



SAARK Workshop on
“Techniques on Energy Conservation and Efficiency in Buildings”
Hotel Heritance Kandalama, Dambulla, Sri Lanka
26 - 28 August 2019

Energy Conservation through Human Behaviour Change



Nimal Perera

Past President / Director

Sri Lanka Energy Managers Association (SLEMA)

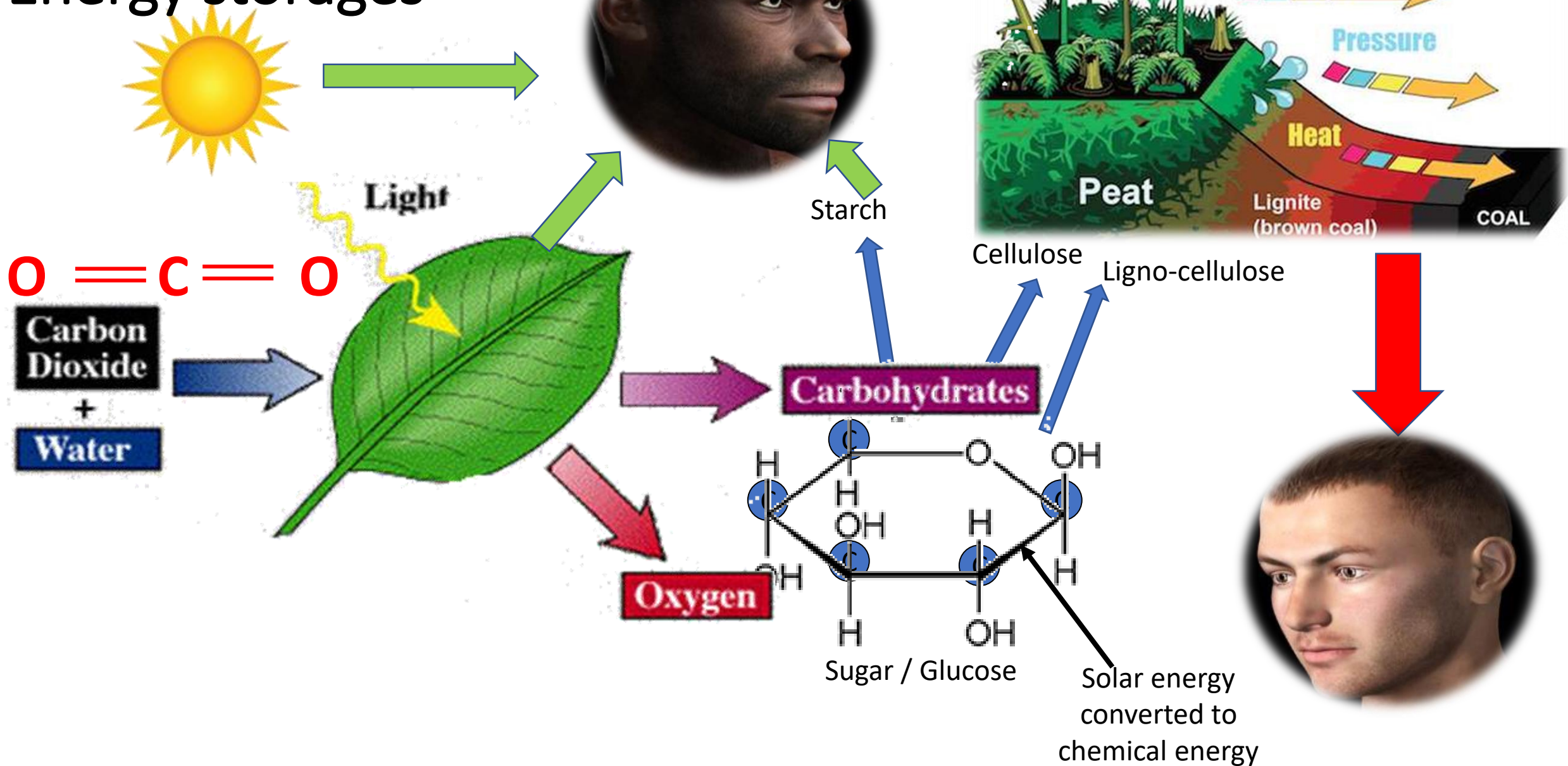
Consultant

Energy, Environment, Climate change and sustainable Productivity

Behaviors and behavioral science

- Behaviours
 - Way in which one acts or conducts oneself, especially towards surrounding environment.
 - Way in which an animal or person behaves in response to a particular situation or stimulus or environmental situation
 - Way in which a machine or natural phenomenon works or functions
 - Ex. Natural / Environmental behaviours
- Behavioral science
 - The scientific study on behaviours of living beings including human and animal
 - Include psychology, psychobiology, anthropology, and cognitive **science**.
 - Generally, behavior **science** deals primarily with human action and often seeks to generalize about human behavior as it relates to society

Sun, Bio photocells and Energy storages



Types of human behaviours

- Conscious
 - State of awareness of thoughts, feelings, perception and what is happening in the environment
- Unconscious
 - Opposite of conscious / without aware or conscious
- Overt
 - open to public observation
- Covert
 - Unseen objects such as thoughts, feelings or responses which are easily not seen
- Rational
 - Pertaining to reason, influenced or guided by reason rather than emotion
- Irrational
 - Illogical
- Voluntary
 - Doing something against your will, action made without intent of carried out despite an attempt to prevent them
- Simple
 - Living with minimal satisfaction Ex; what you see is what you get
- Complex
 - Compound complicated behaviours. Ex; Drug addicted

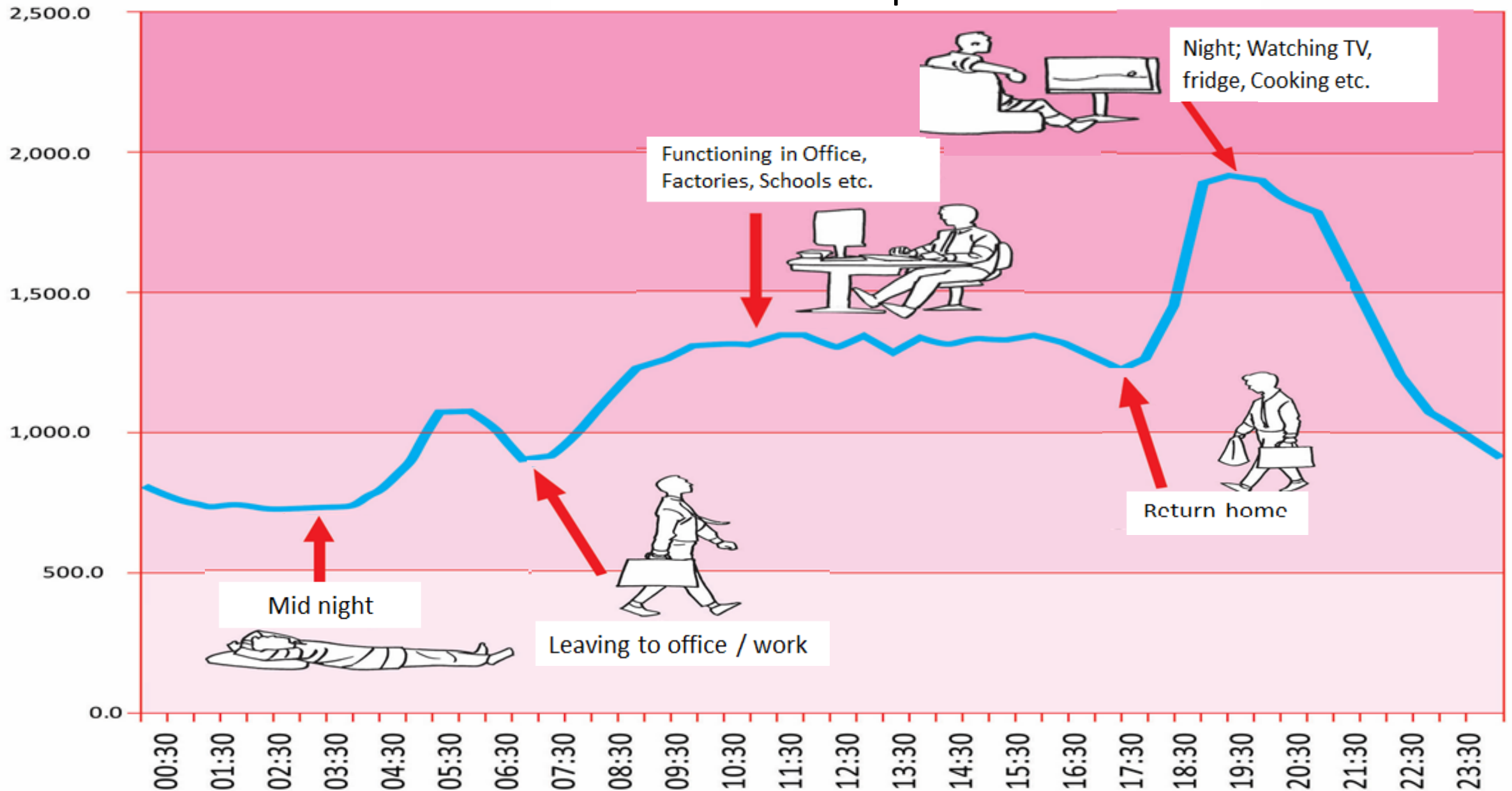
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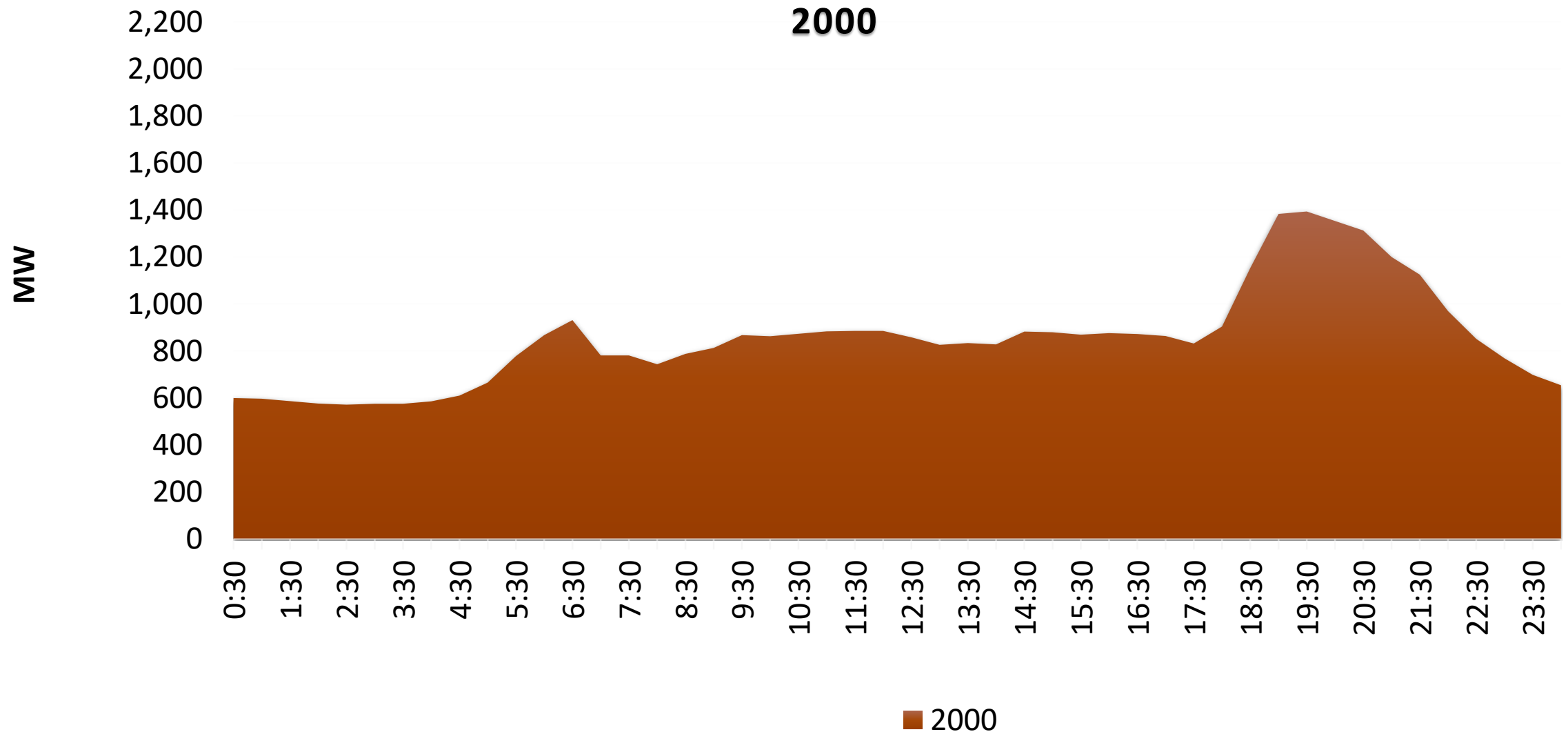
Conservation

- Prevention of wasteful use of a resource
- The principle by which the total value of a physical quantity or parameter of a particular resource remains constant in a system which is not subject to external influence but will have a usefulness of particular this resource through a socio – economical perspective
- Energy conservation with
 - Consciously,
 - Overtly,
 - Rationally,
 - Voluntarily
 - Simple

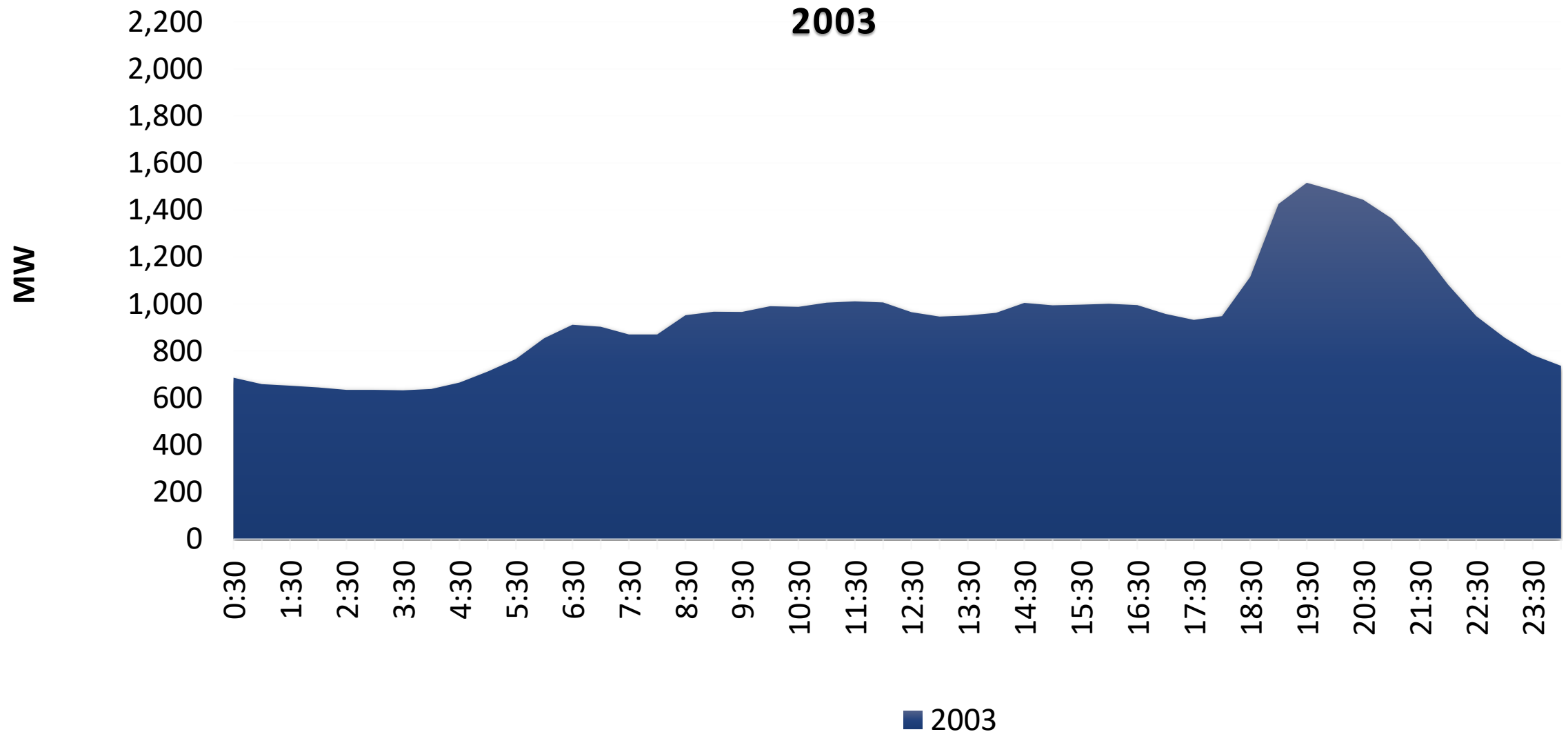
Daily national electricity demand / load curve with behavioral patterns



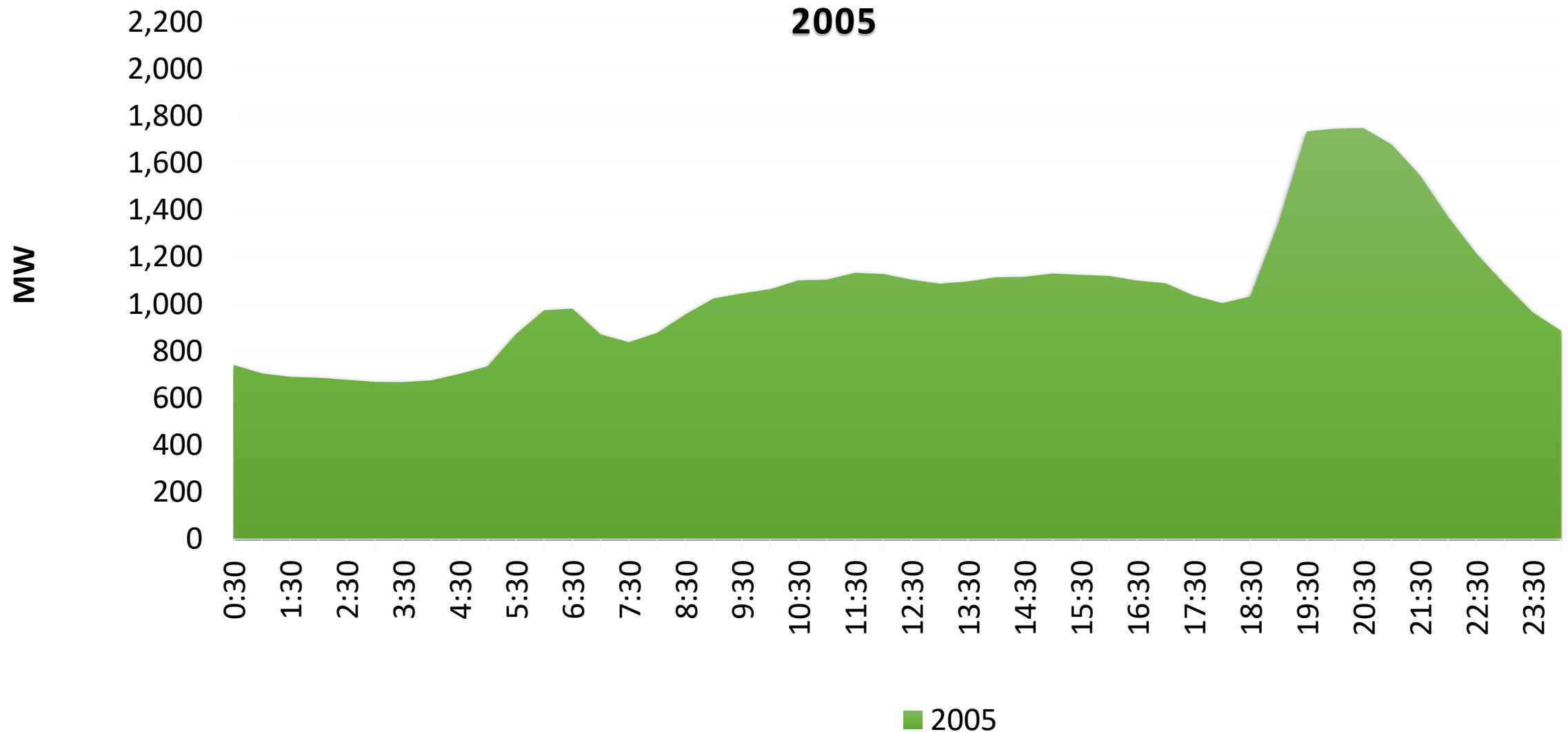
Behavioral change and Electricity Demand Profile change



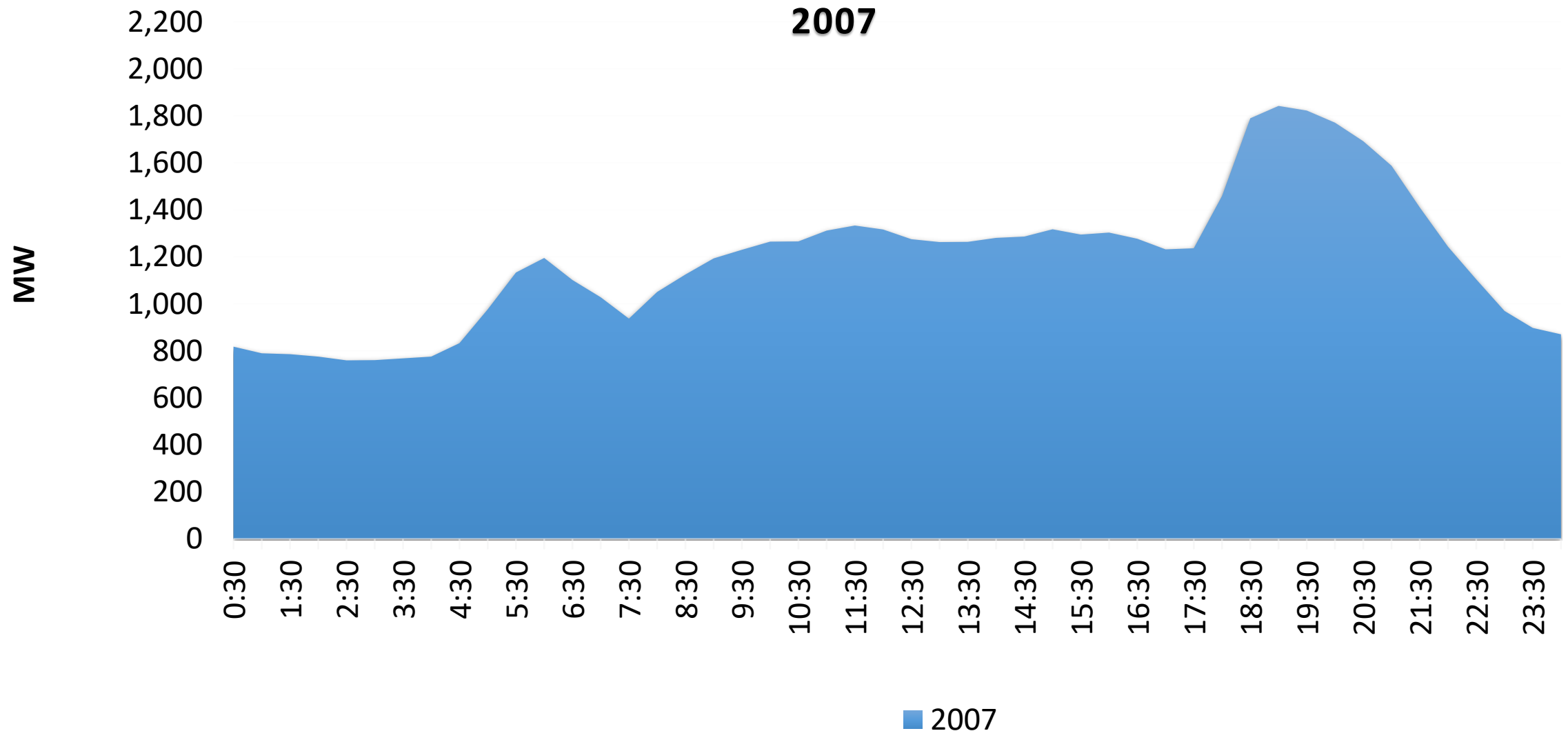
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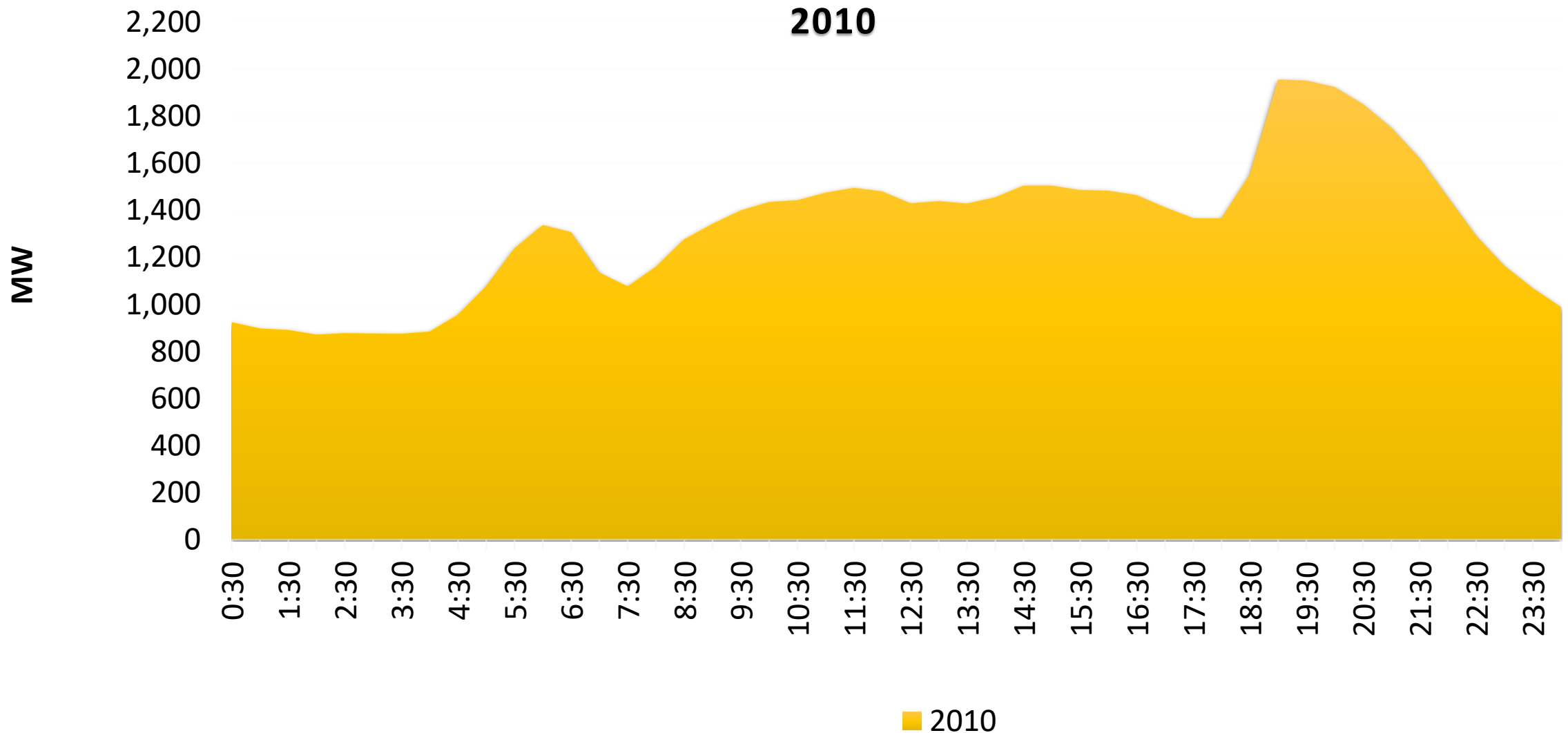
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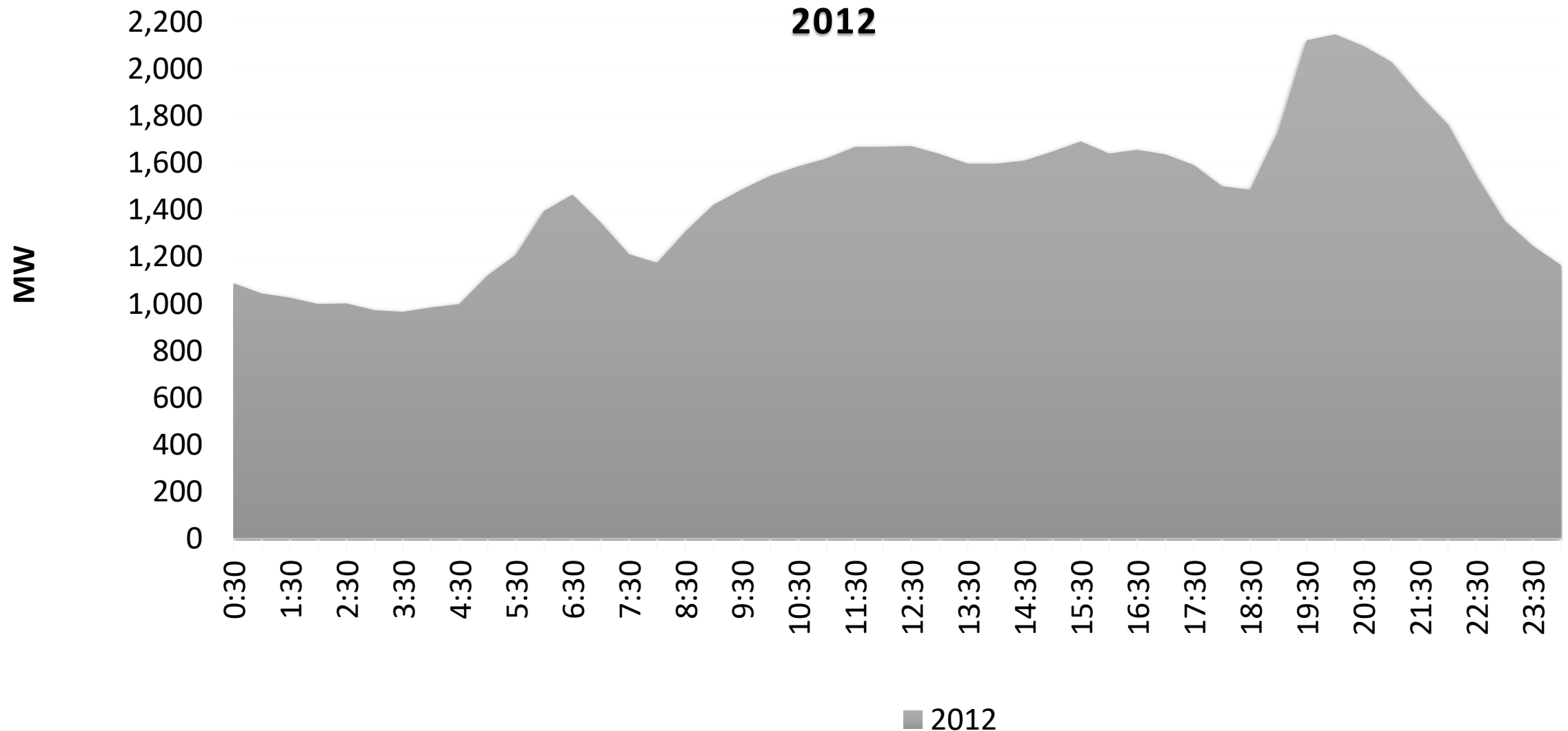
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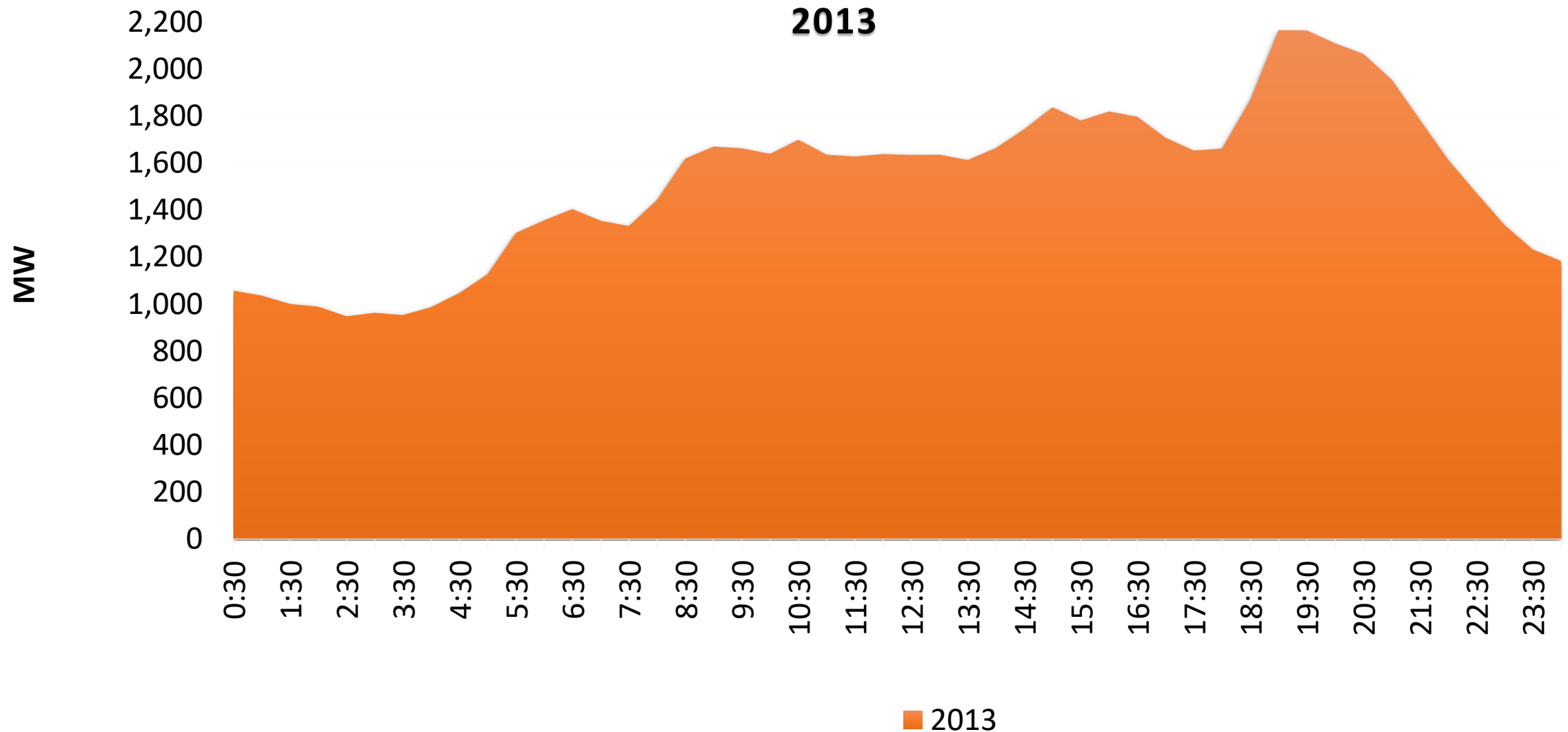
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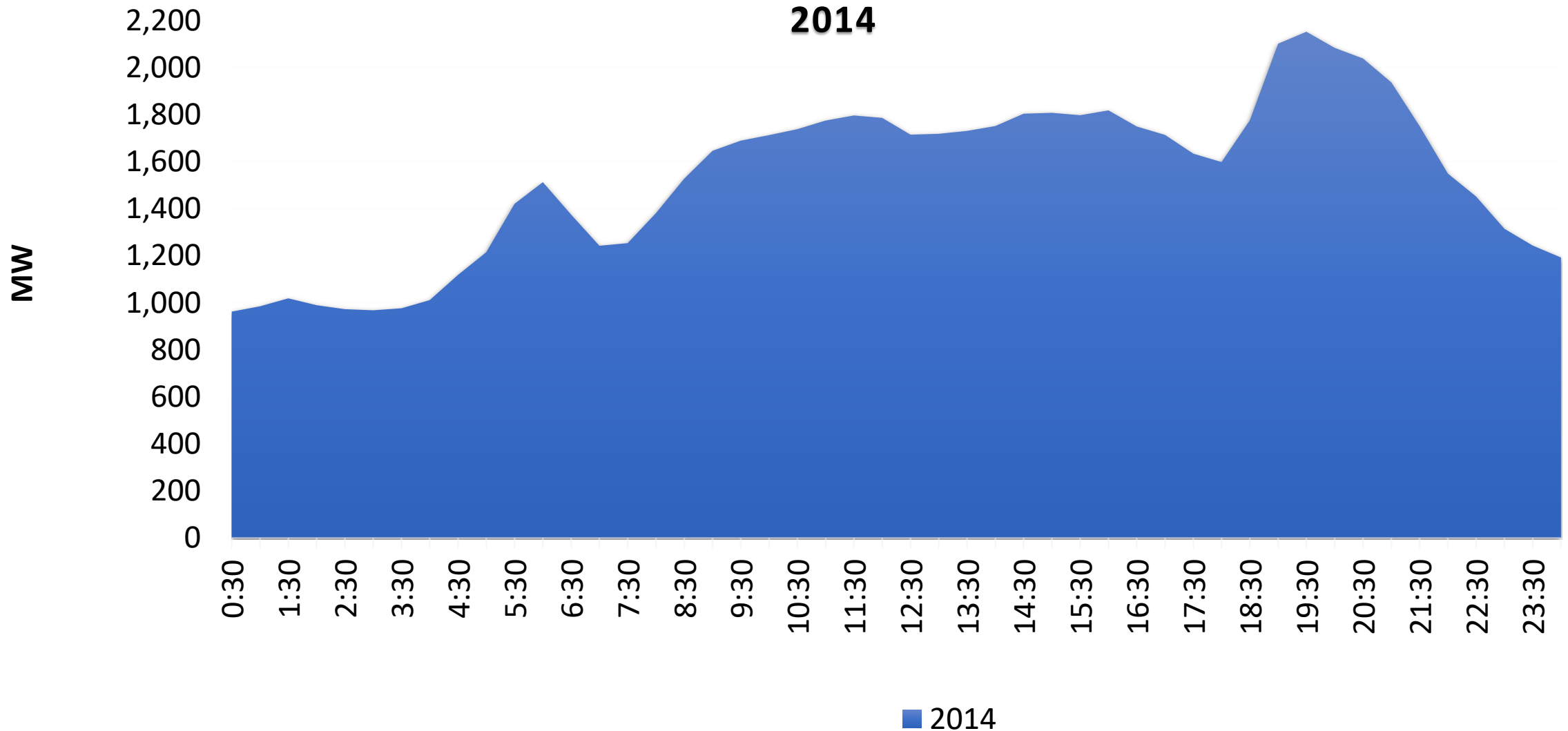
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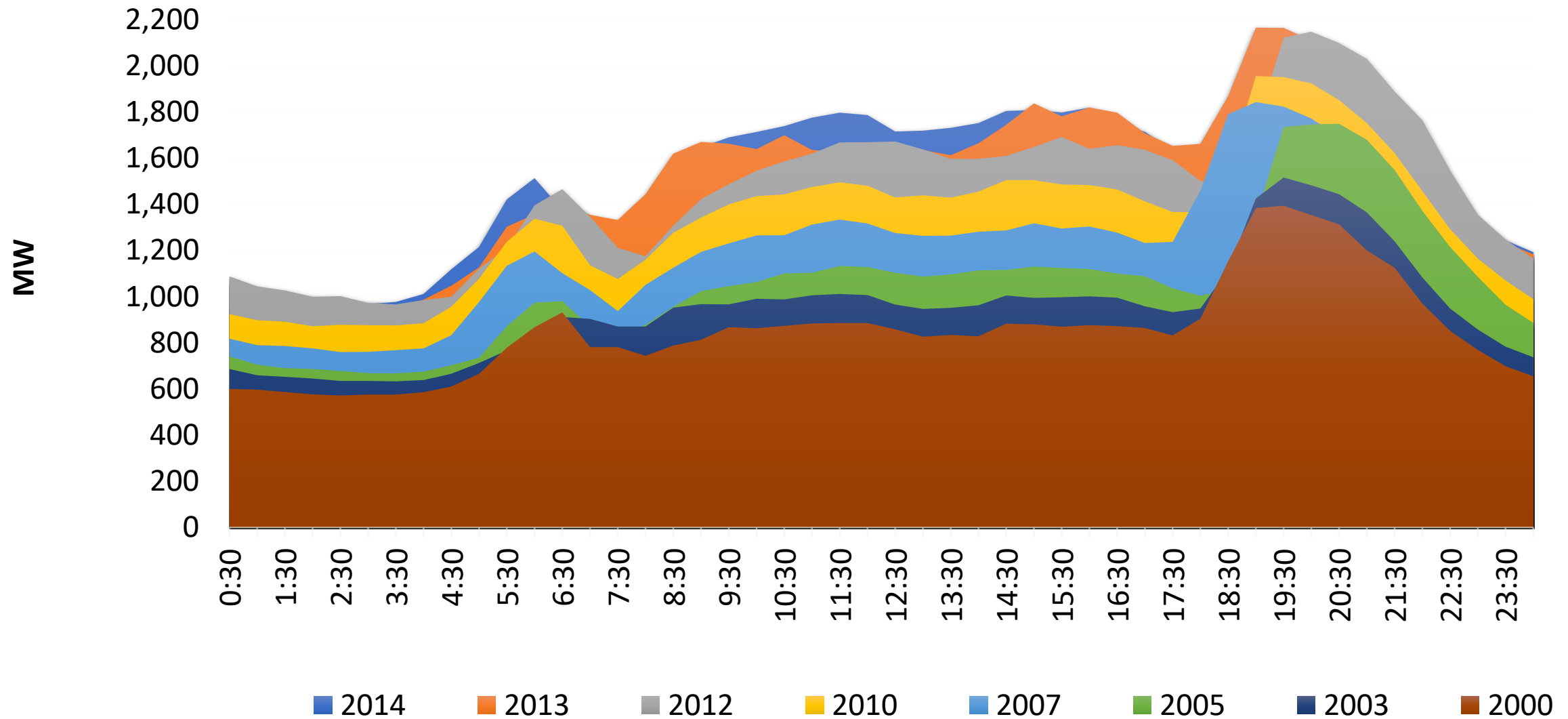
Behavioral change and Electricity Demand Profile change



Behavioral change and Electricity Demand Profile change



Behavioral change and Electricity Demand Profile change



**Energy
conservation**

**Energy
waste**

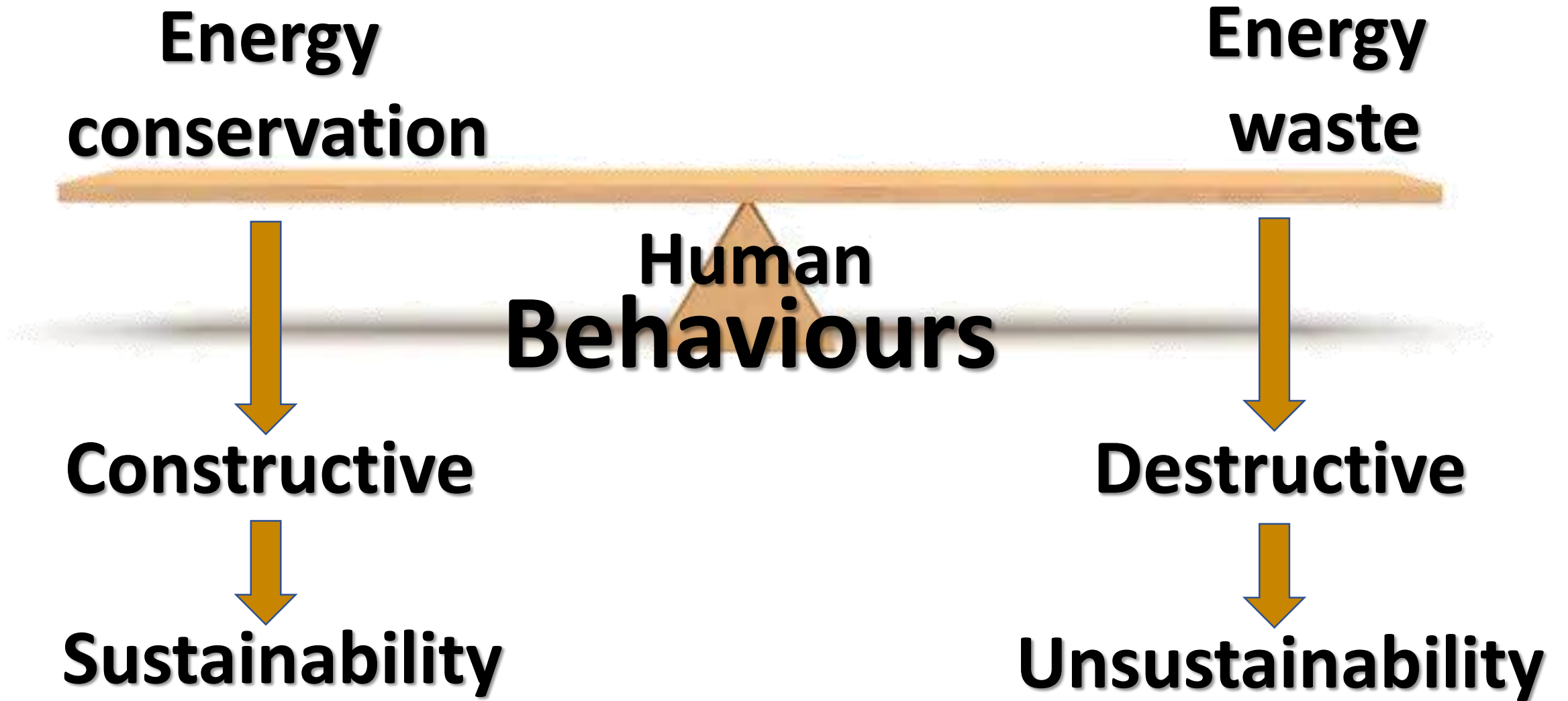
**Human
Behaviours**

Constructive

Destructive

Sustainability

Unsustainability

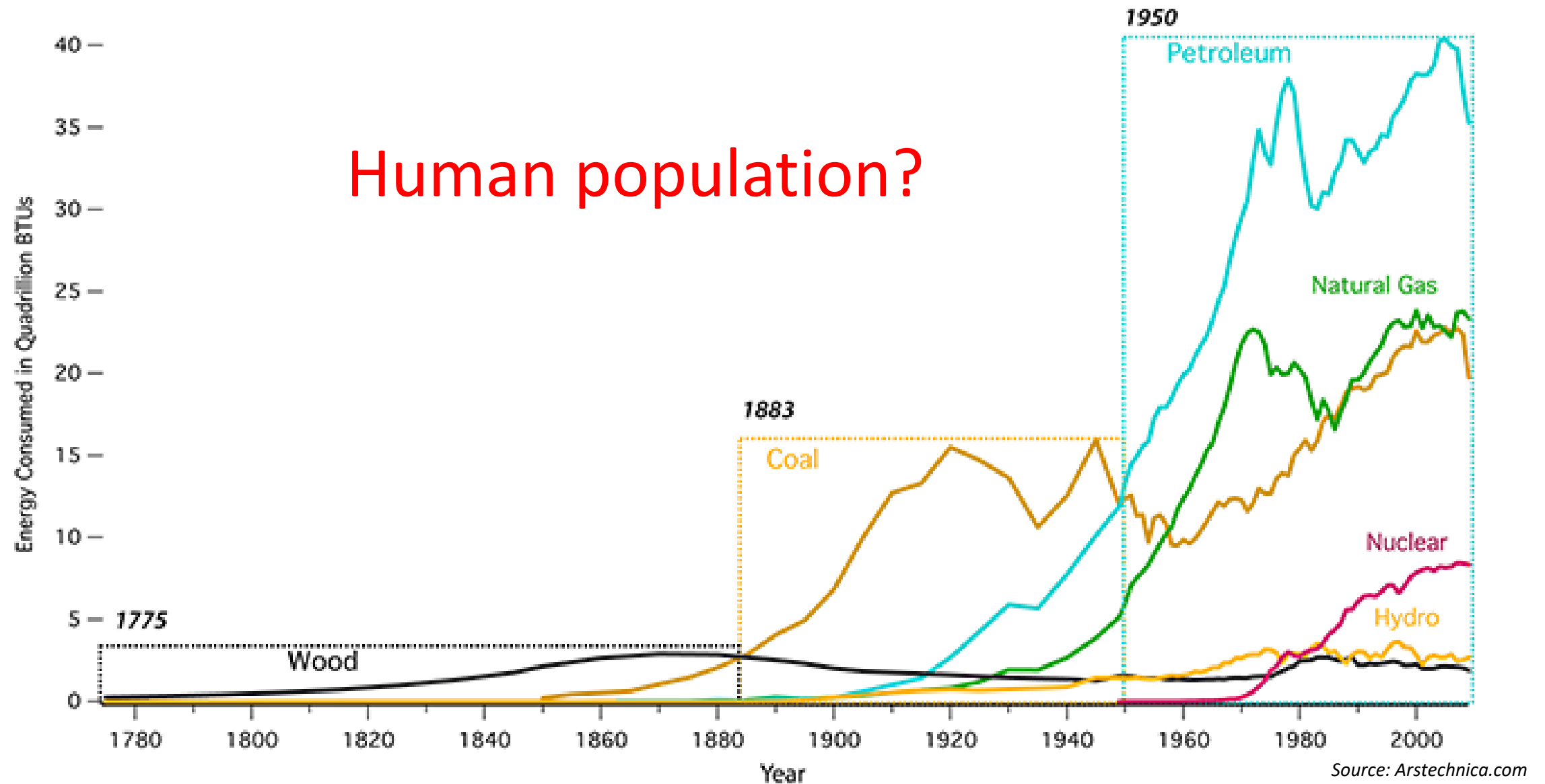


Energy consumption behaviours Vs. Human development milestones

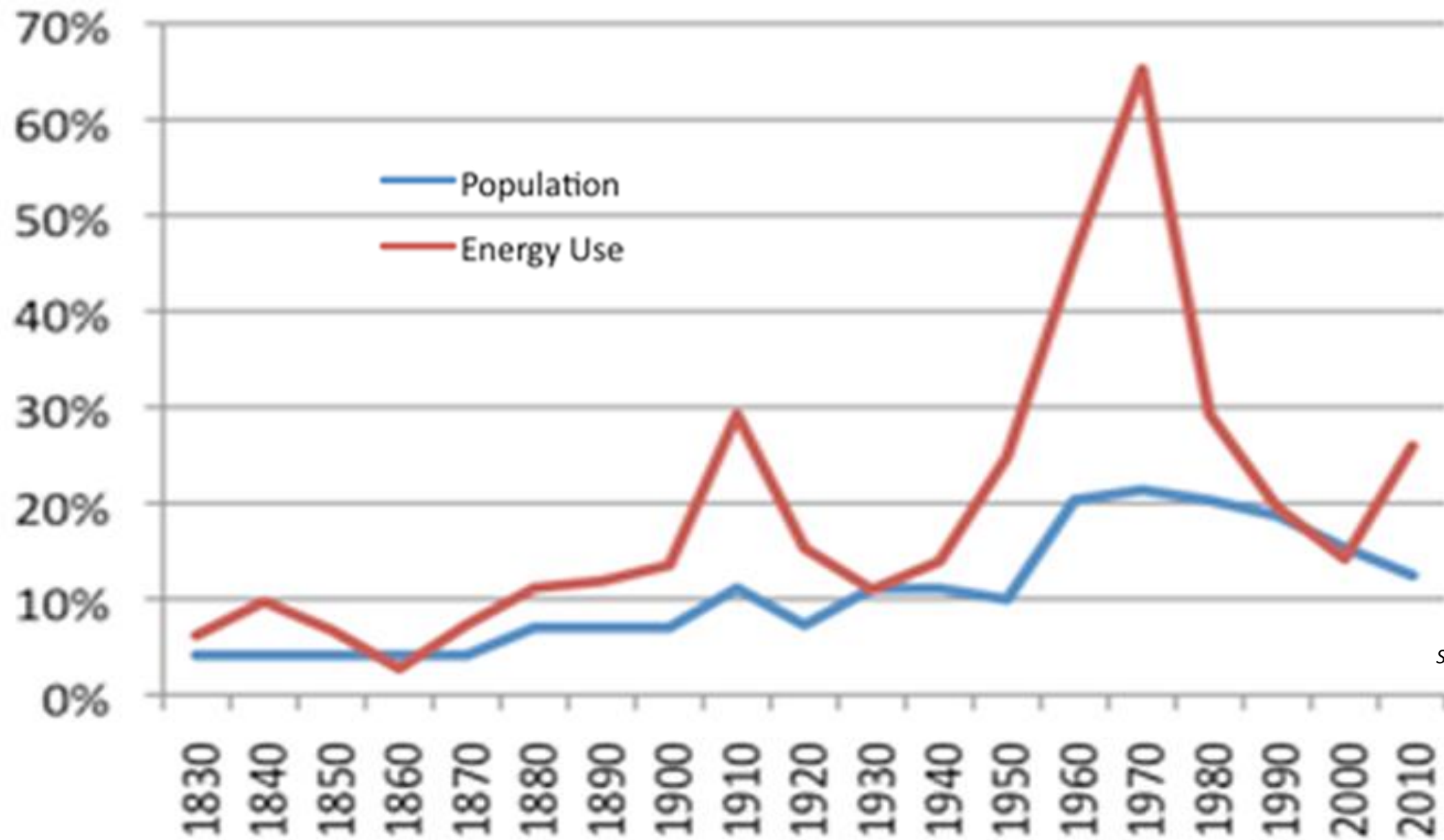
Milestone	Per capita daily energy consumption (Thousand kilo Calories)				
	Preparing food	Agriculture	Industries	Transport	Total
Early Human – Homo erectus (~ million years before)	2				2
Hunting Human (100 thousand years before)	3	2			5
Early agricultural age Human (around 5000 BC)	4	4	4		12
Agricultural Industrialist (around 1400 AD)	6	12	7	1	26
Industrialist (from 1875 AD)	7	32	24	14	77
Modern Man (from 1970 AD)	10	66	91	63	230

Information Age – $245 * 10^3$ Kilo Calories

Global human energy consumption

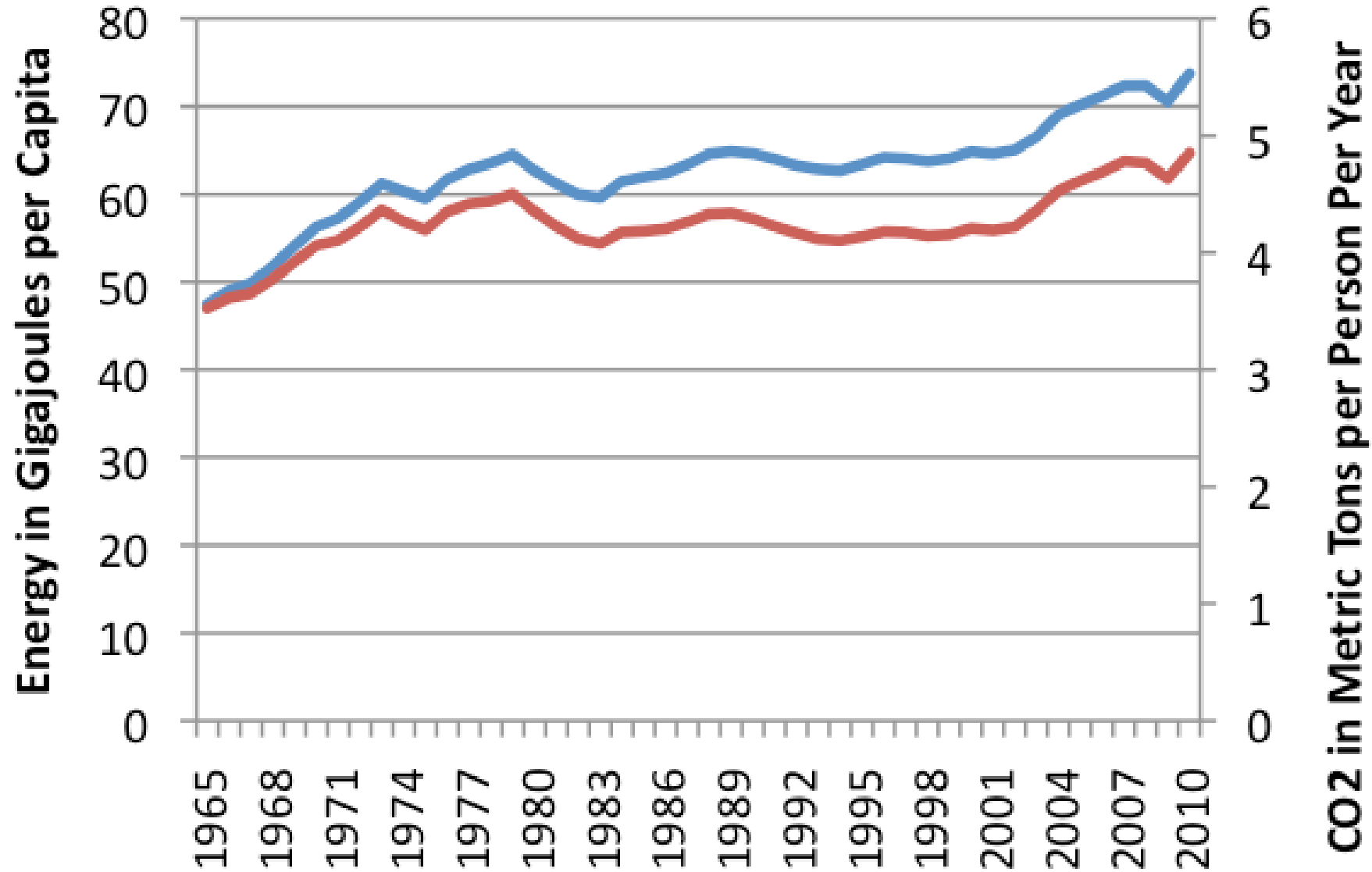


Decade % increase in Energy Vs. Human Population Change

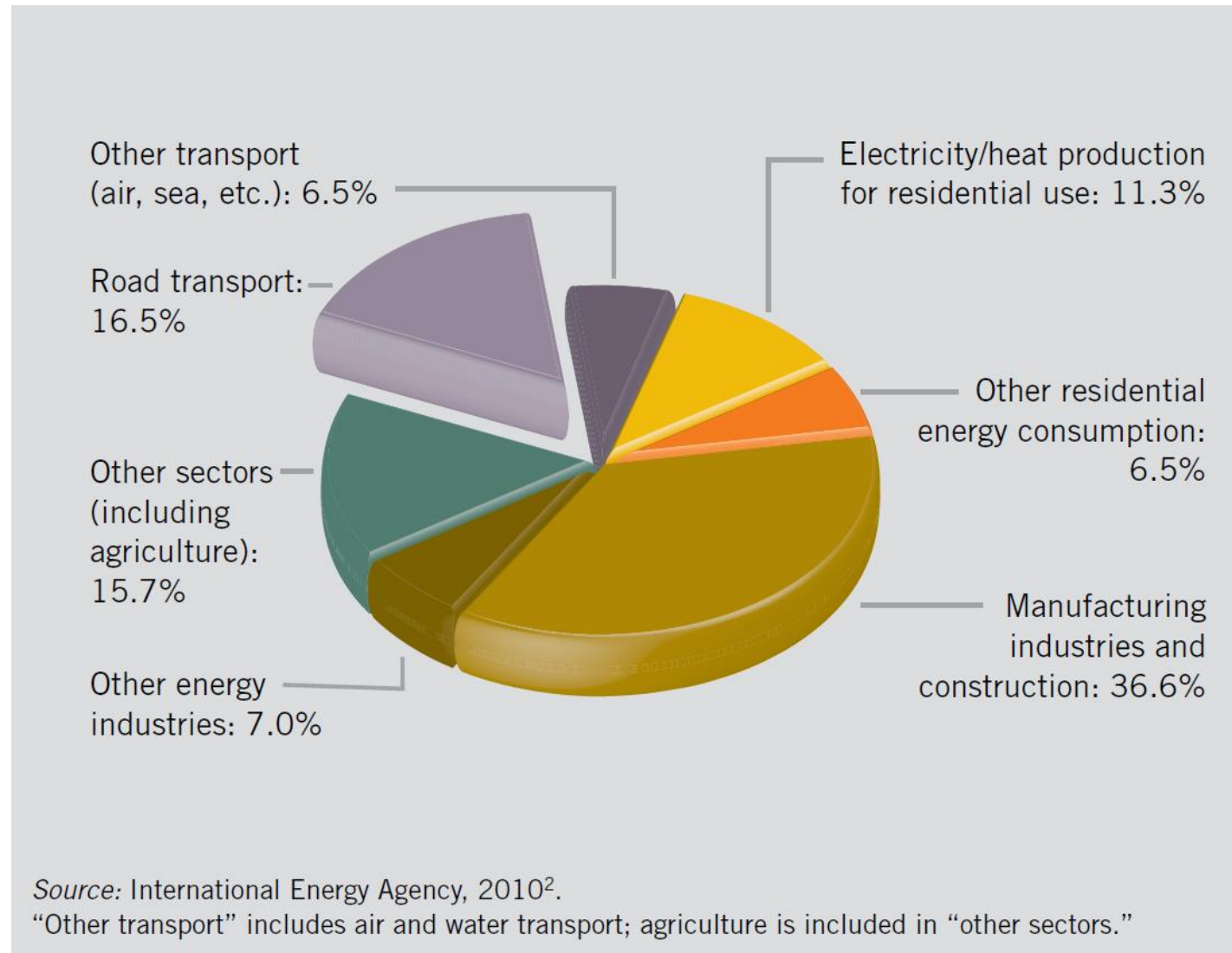


Source: Our finite world

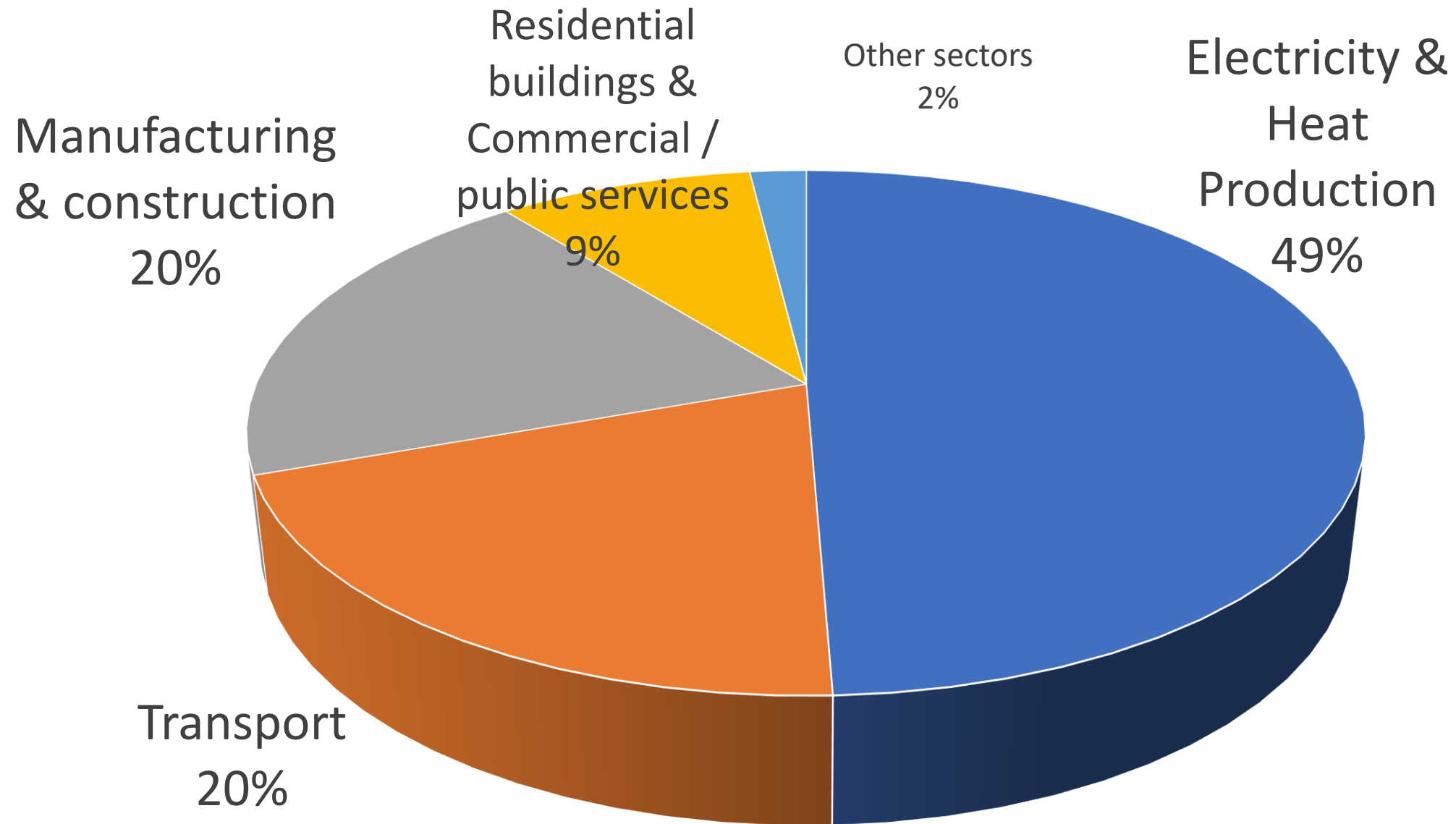
Global per capita Energy consumption Vs. CO₂



Strong need in human behavioral change in human energy consumption patterns

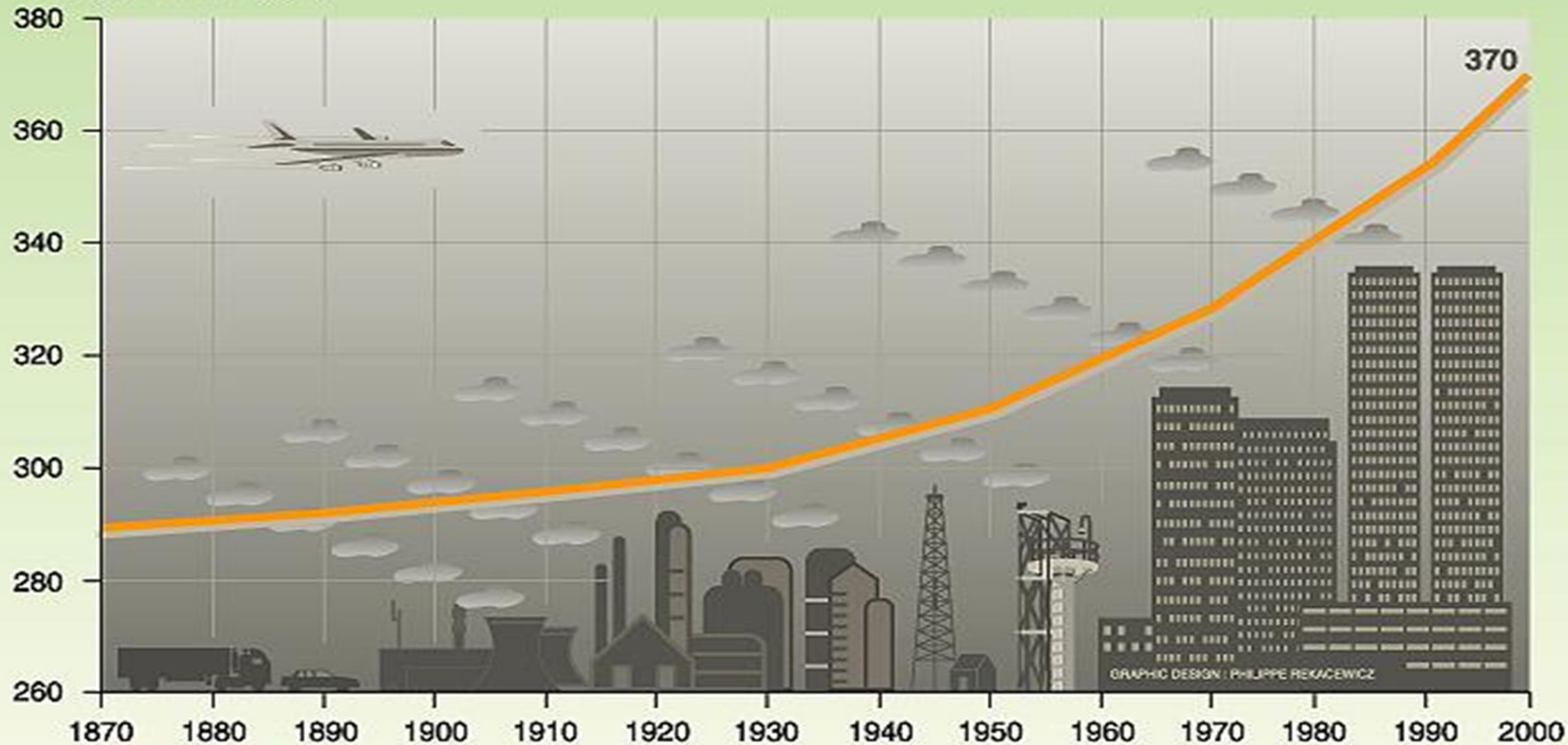


World Carbon dioxide (CO₂) emissions by sector or source - 2014



Global atmospheric concentration of CO₂

Parts per million (ppm)



Increasing Challenge of climate change

Atmospheric CO_2

July 2019

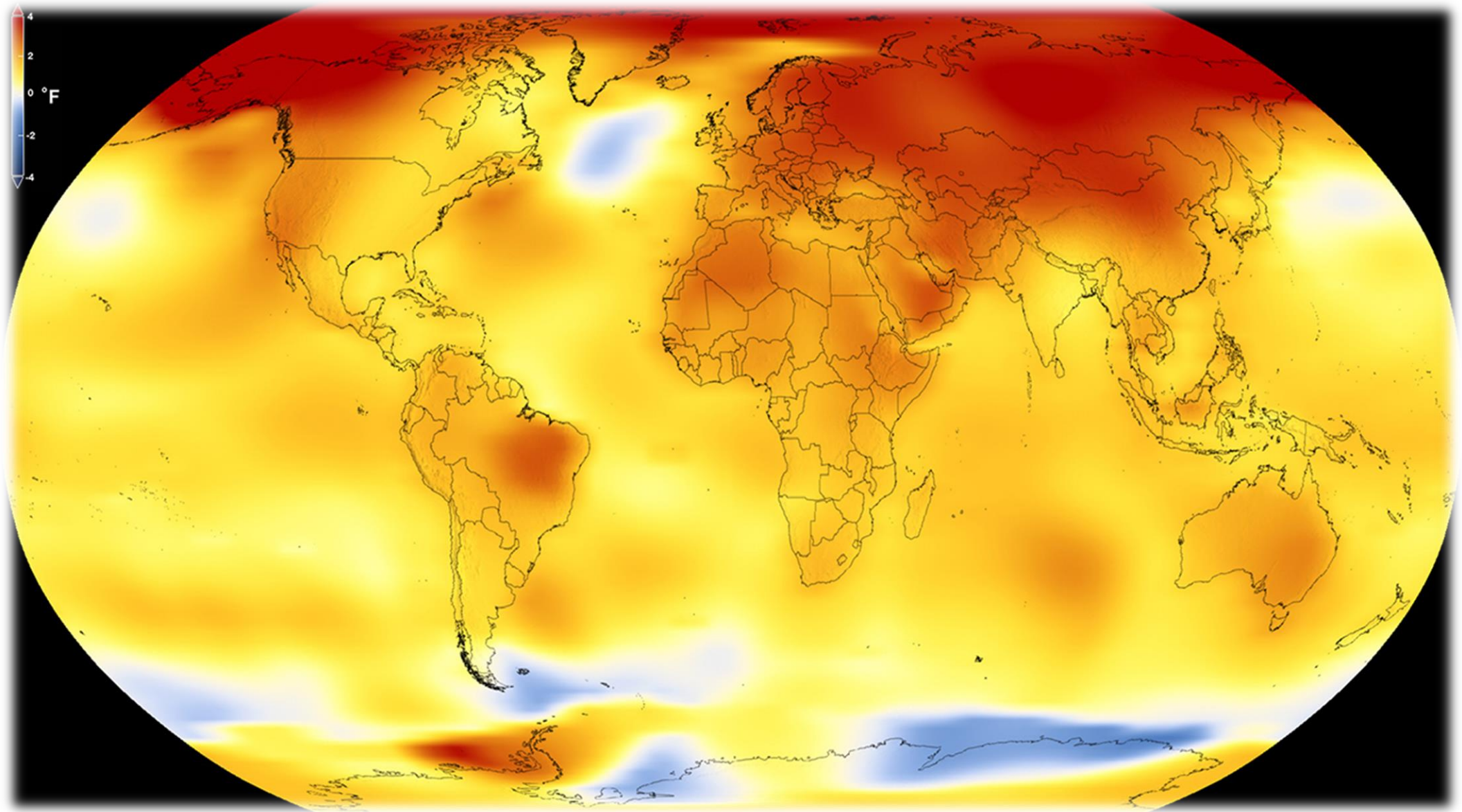
411.77

parts per million (ppm)

Mauna Loa Observatory, Hawaii (NOAA)

Preliminary data released August 5, 2019

Warming planet



Need for a sustainable lifestyle

- Sustainable living is fundamentally the application of sustainability to lifestyle choice and decisions
- Living with balanced triple-bottom-lines
- Meeting present ecological, societal, and economical needs without compromising same factors for future generations

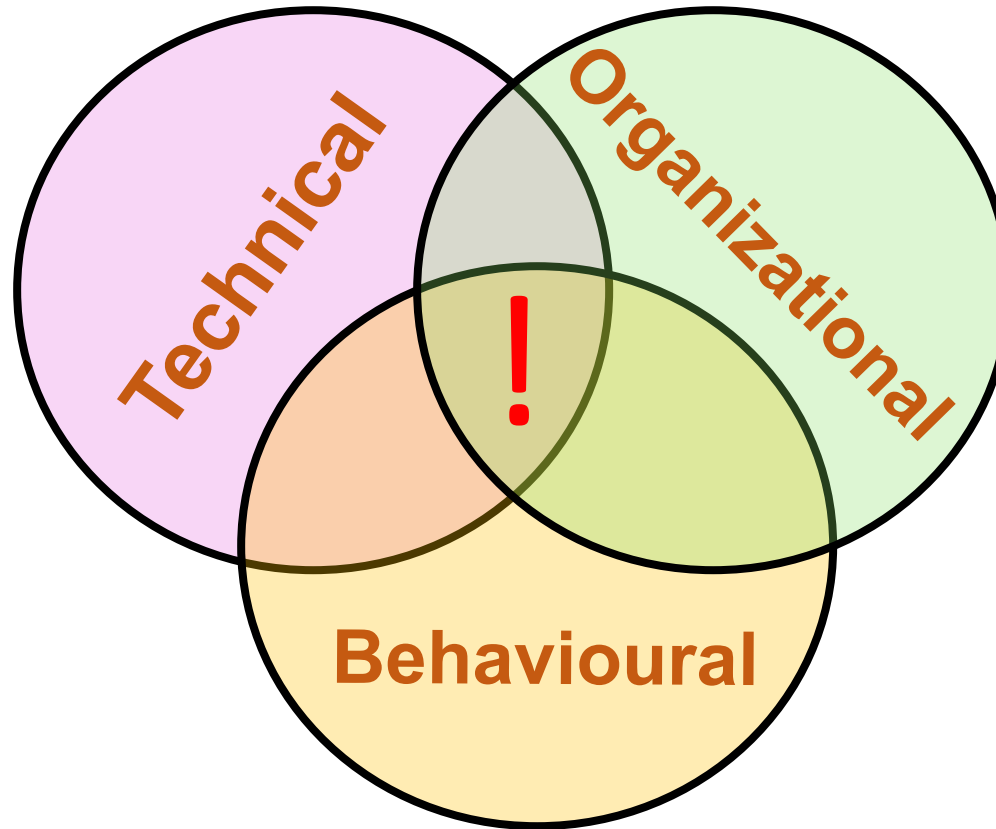


SUSTAINABLE LIFESTYLE

“through energy perspective”

- Dimensions

Appliances,
materials,
services etc.
that use
energy
efficiently



Systems that can
support the
achievement
of energy
efficiency goals

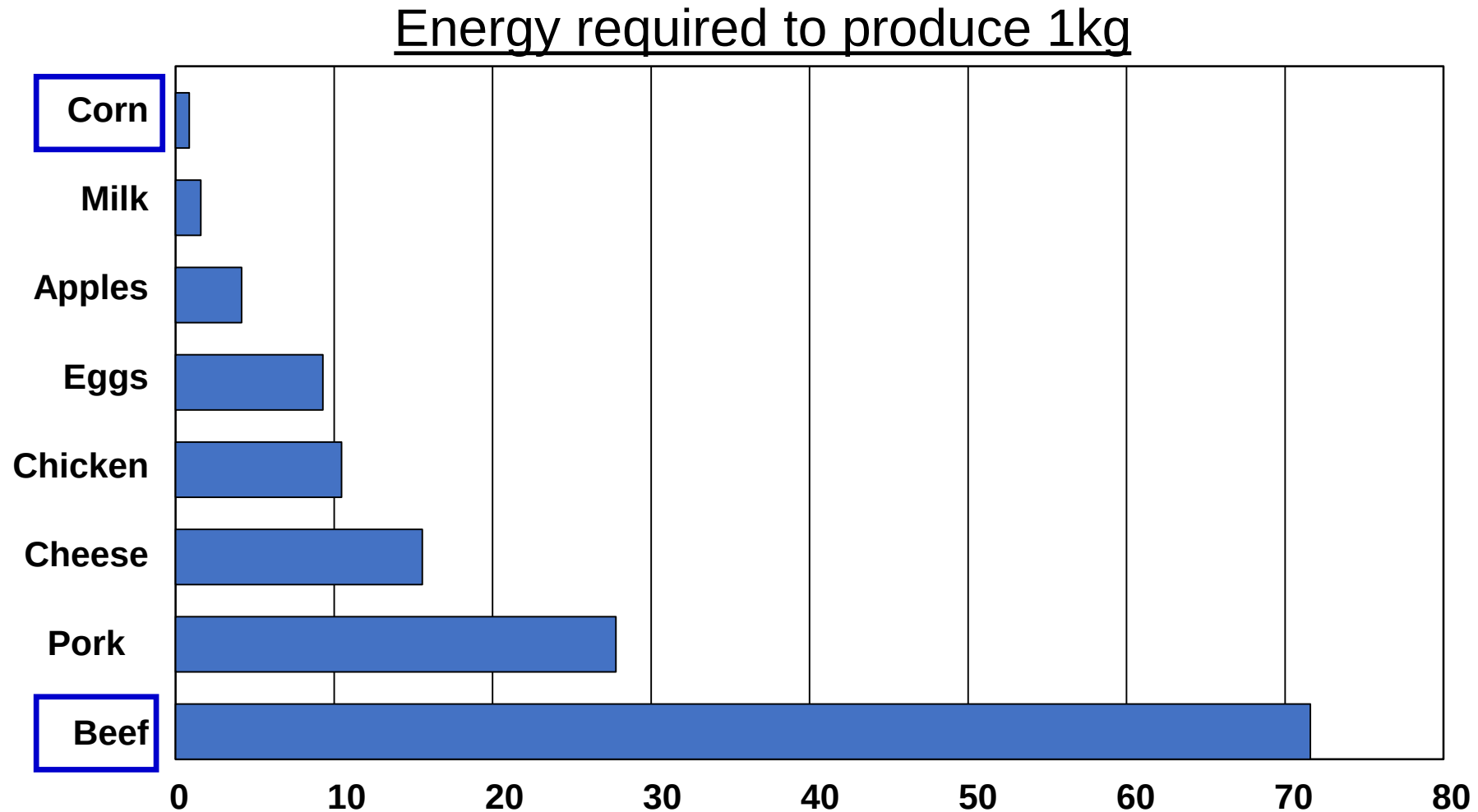
Personal values, attitudes and practices
of individuals that impact on energy use

SUSTAINABLE LIFESTYLE

- Key behaviours for a sustainable lifestyle
 - Greening the home (retrofitting)
 - Lifecycle perspective
 - Using energy (and other utilities) wisely
 - Extending the life of things (to minimize waste)
 - Managing cooking and a sustainable & healthier diet
 - Choosing eco-products & services
 - Travelling sustainably
 - Setting up & using resources in the community
 - Using & futureproofing outdoor spaces
 - Being part of improving the environment

SUSTAINABLE LIFESTYLE

- Decisive Choices
 - Example: Choice of food



SUSTAINABLE LIFESTYLE

- Decisive Choices
 - Example: Choice of food

Liters of water required to produce 1kg

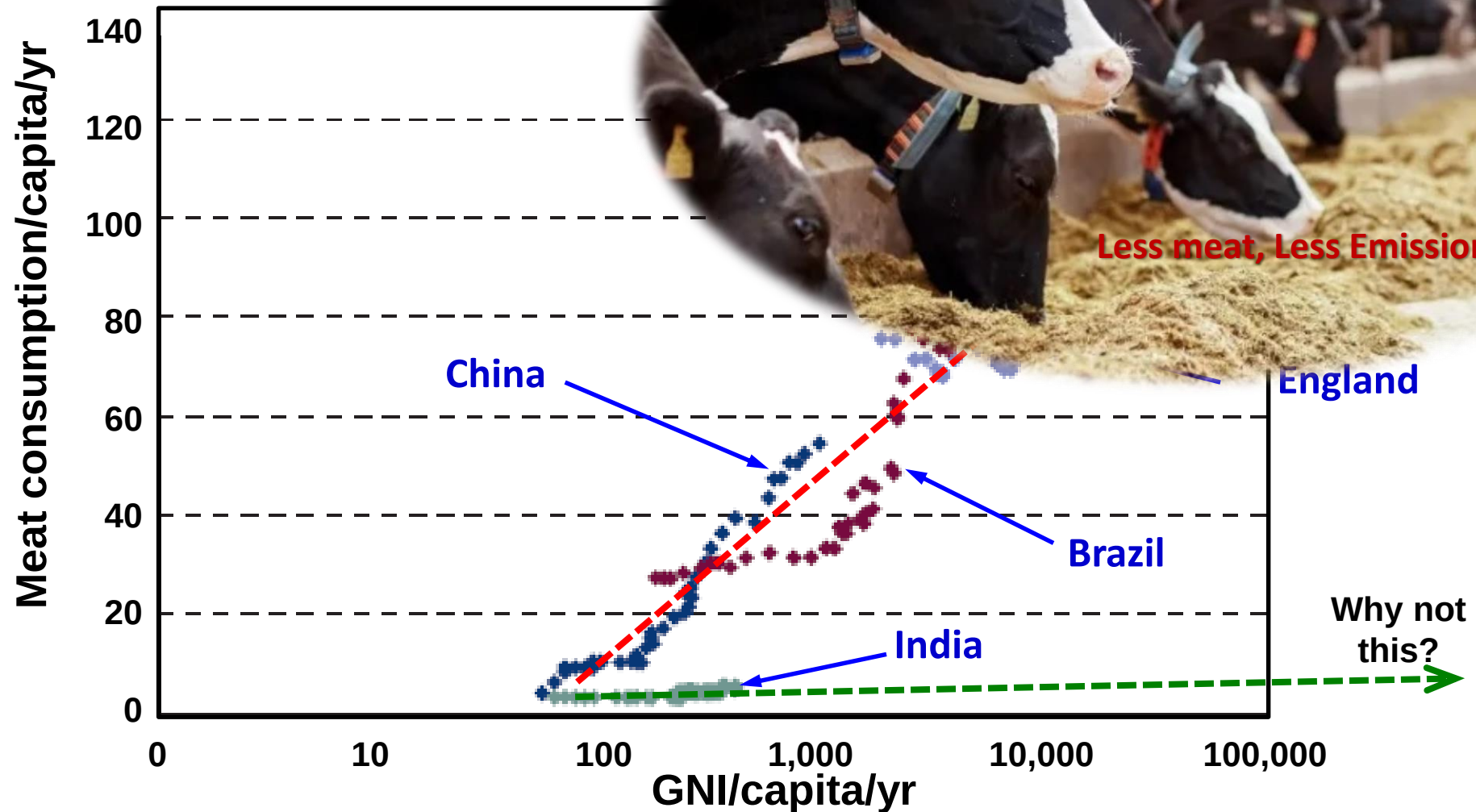
Food Type	LC Water requirement (liters/kg)
Potatoes	500
Wheat	900
Sorghum	1100
Maize	1400
Rice	1900
Soya beans	2000
Chicken	3500
Beef	50,000

SUSTAINABLE LIFESTYLE

- Decisive Choices

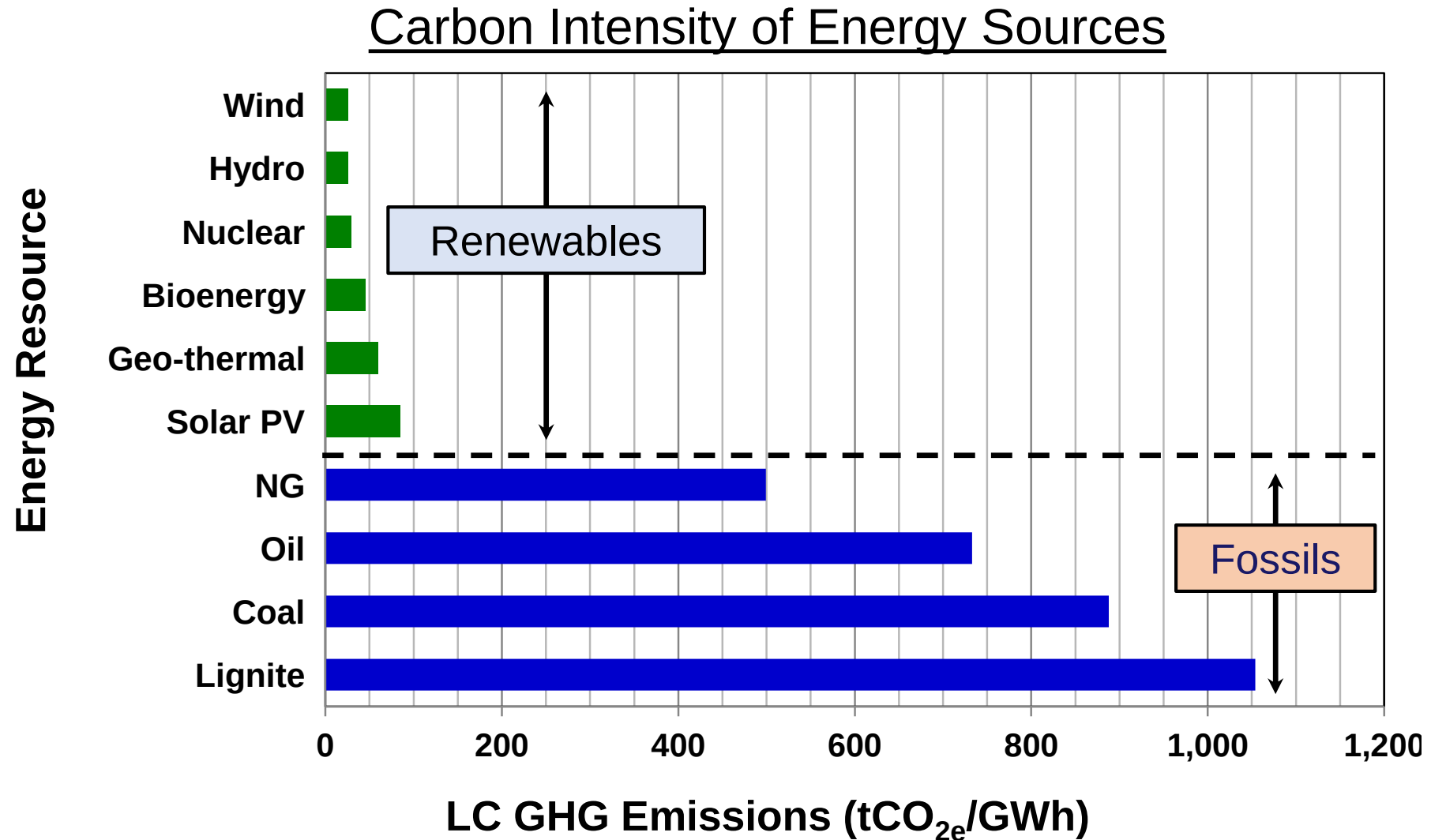
- Example: Choice of food

Per Capita Meat Co



SUSTAINABLE LIFESTYLE

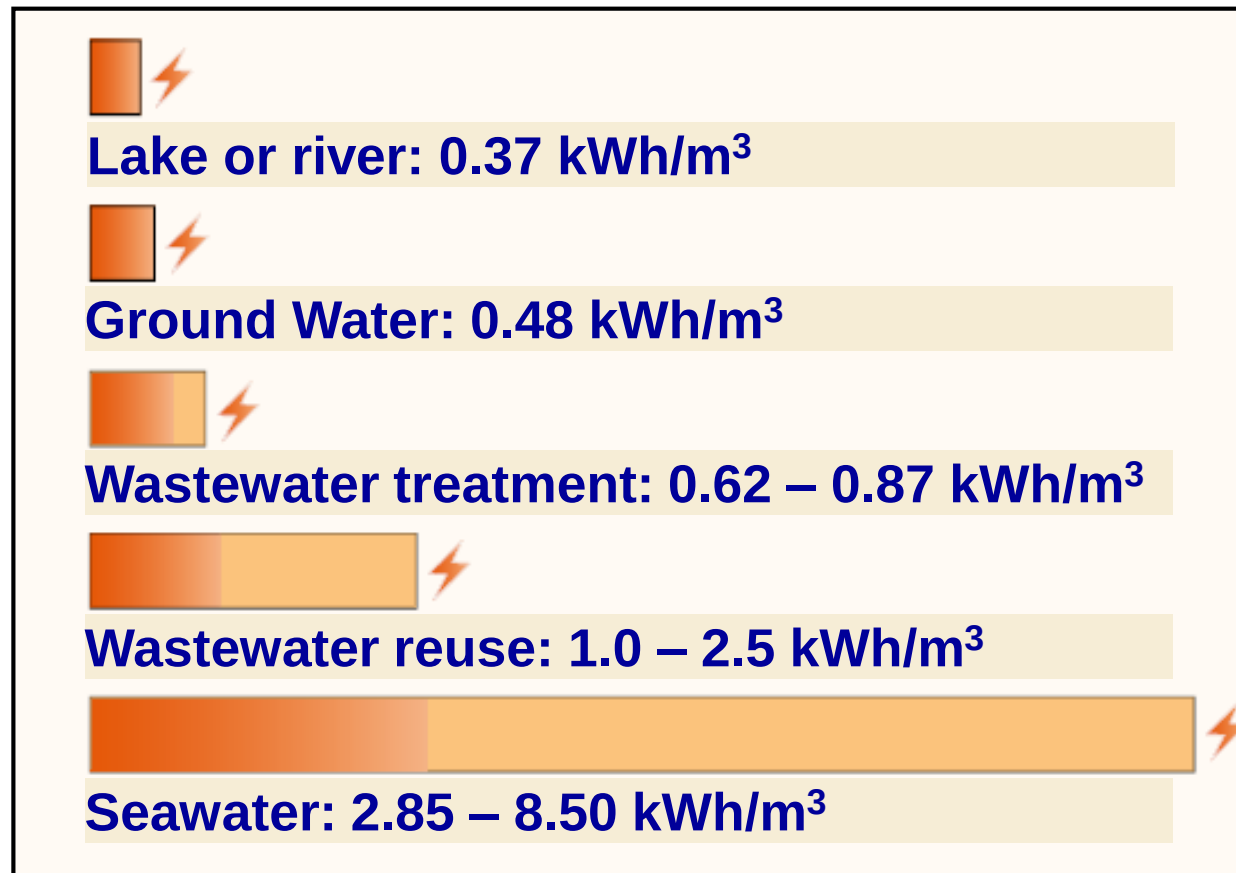
- Decisive Choices
 - Example: Choice of energy



SUSTAINABLE LIFESTYLE

- Decisive Choices
 - Example: Choice of water resource

Energy requirement for water supply



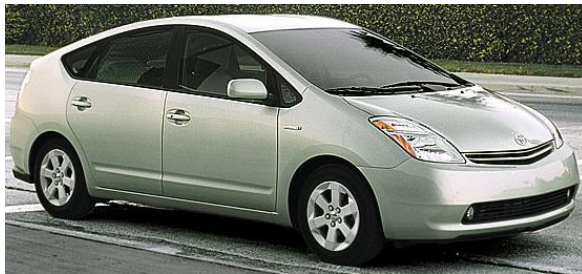
SUSTAINABLE LIFESTYLE

- Decisive Choices
 - Example: Choice of Transport

Energy requirement for passenger transportation



0.05 liter/passenger km



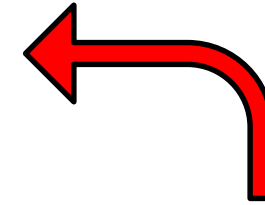
0.025 liter/passenger km



0.008 liter/passenger km



0 liter/passenger km

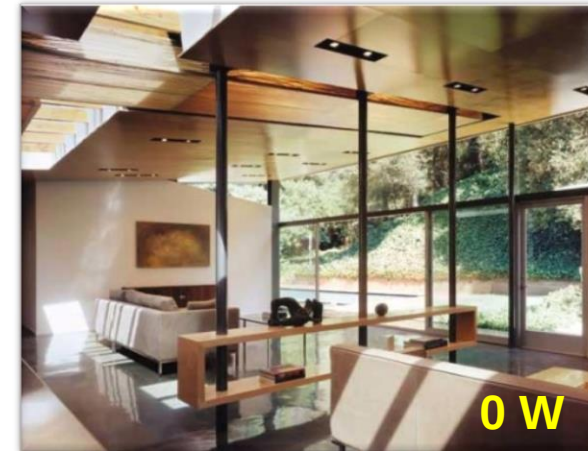
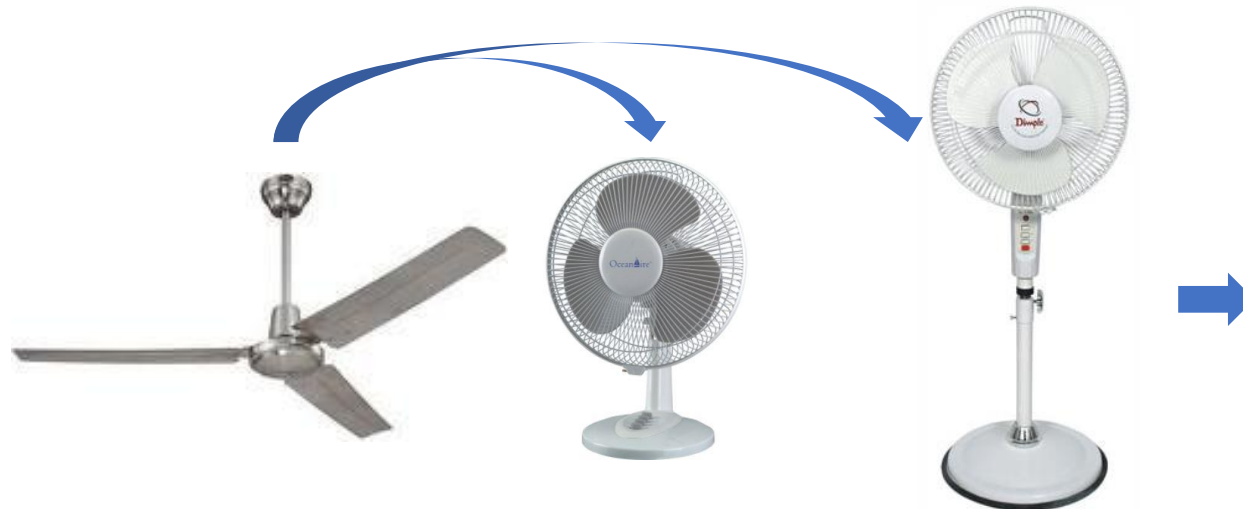
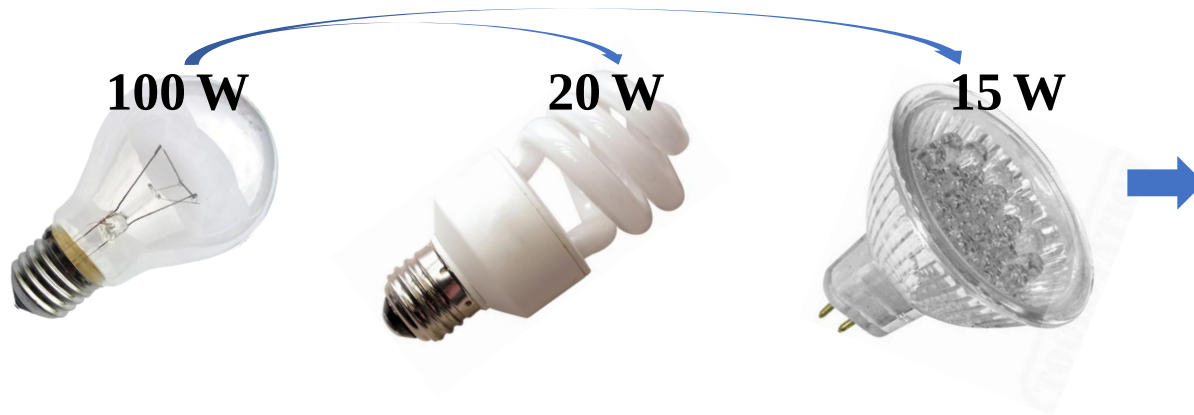


0.0025 liter/passenger km



SUSTAINABLE LIFESTYLE

- Decisive Choices
 - Example: Choice of Appliances



SUSTAINABLE LIFESTYLE

■ KPI

□ HH Energy Modesty Index

Energy Services

ES1: Lighting

ES2: Refrigeration

ES3: Ironing

ES4: Cloth Washing

ES5: Food preparation

ES6: Cooking

ES7: Rice cooker / Oven / Microwave

ES8: Water Heating / boiling

ES9: Water pump

ES10: Ventilation and Air Conditioning

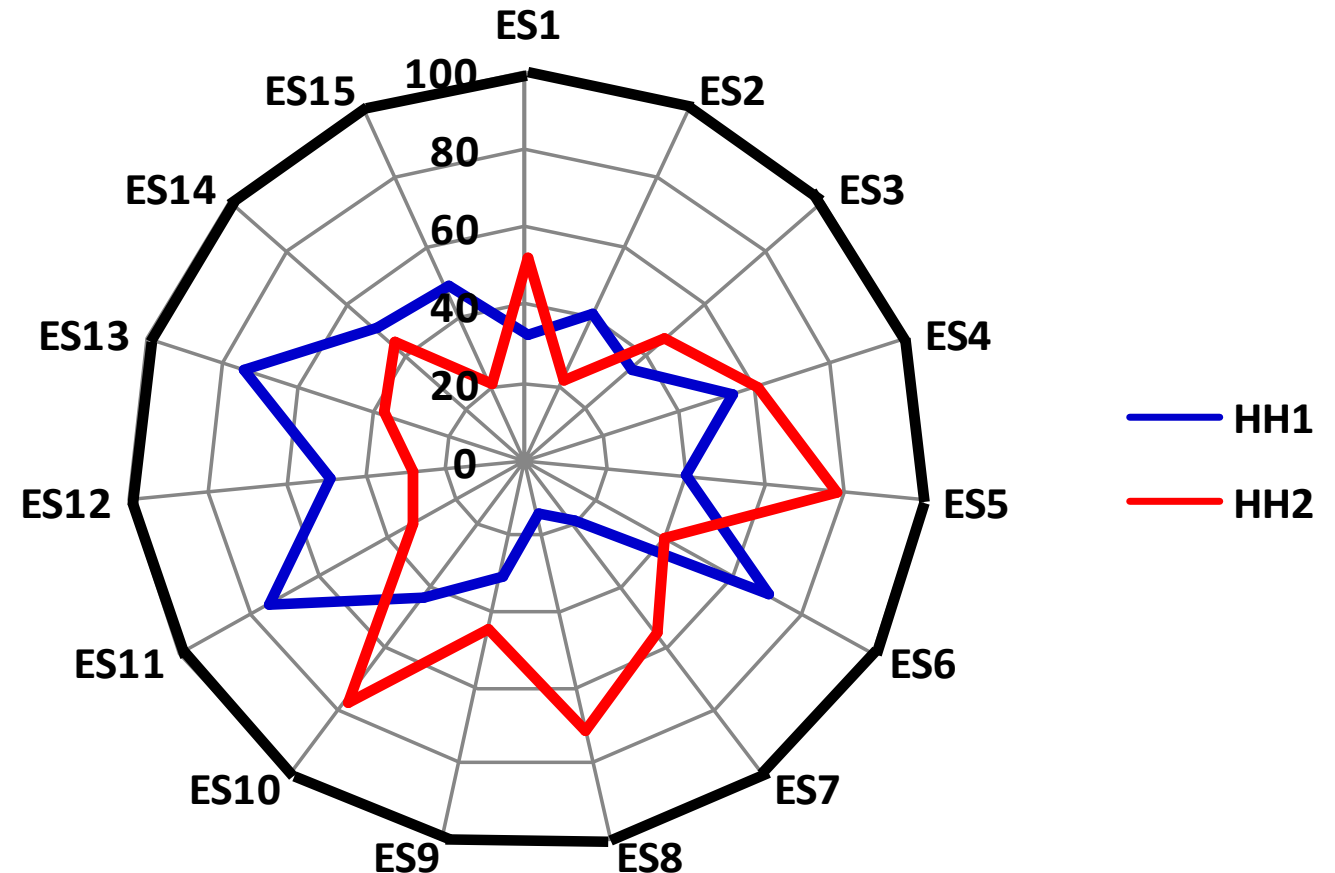
ES11: Mobile Charger / CDMA

ES12: Computer

ES13: TV

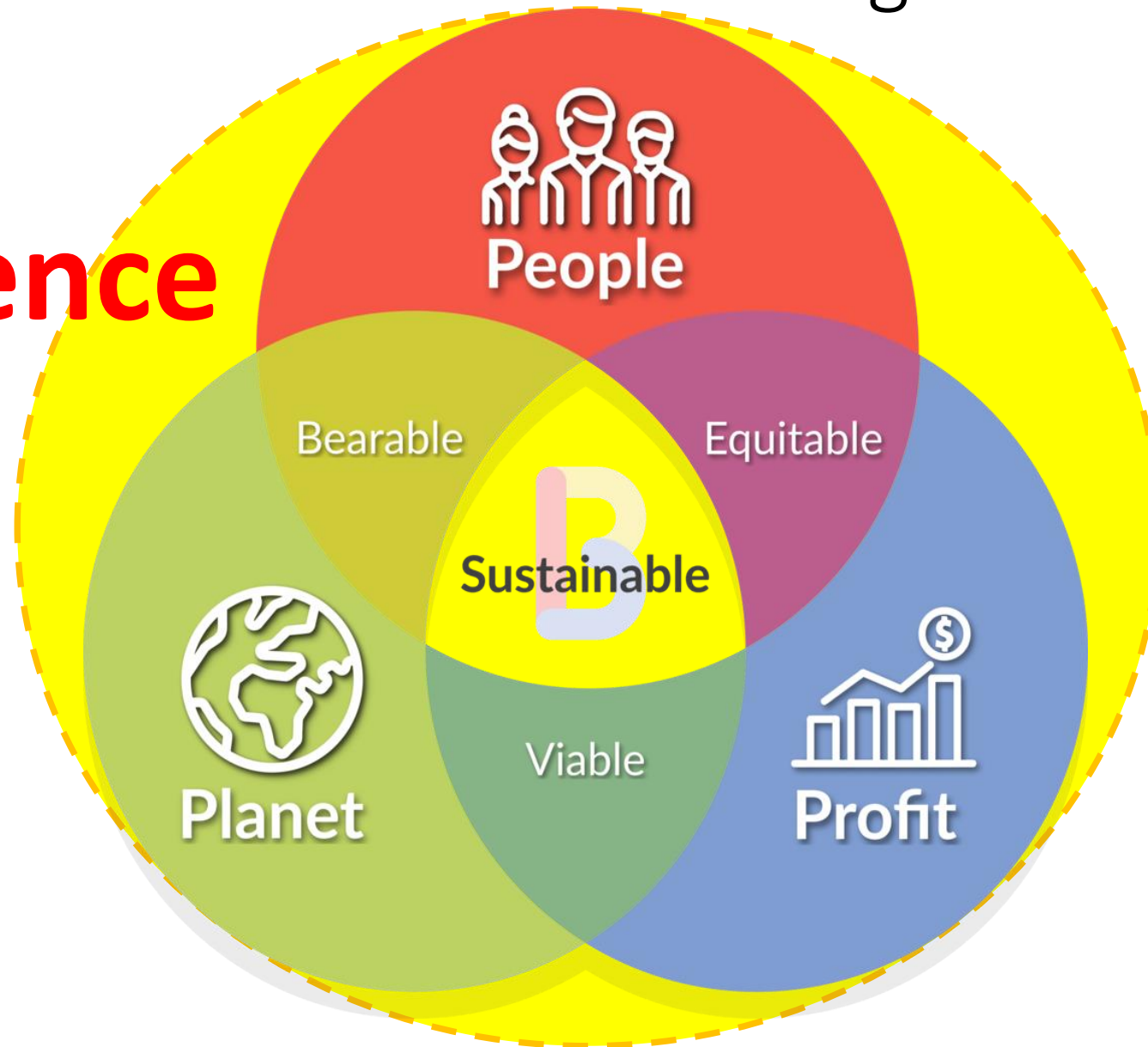
ES14: Cassette Recorder / Radio / DVD

ES15: Other equipment / Services



Need beyond triple bottom approach for
human Behaviour change

Conscience



End of presentation