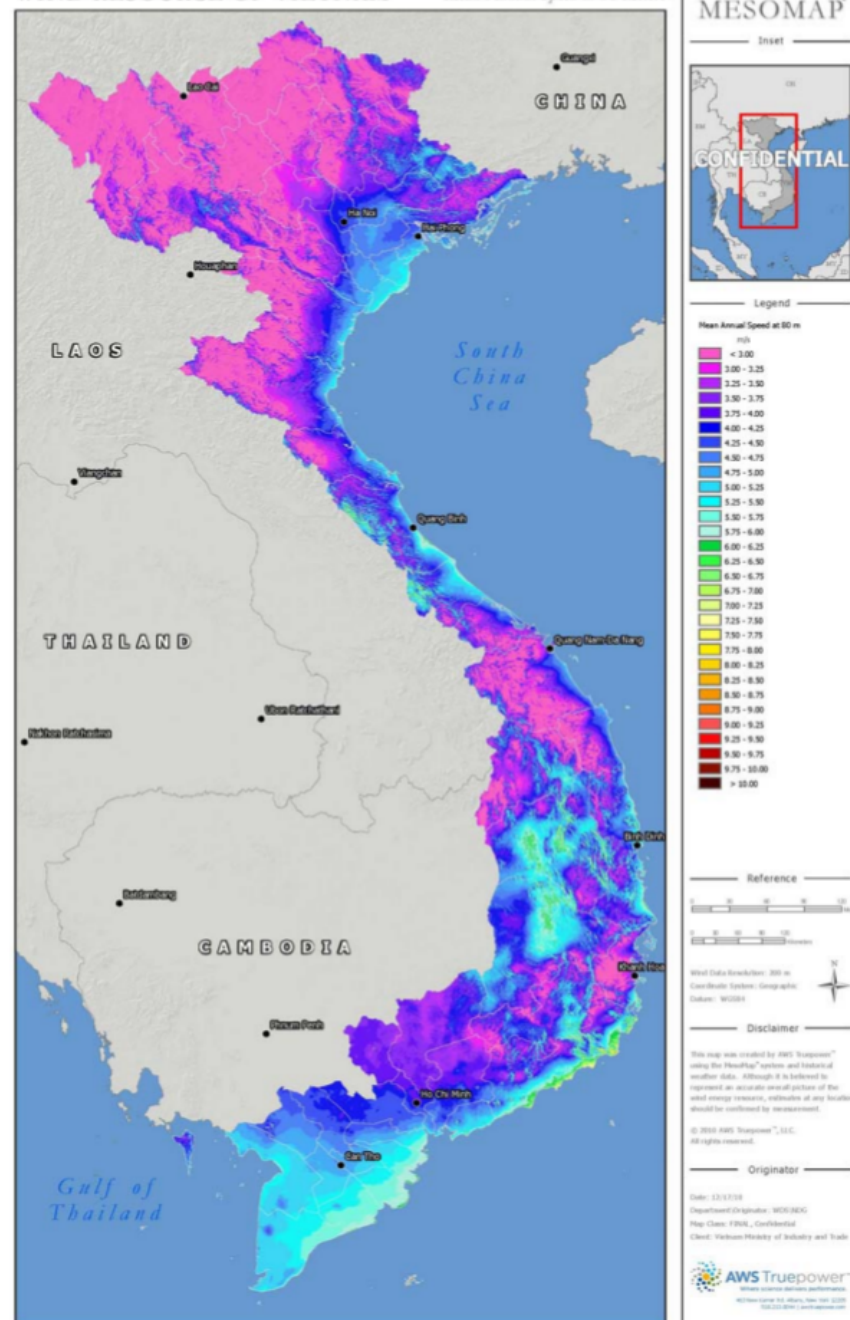


Figure 3. Wind speed map of Vietnam for a height of 80 m.

# Wind and Solar in Vietnam

☰ Wind and Solar farms in Vietnam 🔍 ⋮

▼ Solar (new): Orange: in operation, Blue: Under development  
Wind: Green: Operation, Red: Construction, 8,680 views  
[SHARE](#)

☑ Wind farms in Vietnam

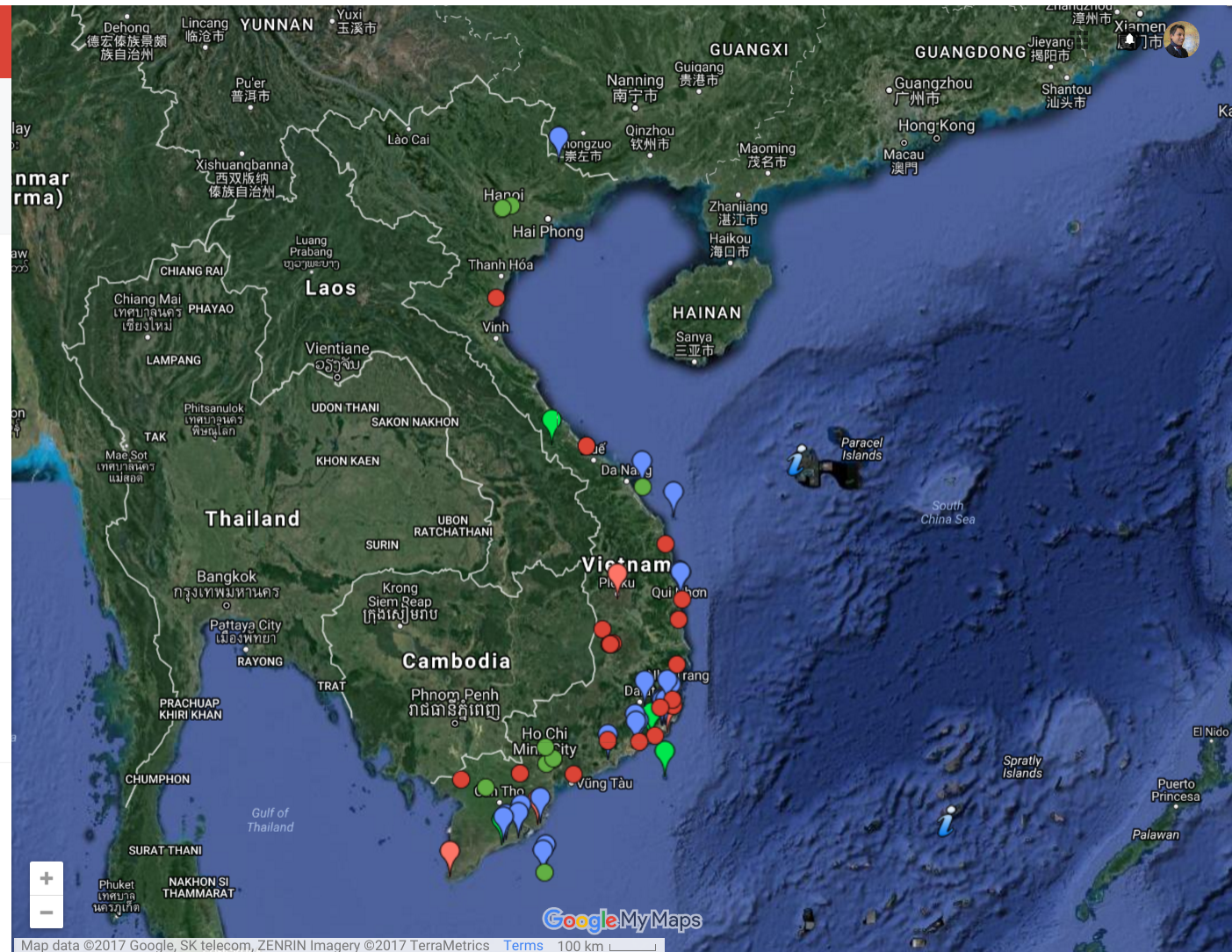
▼

- 📍 Tuy Phong wind park - 30MW
- 📍 Bạc Liêu wind power plant - 99MW
- 📍 Phú Lạc wind power plant - 24MW
- 📍 Phú Quý island hybrid wind power plant - 6...
- ... 33 more

☑ Solar farms in Vietnam

▼

- 📍 Sao Mai 1.06MW rooftop
- 📍 BigC 212kWp - Binh Duong
- 📍 Intel Products 200kWp
- 📍 BK TPHCM - 160kWp
- ... 29 more



Made with Google My Maps

What do you think about green electricity  
at Officience?