Don't Change the Climate, Change the System...

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VALERIANO RUIZ HERNÁNDEZ

Doctor of Physics from the University of Seville
Professor of Thermodynamics of the Department of Energy Engineering of the University of Seville President of the CTAER
President of PROTERMOSOLAR.
Valeriano Ruiz Hernández, along with his university career where he directs the Group of Thermodynamics and Renewable Energies (GTER), a research group of this University, also attached to the Association of Industrial Research and Cooperation of Andalusia (AICIA)

Author of four books:

- "The Energy Challenge". Editorial Almuzara, 2006
- "Solar thermal electricity, so far, so close." Gas Natural Foundation, 2007
- "Solar thermal electricity, research success story", Ed. PROTERMOSOLAR, May, 2010
- "Nuclear Energy", series "Scientific debates". CSIC, 2010

Manuel Antonio Silva Pérez

Research Group: Thermodynamics and Renewable Energy
Department / Unit: Energy Engineering
Professional situation: Professor at the University
Responsible for the following projects / grants in the US:
Projects:

STAGE-STE (Scientific and Technological Alliance for Guaranteeing the European Excellence in Concentrating Solar Thermal Energy) (
Consulting and technical assistance for the preparation of the strategic document 'Andalusia Solar'
Creation of a parameter shield for the calculation of energy installations in Andalusian buildings.

Books

Jurgens., Bjorn, Haek, Abraham, Herrero Solana, Víctor, Lobo Márquez, Gonzalo, Silva Pérez, Manuel Antonio, et. al .:
Solar Thermal Electricity (Sector Study. Renewable Energy Sector. Technological Surveillance).

Ruiz Hernández, Valeriano, Silva Pérez, Manuel Antonio, Lillo Bravo, Isidoro, Moreno Tejera, Sara, Blanco Muriel, Manuel Jesús:
Evaluation of the Thermoelectric Solar Energy Potential. Collection. Support Studies for the Preparation of the Renewable Energy Plan 2011-2020. IDAE-Institute for Diversification and Energy Saving
Ruiz Hernández, Valeriano, Silva Pérez, Manuel Antonio, Lillo Bravo, Isidoro:
Solar Thermal Electricity, So Far, So Close. Gerona. Gas Natural Foundation

PEDRO J. BANON SOLER
THE FOUNDER OF SOLAR GREEN EDUCATION PROJECT

With our **enthusiasm** and our **desire** to change the world, we want to make the new generations fully aware of the preservation of **the natural environment** and, in turn, perfectly trained in **sustainability** .

We believe that educating in **sustainability** , and more specifically, in **renewable energies** , is the best tool to build a legacy to leave to young people.
Having acquired this knowledge, **future generations will be able to continue working for the conservation of the planet** and will make their decisions always acting responsibly with nature and the environment.

Further,**We want to bring solar energy to as many roofs and school roofs as possible, because clean and renewable energy is the best solution for the planet** , since it allows saving traditional energy while being respectful of the environment.

Our team is sure of what it does and that, with the effort of the entire community, we will all achieve the dream of living on a planet less polluted and in solidarity with the resources we have.

Everything is energy, $E= mc^2$

Climate change and Energy

Valeriano Ruiz
Manuel Silva
University of Seville

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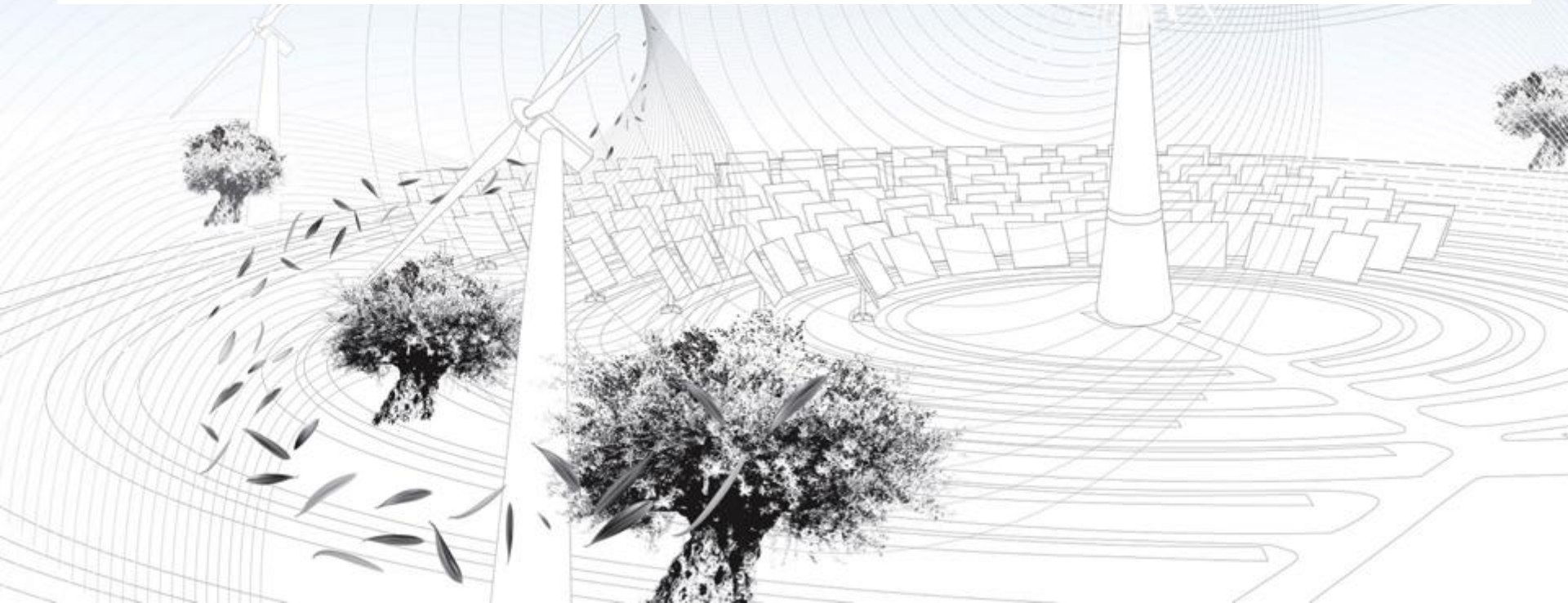


Initial Thought:

This presentation is only a conceptual advance of the course

Climate Change, Energy And Nature

That we are preparing

What can I do regarding the climate change?

Return to the rural environment as in ancient times or change the present to build a viable future?

Introduction

Something essential to understand what is happening and what might happen in the future:

The current energy system is leading us to an environmental and social disaster. Perhaps an economic disaster, too. The current energy system is unsustainable.

With this short talk we just wish to make it clear the complexity of both climate change and energy system, and their mutual interactions.

We are available for any question you wish to formulate.

What is climate change?

Obviously, the modification of the earth climate.

What do we understand by *climate*?

Climate is conventionally defined as ‘the statistical meteorological weather in a relatively long time period, approximately 30 years’.

This is the different meteorological variables statistically characterized: statisitical values of temperature, atmospheric pressure, humidity, wind, rainfall, aerosols, etc., in a given place or region and for the whole planet (atmosphere, hydrosphere, chryosphere, lithosphere and biosphere).

What is climate change?

Most people confuse climate and weather. This is logical, since there is an evident relationship between both concepts.

Weather, as most of us understand it, is realted to the meteorological variables that most affect us in a given place: temperature, rainfall, wind, clouds, sunlight, etc., but always in a relatively short time period (days, weeks, months, perhaps a year).

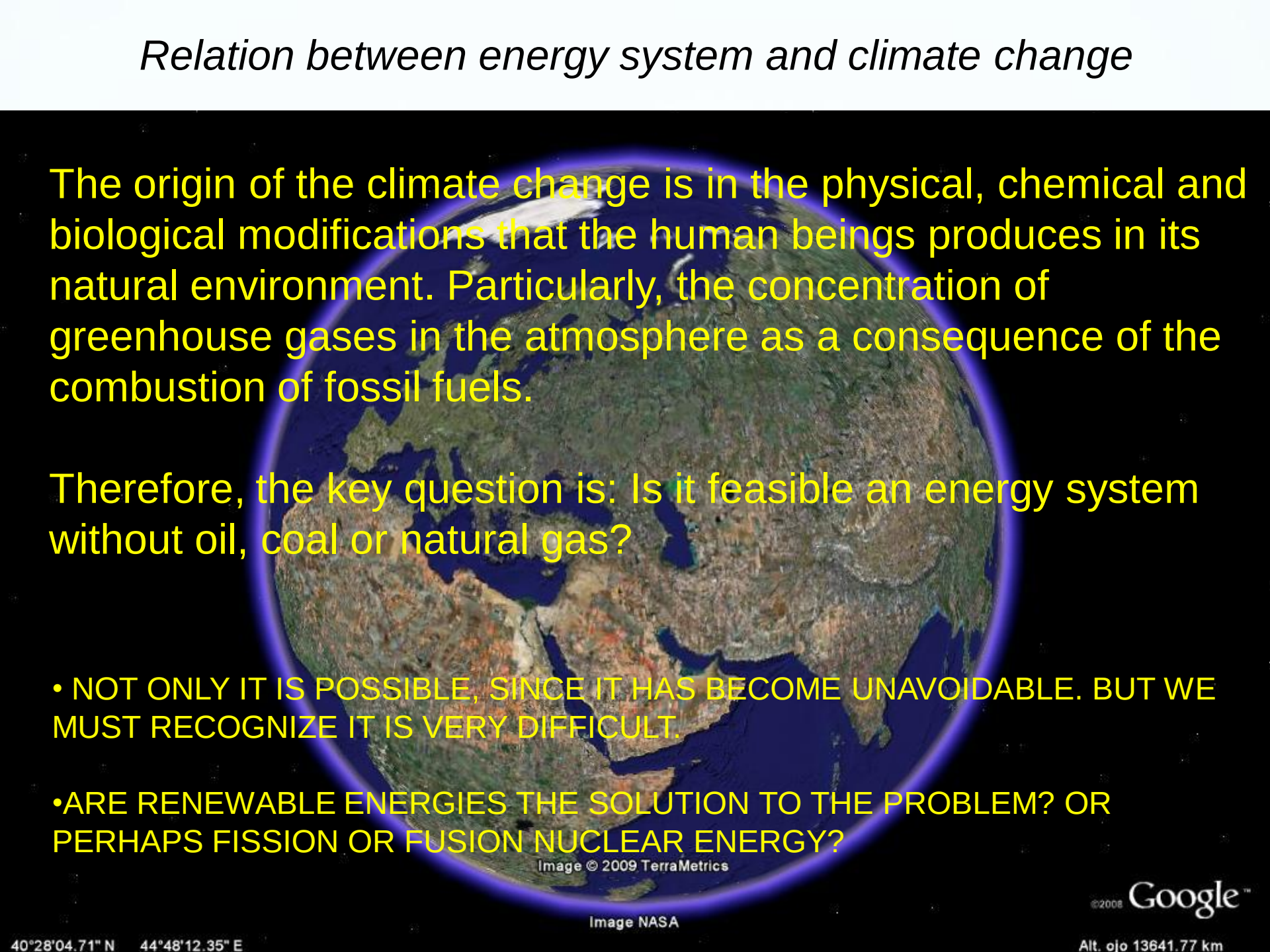
Relation between energy system and climate change

The origin of the climate change is in the physical, chemical and biological modifications that the human beings produces in its natural environment. Particularly, the concentration of greenhouse gases in the atmosphere as a consequence of the combustion of fossil fuels.

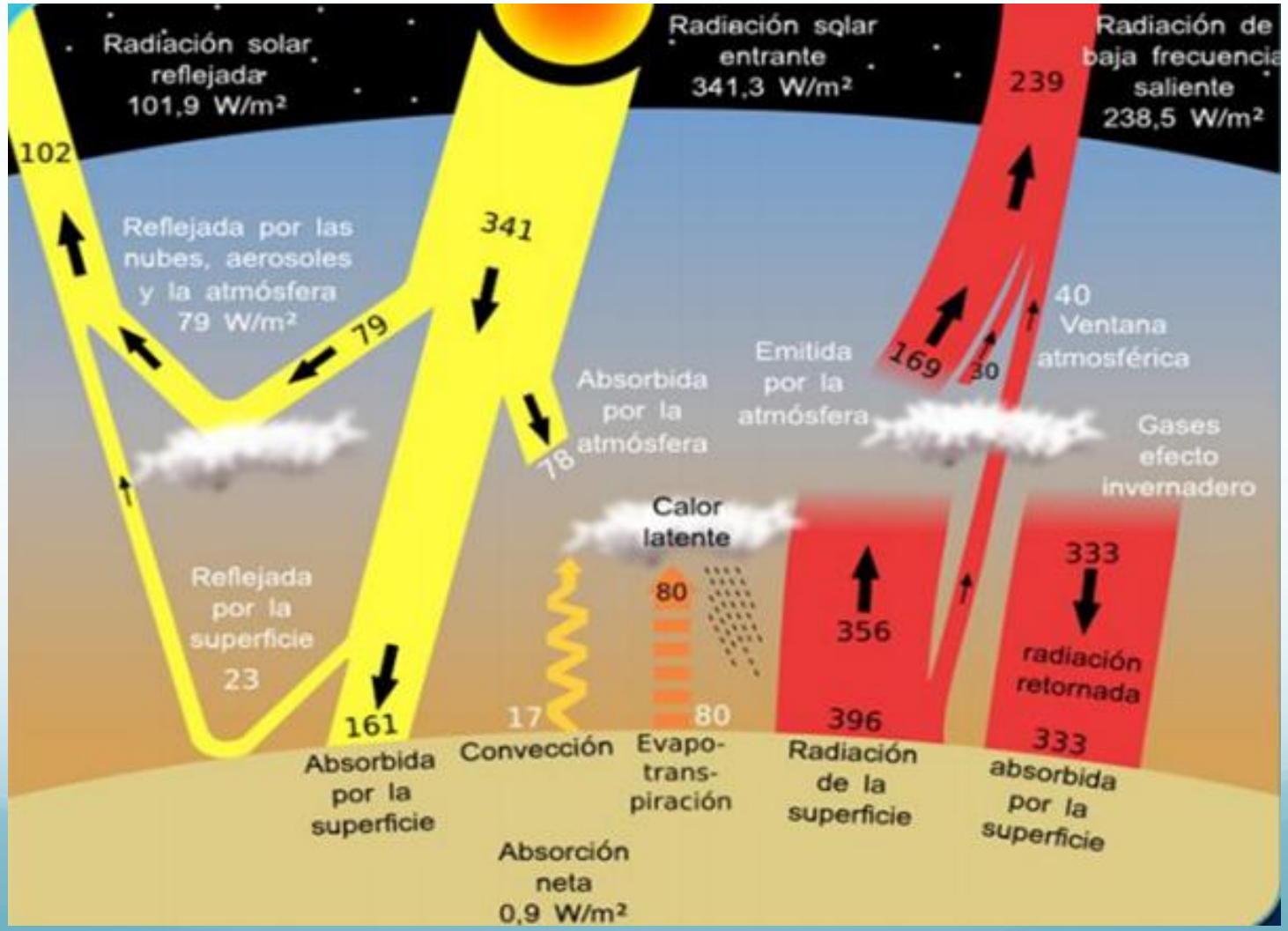
Therefore, the key question is: Is it feasible an energy system without oil, coal or natural gas?

- NOT ONLY IT IS POSSIBLE, SINCE IT HAS BECOME UNAVOIDABLE. BUT WE MUST RECOGNIZE IT IS VERY DIFFICULT.

- ARE RENEWABLE ENERGIES THE SOLUTION TO THE PROBLEM? OR PERHAPS FISSION OR FUSION NUCLEAR ENERGY?

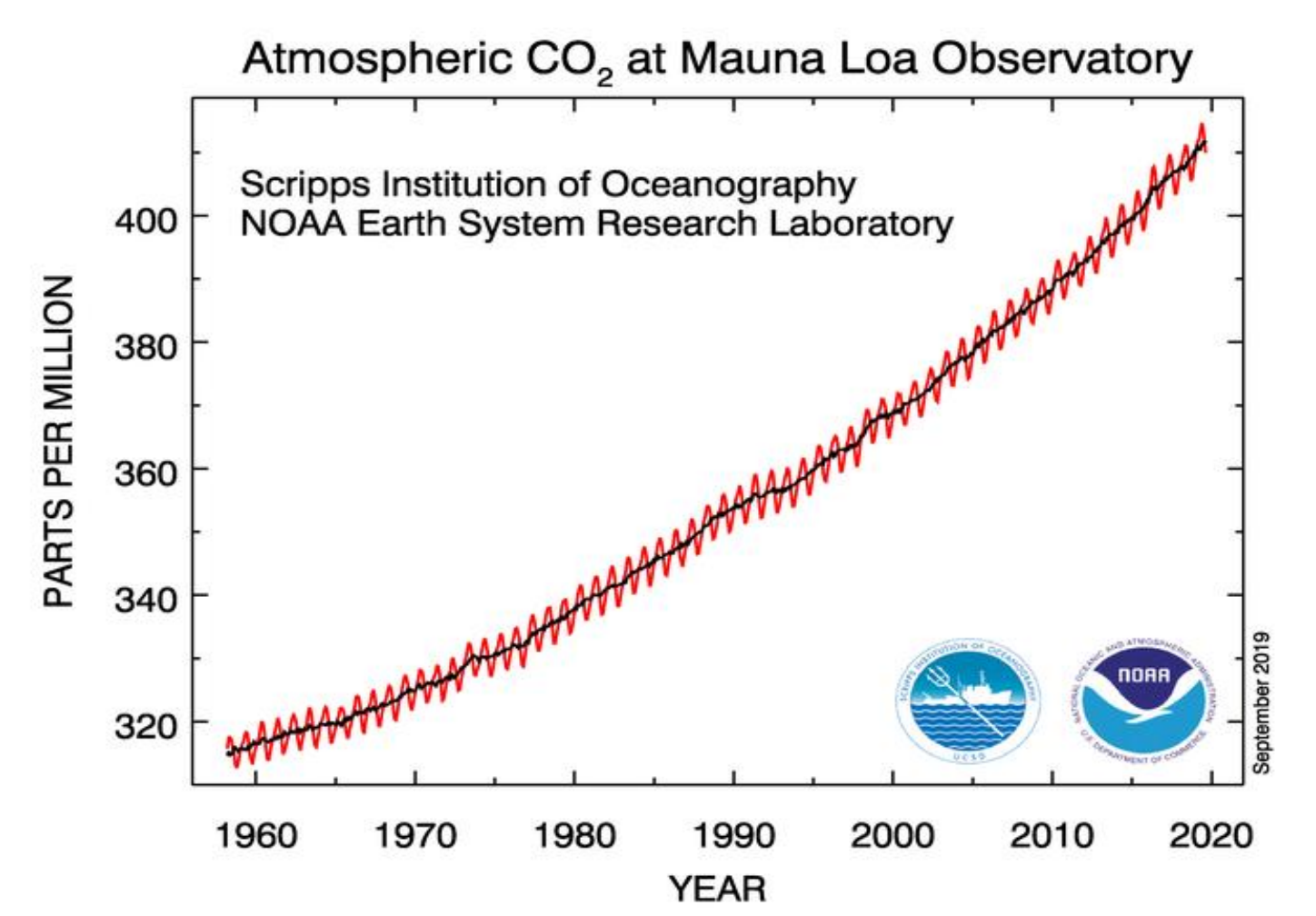


A simple explanation of the greenhouse effect:
341,3 W/m^2 of shortwave solar radiation enter the atmosphere
101,9 (SW) + 239 (IR) = 340,9 W/m^2 leave the atmosphere as longwave radiation.



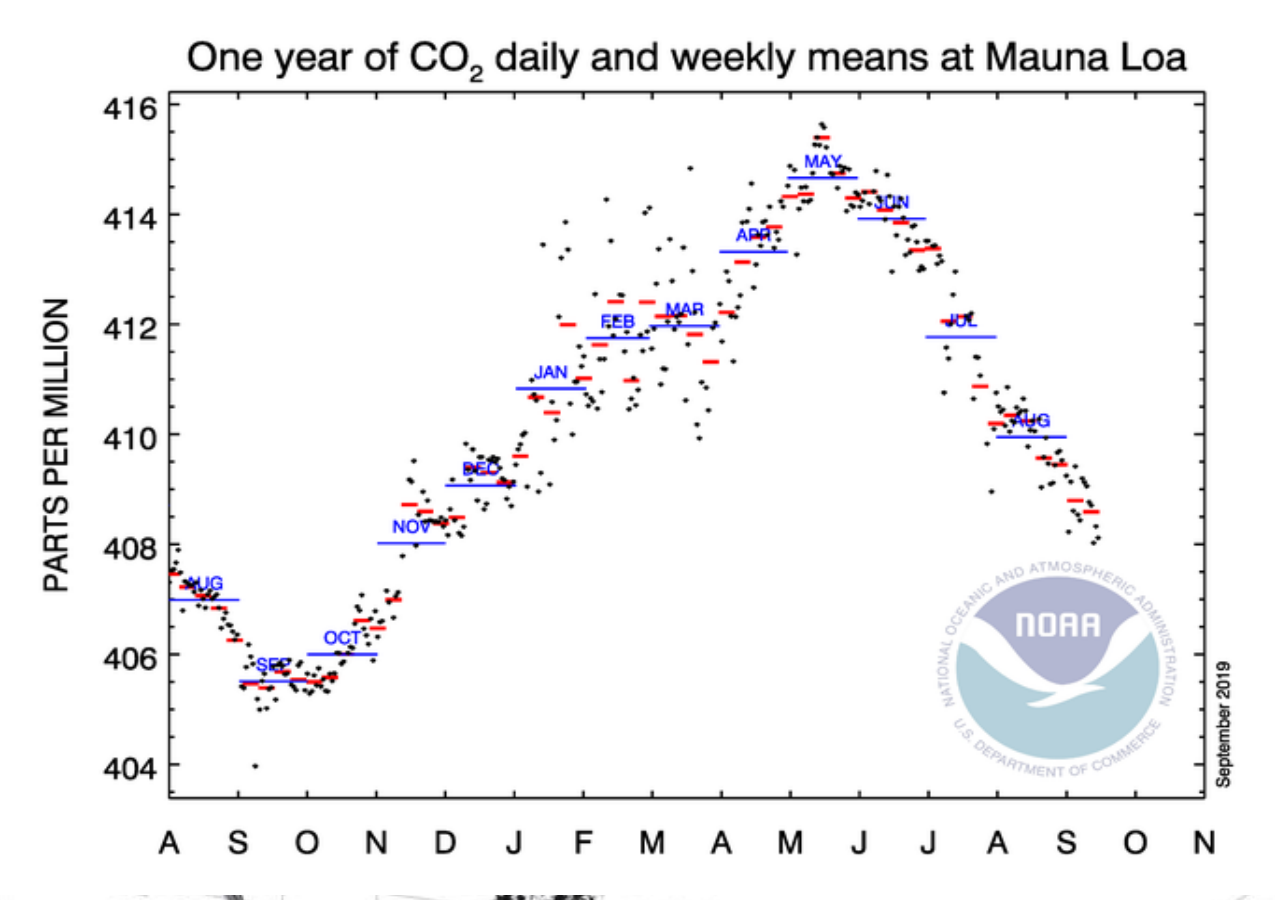
Climate change. The key: Keeling's curve

It represents the concentration of CO_2, the main greenhouse gas, since 1958, when it was first measured in Mauna Loa by Dr. Keeling. The graph shows that this concentratin has steadily increased until today's level, above 410 ppm = 3190 Gt_{CO2}.



An explanation to the saw-tooth pattern of the Keeling curve:

The measurements correspond to the Northern hemisphere, where there land surface (100 million km^2) is greater than in the Southern hemisphere and therefore the vegetation, that absorbs more CO_2 in spring-summer, too, causing a reduction in the CO_2 concentration during these seasons, while the rest of the year cars and gas and coal thermal power plants continue emmitting CO_2.



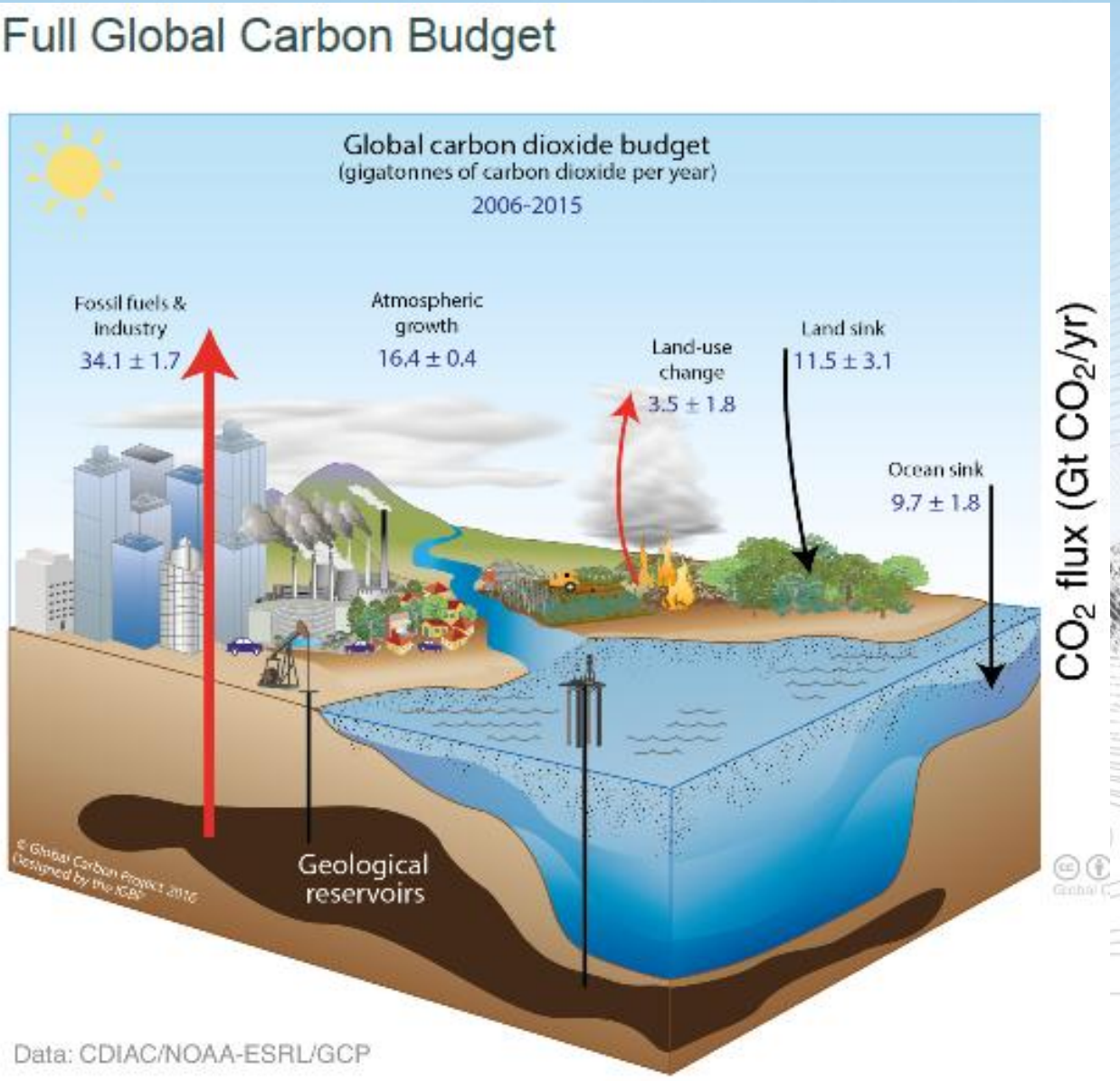
How and where are atmospheric CO_2 emmissions produced?

A much simplified explanation:

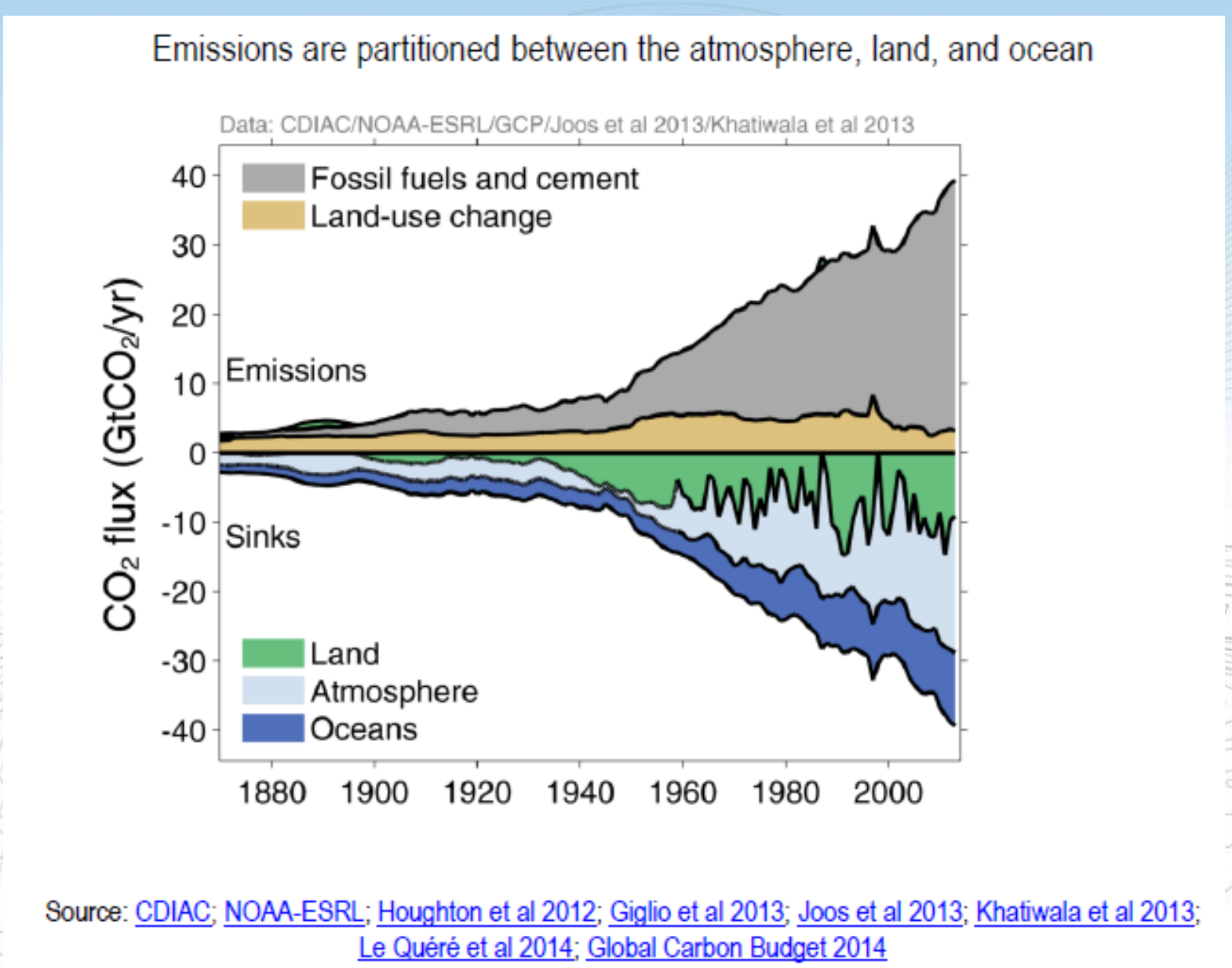
Emissions originate in the combustion of fossil fuels (34,1 Gt_{CO2}) and in the use of soil (3,5 Gt_{CO2}), totalling 37,6 Gt_{CO2}

But vegetation absorbs 11,5 Gt_{CO2} and oceans 9,7 Gt_{CO2} , totalling 21,2 Gt_{CO2}

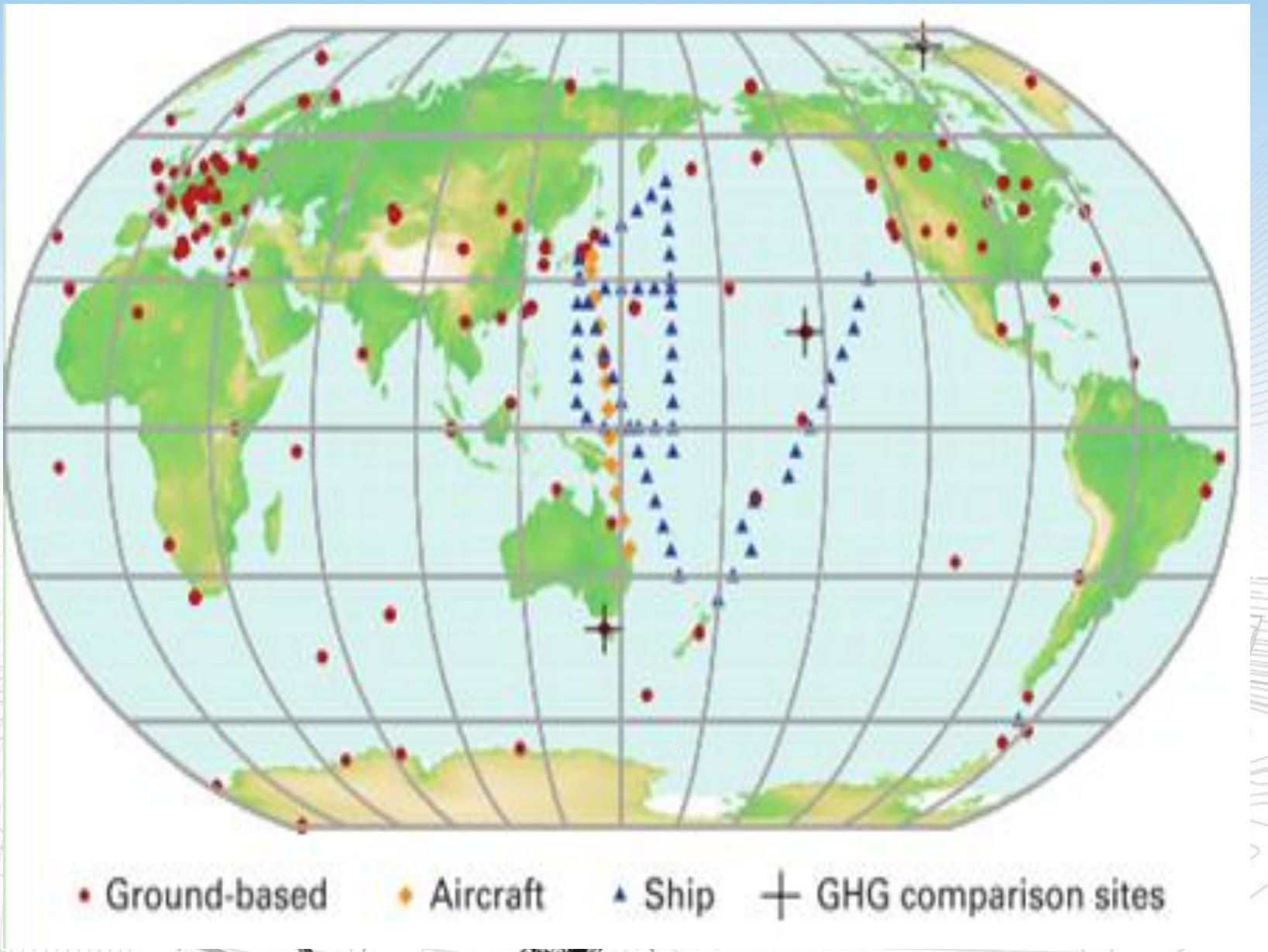
The CO_2 balance is 16,4 Gt_{CO2} retained in the atmosphere, this is what really matters.



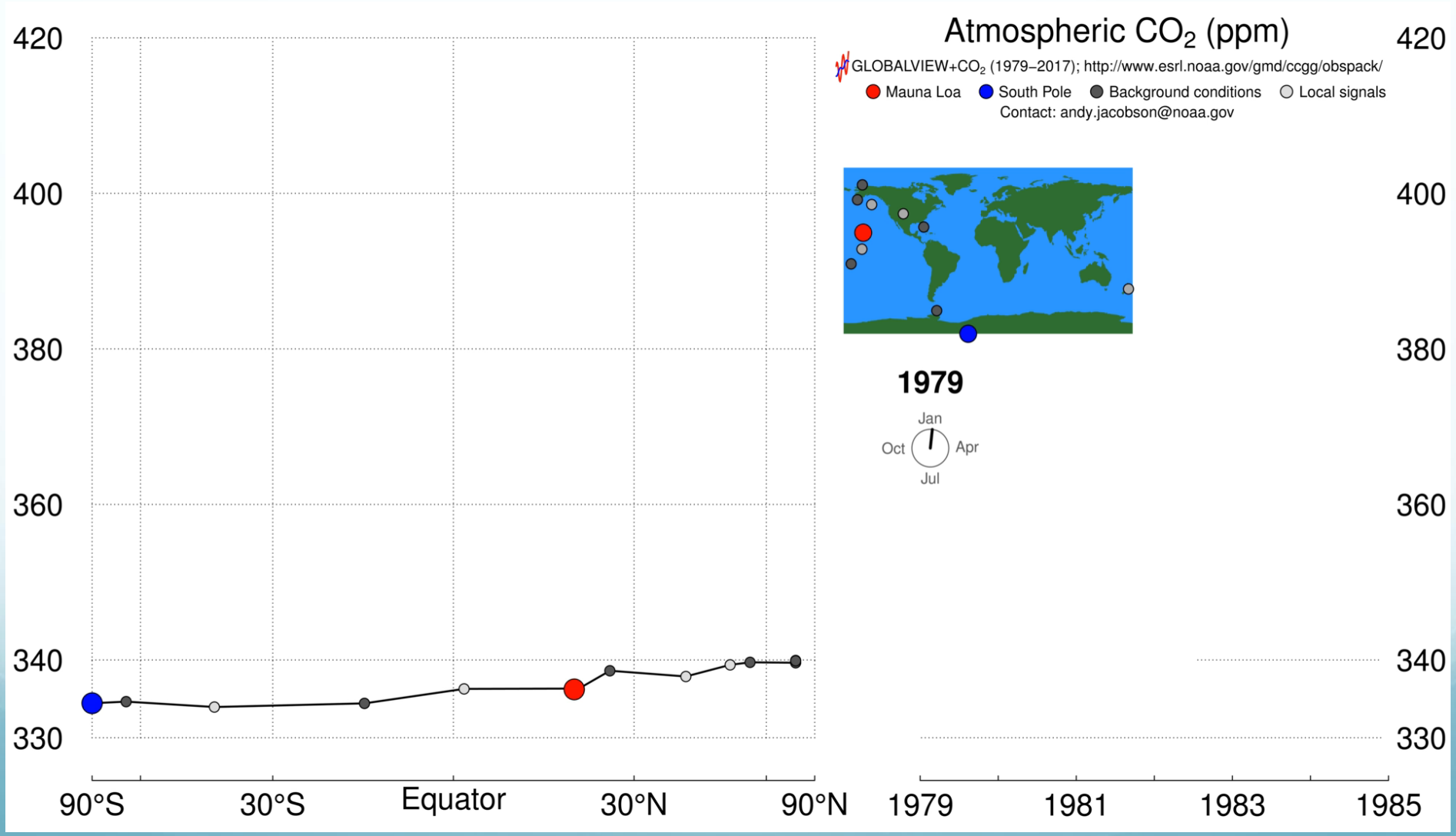
This graph shows very clearly the evolution of the CO_2 exchanges. It is evident that combustion is the main cause of the greenhouse effect.



Is important to note that the values correspond to measurements taken all over the world by different methods.

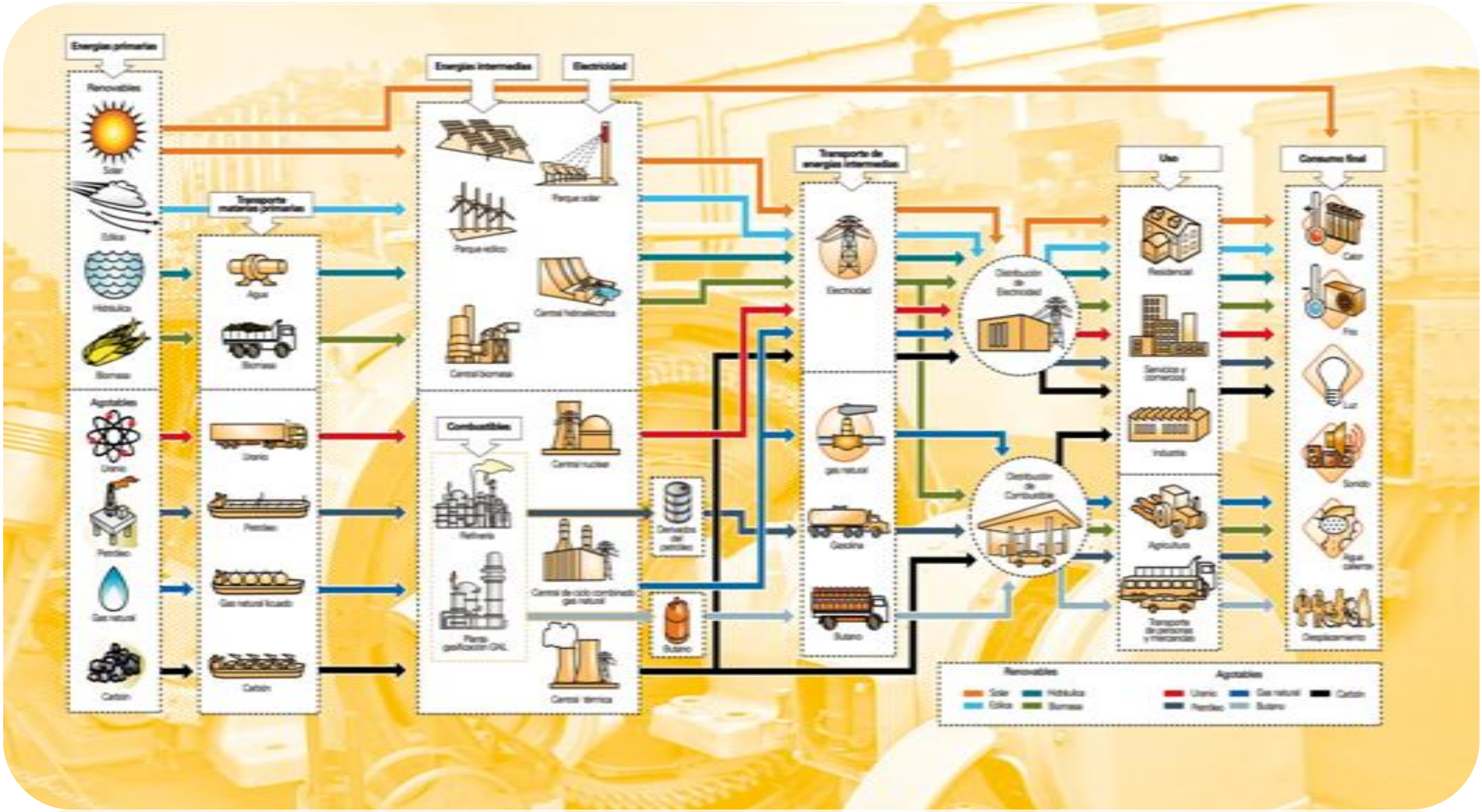


This is an interesting video that shows how the atmospheric CO_2 concentration has evolved. Pay attention!



The energy system

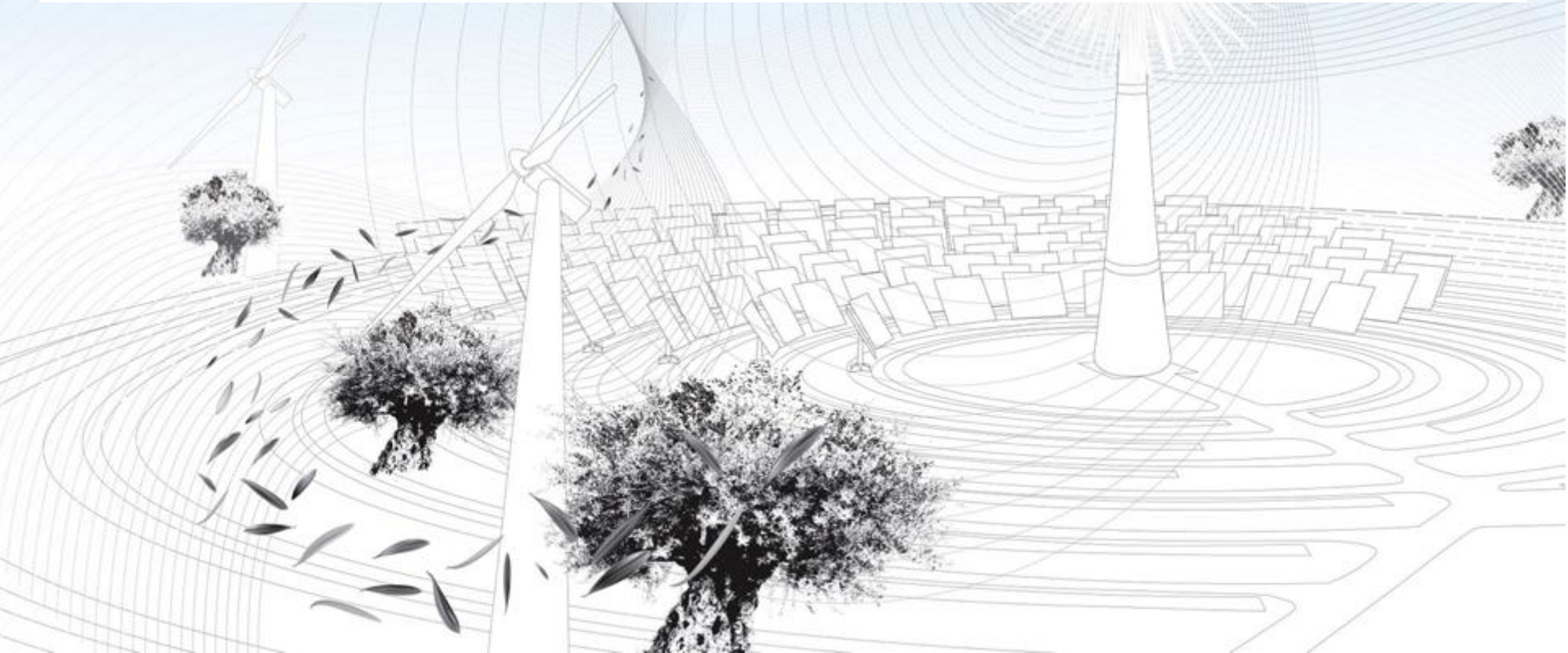
How do electricity and fuels reach our homes and neighbourhoods?



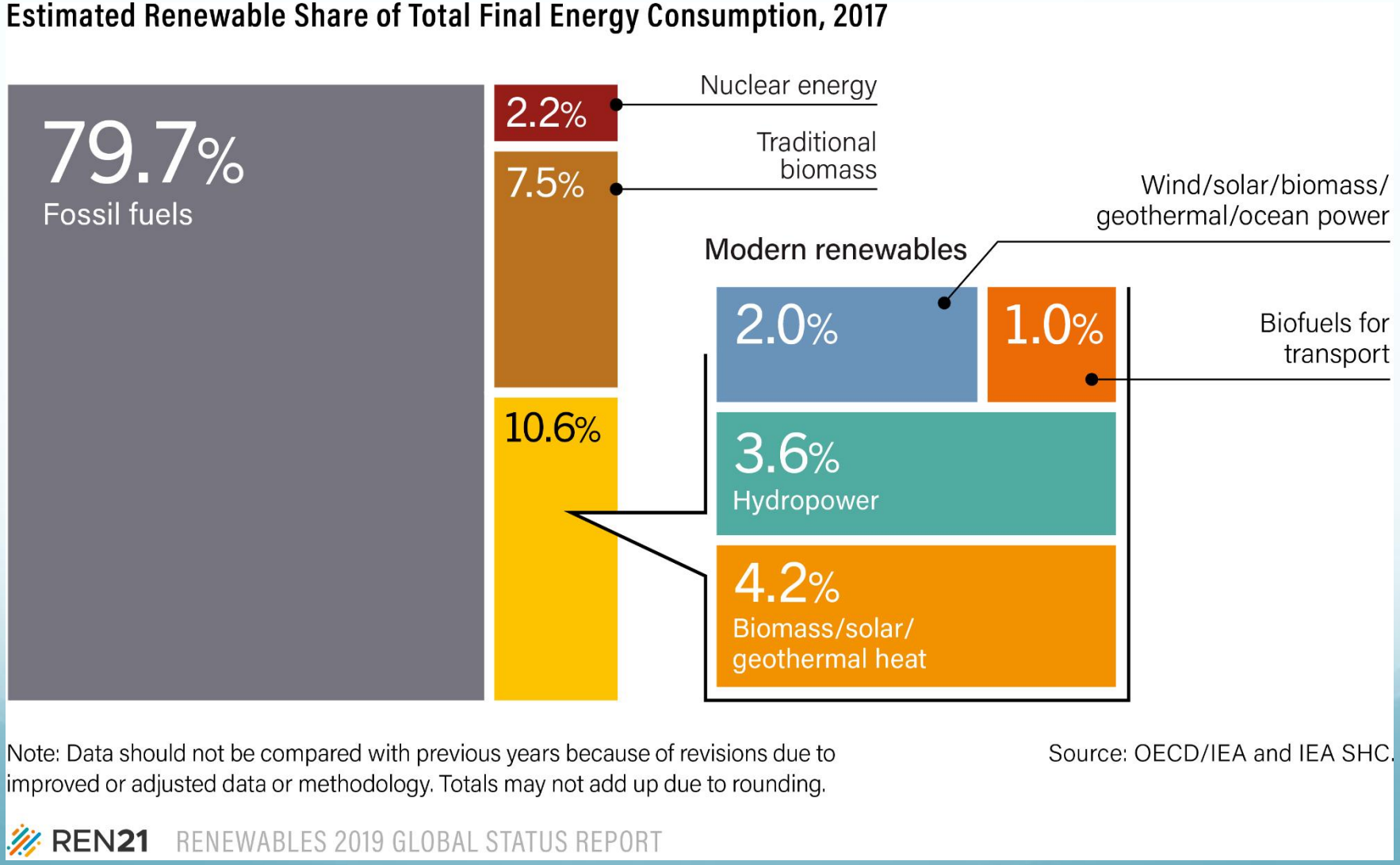
The energy system. Confusion and key

Electricity and fuels

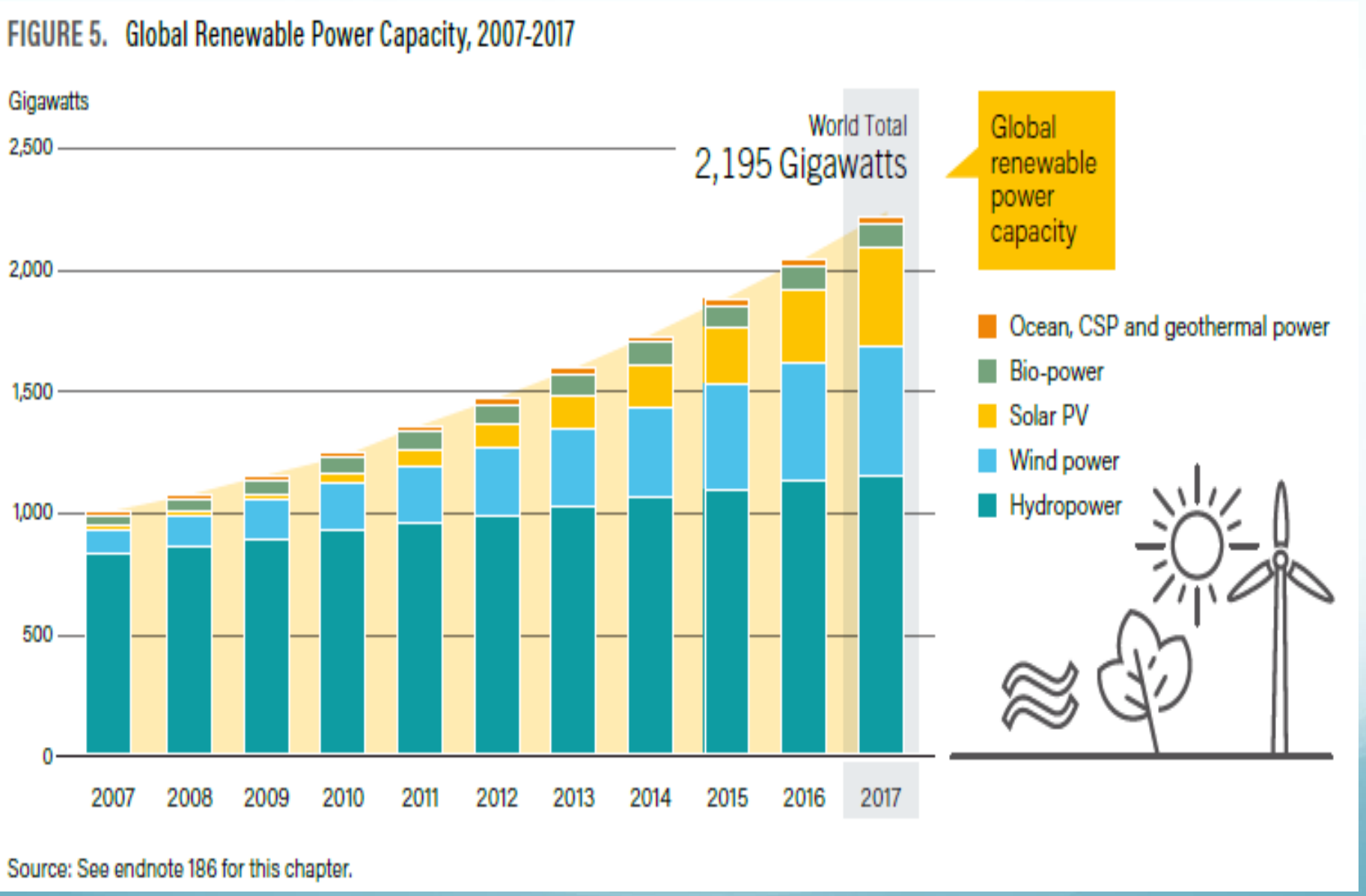
They are the fundamental intermediate forms of energy for all countries and consumers. A good understanding of the energy transformations is the key to understand the climate change.



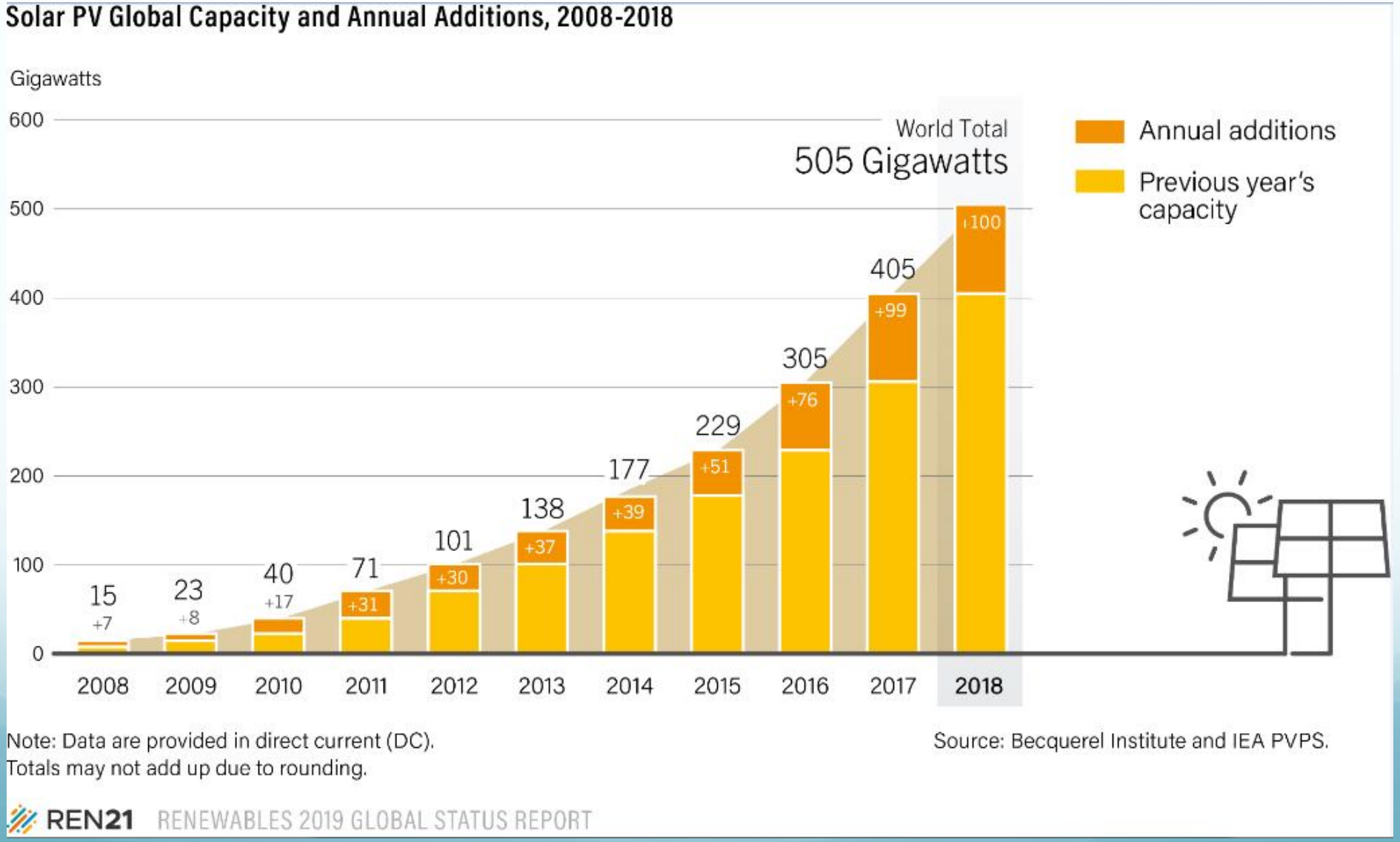
The problem is clearly shown In this REN21 scheme: almost 80 % of today's energy system are fossil fuels, while modern renewables opnly amoint to 10,6 %. It is evident that there is still much to do. We are only at the beginning of the energy system transition.



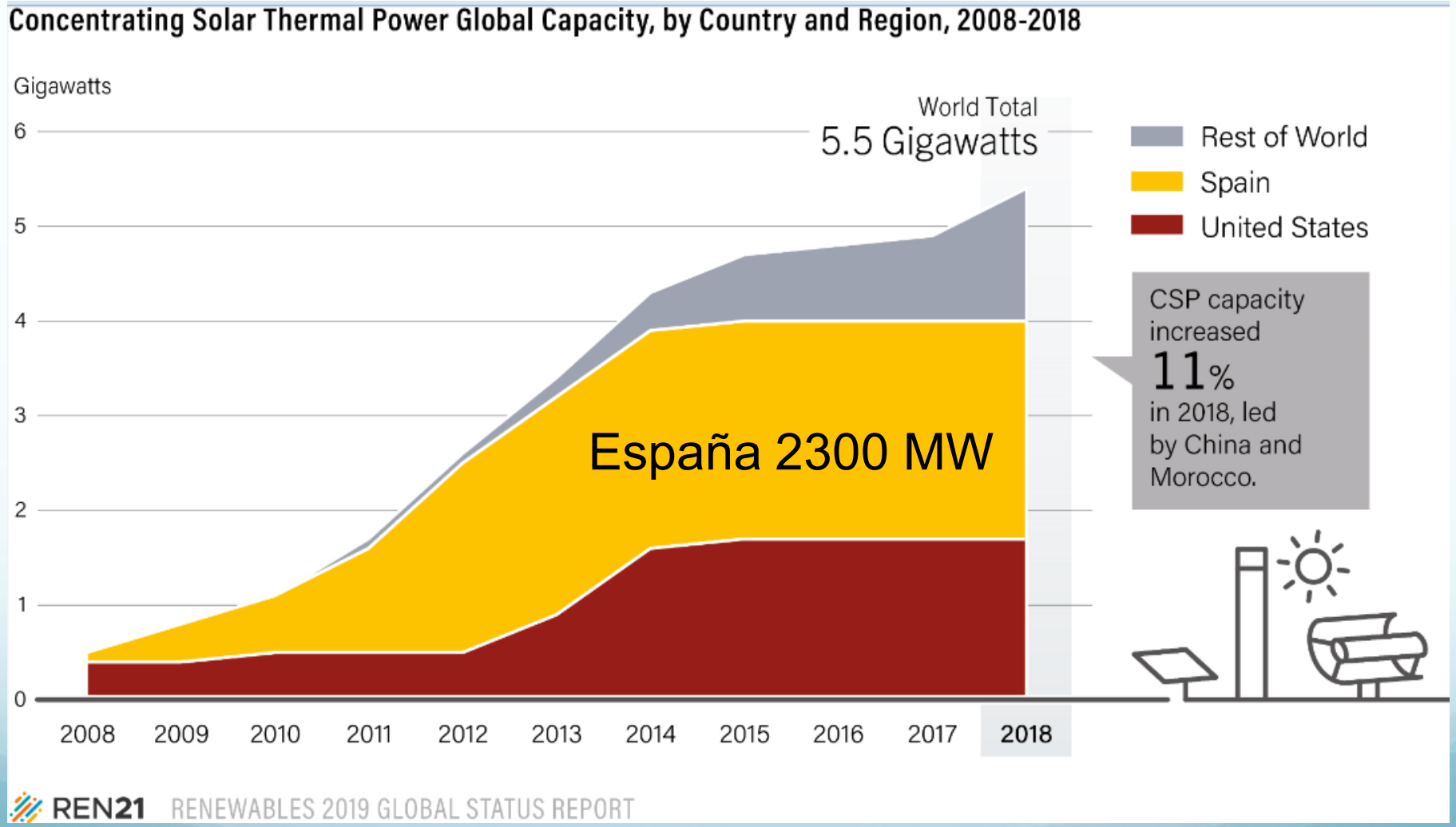
Renewable energies in the world. Electricity



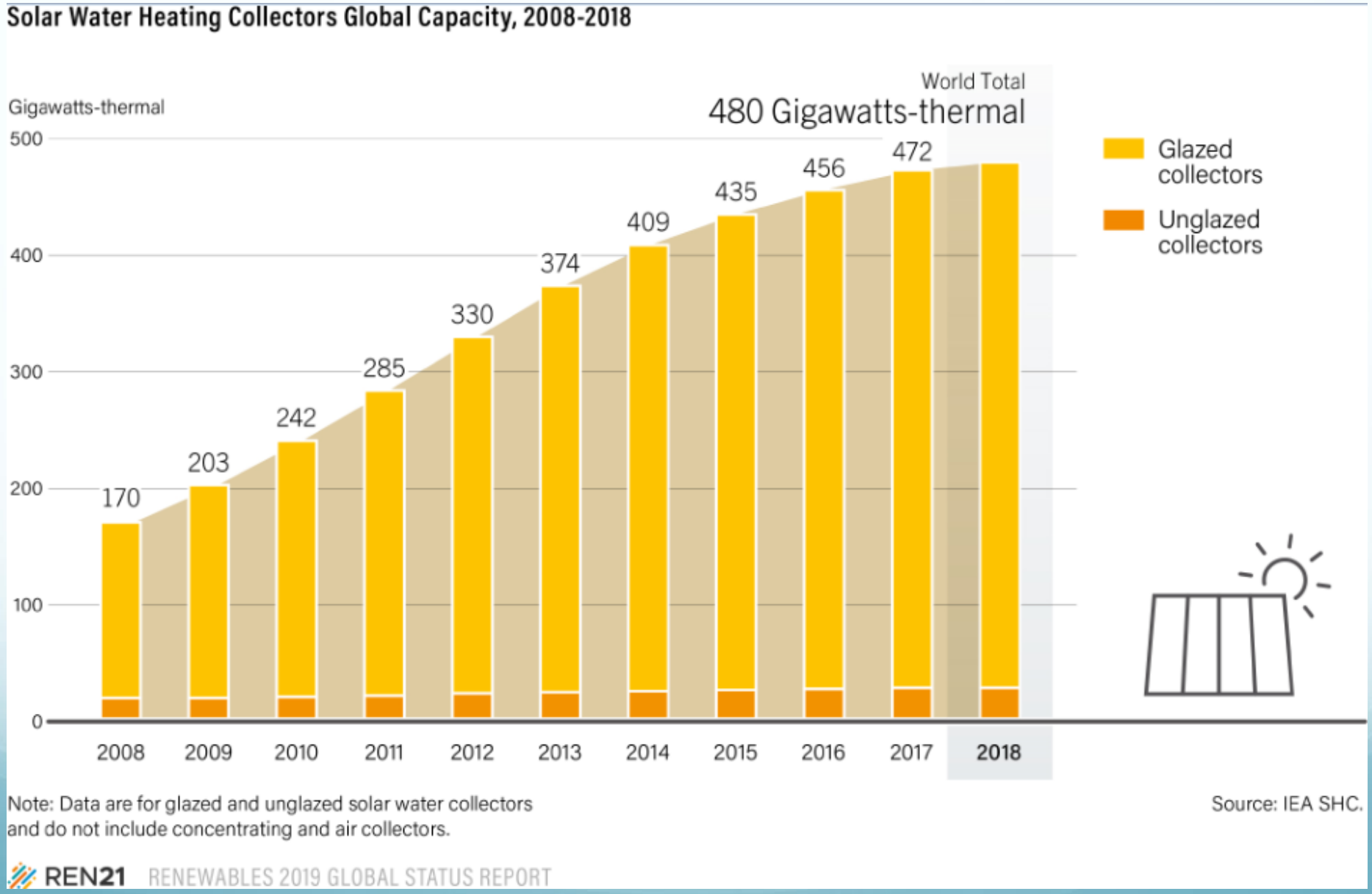
PV: extraordinary growth. The best is yet to come.



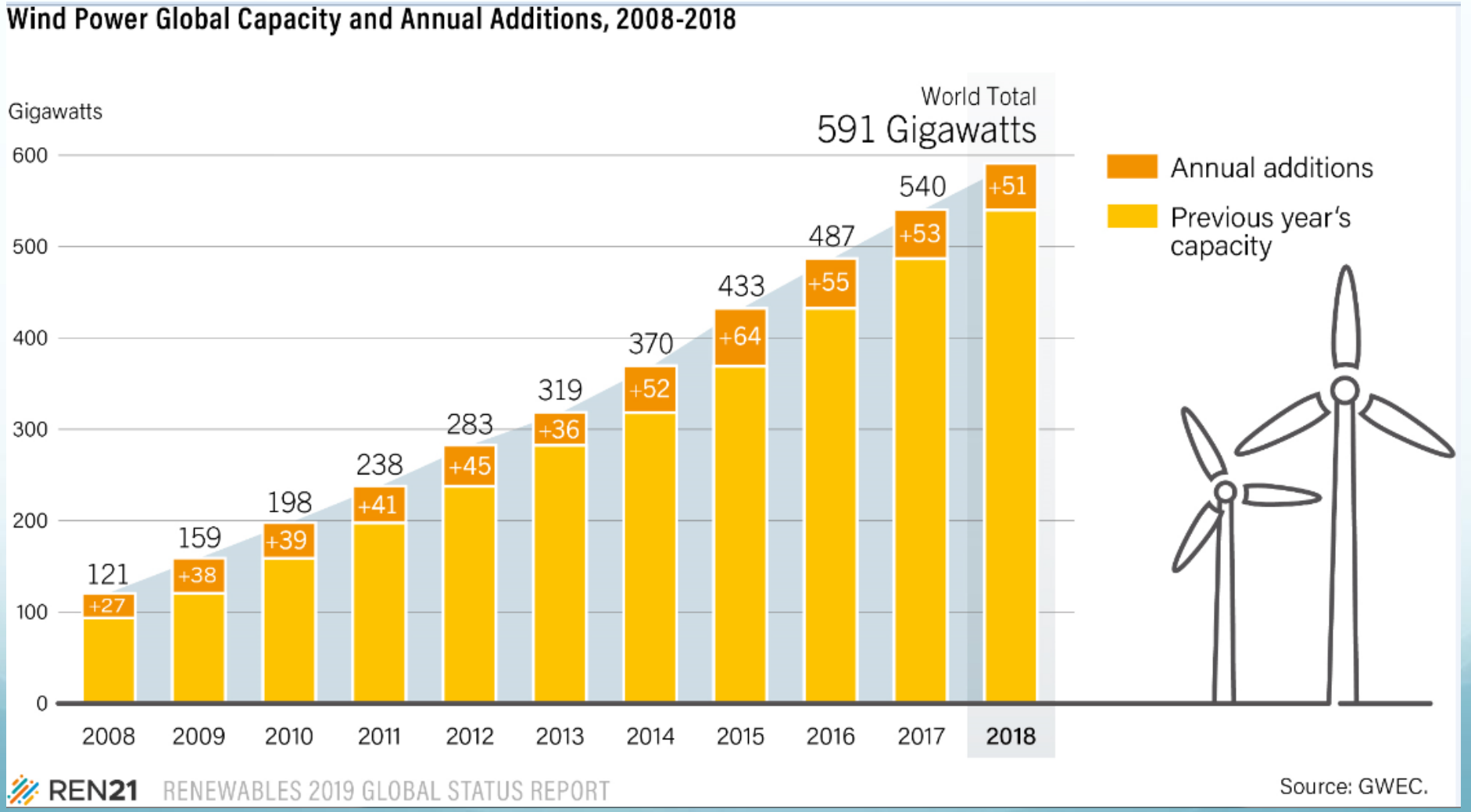
Medium and high temperature solar thermal electricity



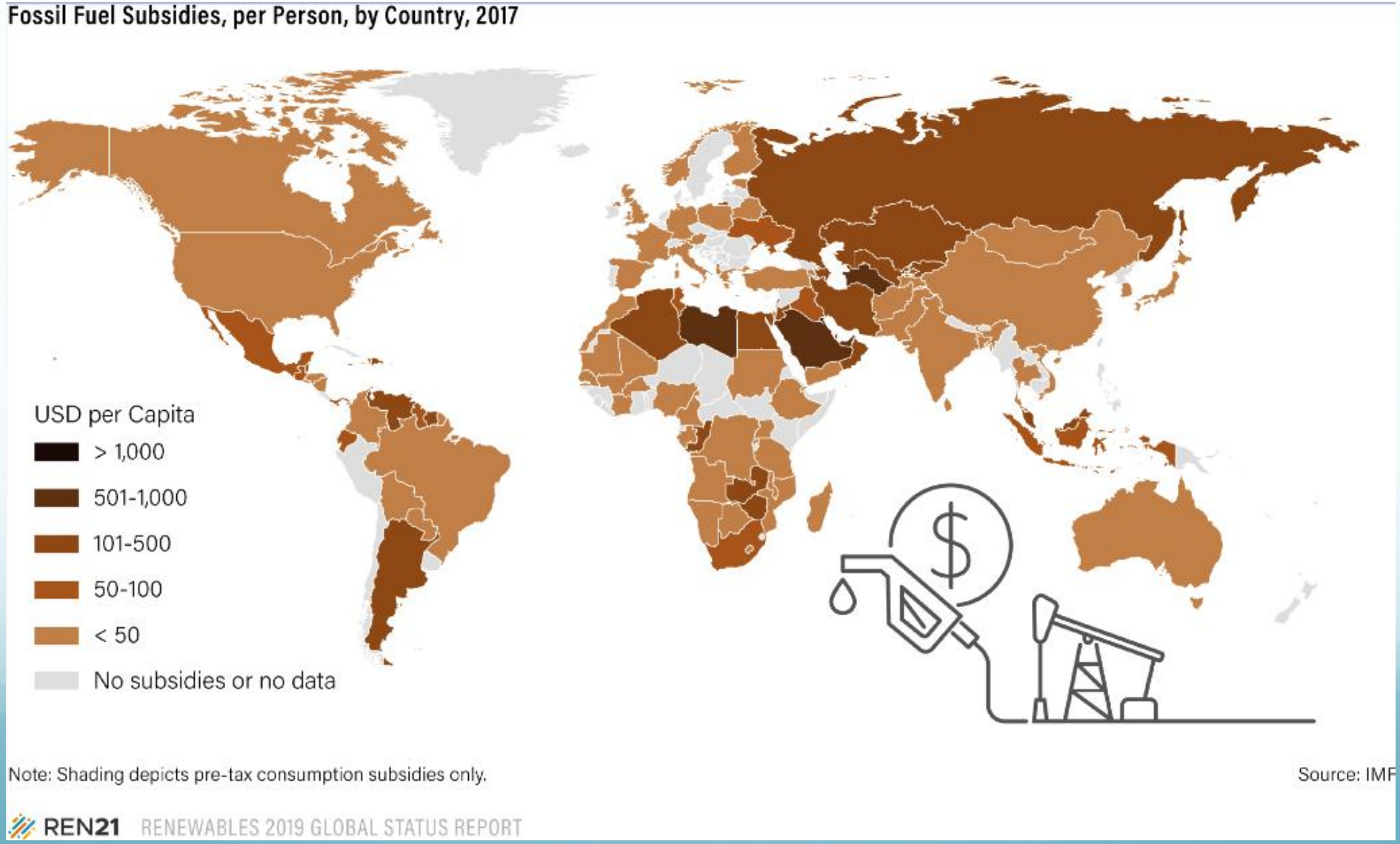
Low temperature solar energy. A lot, but insufficient



Wind energy. Steady growth



The worst thing is that almost all countries still subsidize non-renewable energy sources. This makes the energy transition very difficult..



How to achieve a reasonable ENERGY FUTURE

A **reasonable energy future** (and the associated climate change mitigation) requires a radical change of the approach, analyzing the energy demand from a thermodynamic, rather than economic, point of view.

It is clear that the artificial energy forms have an economic value that has to be considered, independently of their character (renewable or exhaustible).

The optimization of the needs will undoubtedly lead to the optimization of the consumer costs.

A key for the future: distributed generation, proximity of production and consumption.

The distributed generation of intermediate energies (electricity, heat and fuels) and the demand management are some of the key factors. Therefore the effective application of these concepts –which are perfectly feasible- with renewable energies is an essential tool.

A specific measure: replace the centralized systems of intermediate energies by a new one that massively applies the concepts of bioclimatic architecture, solar water heating, generation of electricity, heating and cooling at homes using solar energy and/or biomass, at least in similar quantities to the consumption.

General conclusions

1. Mankind (and all living beings) are facing the extremely grave problem of climate change; the only effective way to stop it is the modification of the energy system.
2. In these circumstances there are two attitudes:
   Those who think that little or nothing is being done and those who know that something is being done, although still insufficient and irrelevant in relation to climate change.
3. The necessary and unavoidable actions require the active involvement of all human beings. Only so the public authorities will confront their responsibility and obligation.

To finish with...

“Podrán los encantadores quitarme la ventura, pero el esfuerzo y el ánimo será imposible”.

Miguel de Cervantes Saavedra. El Ingenioso hidalgo D. Quijote de la Mancha

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One of our books (**La electricidad solar térmica, tan lejos, tan cerca)** can be downloaded for free from l “El blog de Valeriano Ruiz” (Valeriano Ruiz’s blog)