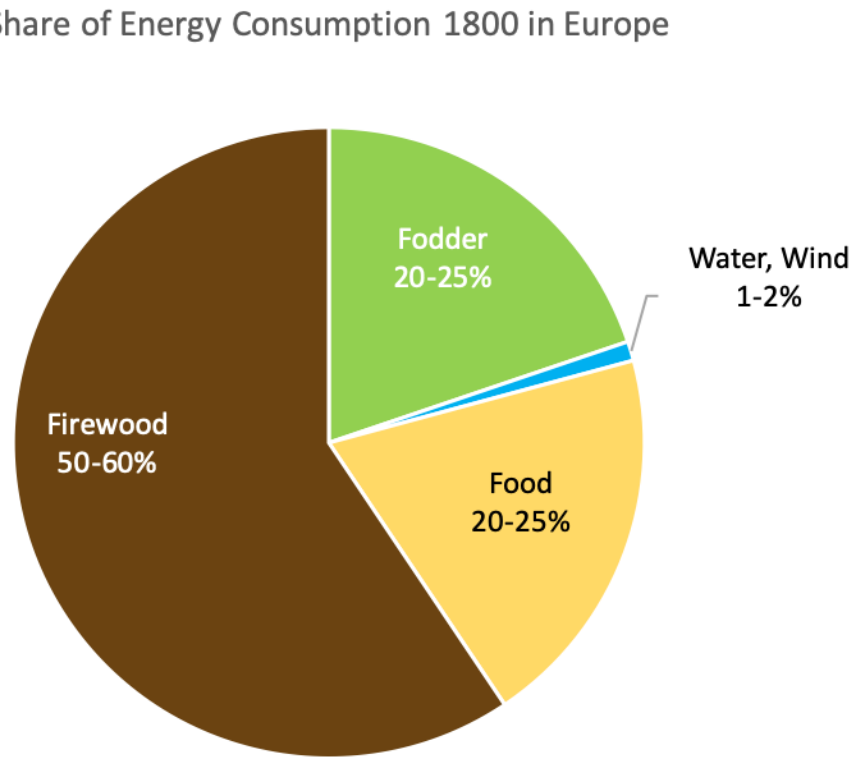
NEW TECHNOLOGIES, AFFLUENCE, SUFFICIENCY

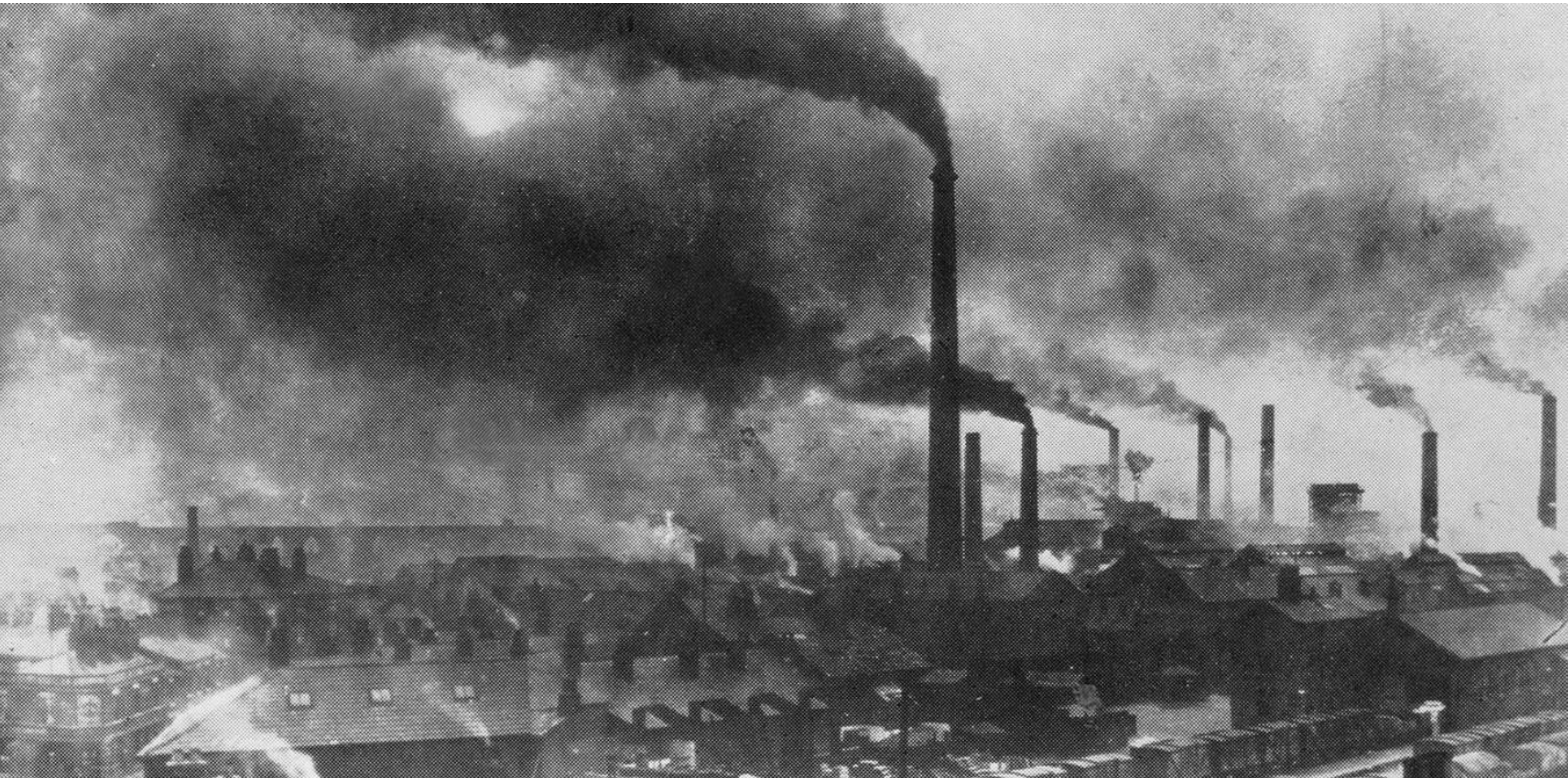
presentation by **Amray Schwabe**

Digitalization and the Rebound Effect – Seminar HS2019

BEFORE COAL

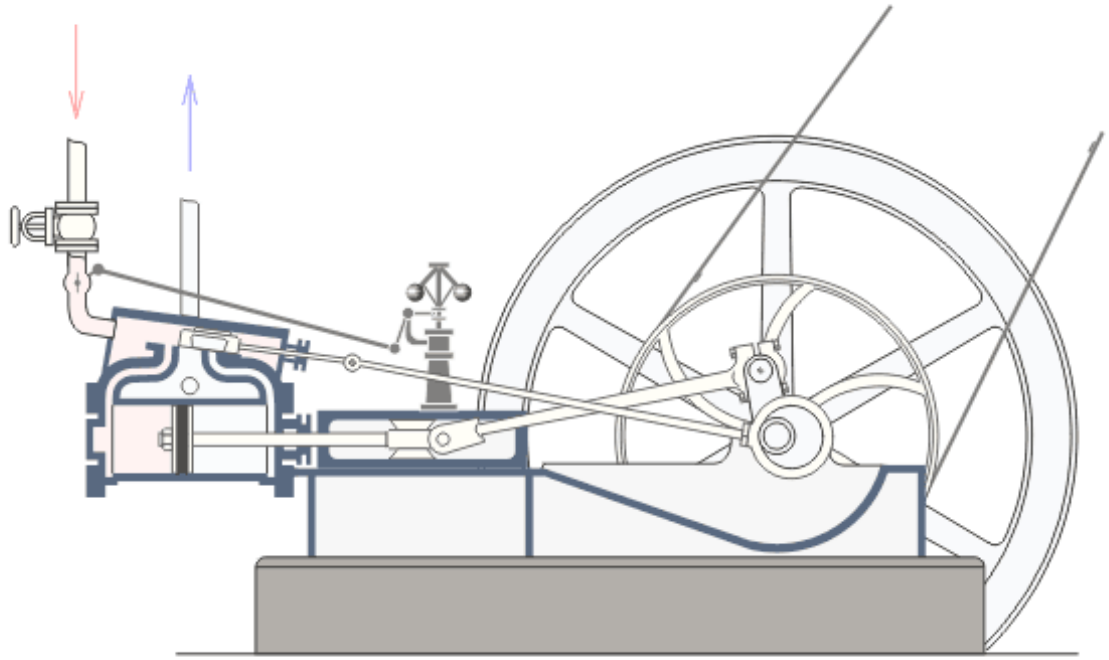


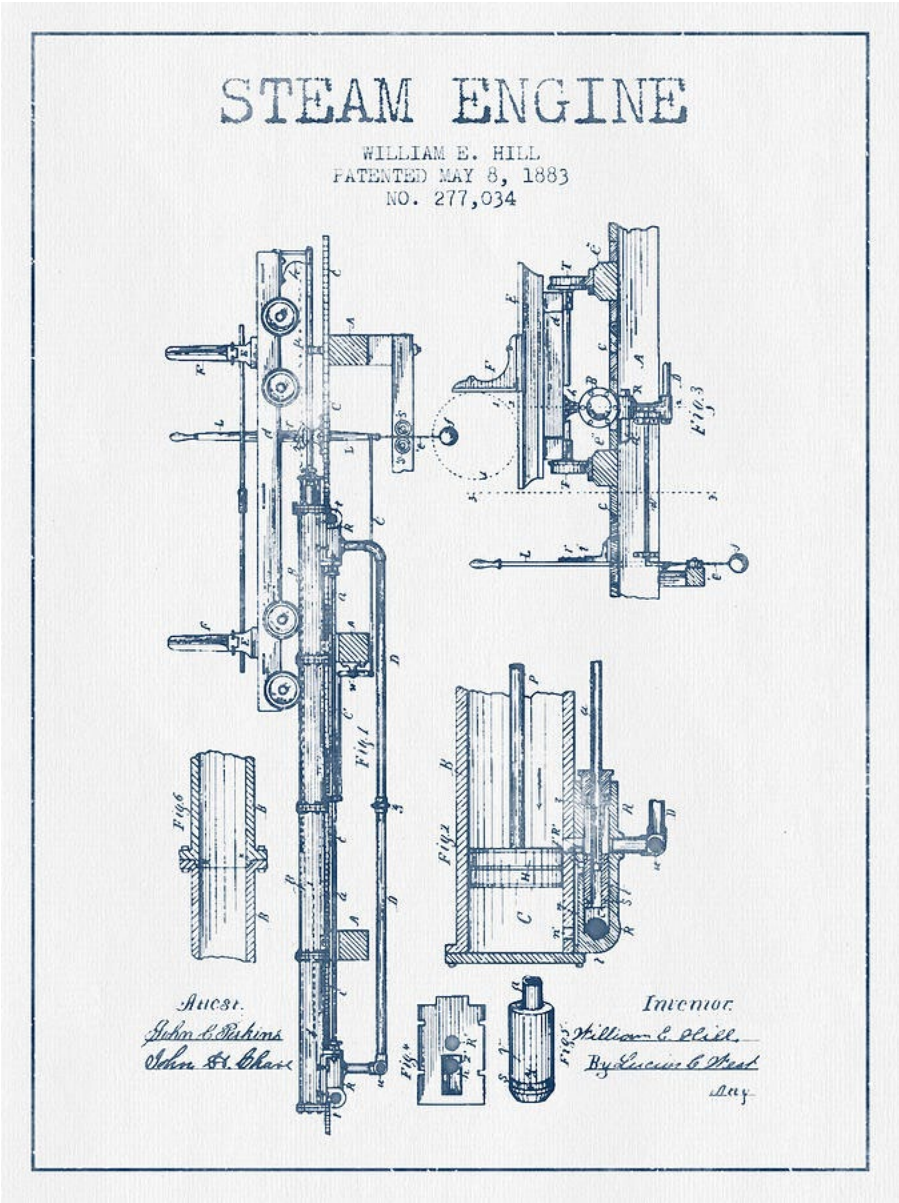
Source: Kander 2013



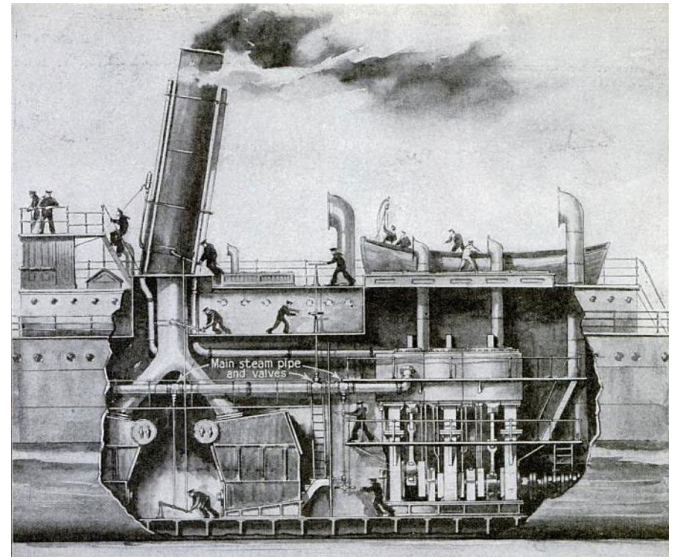
England, late 19th century

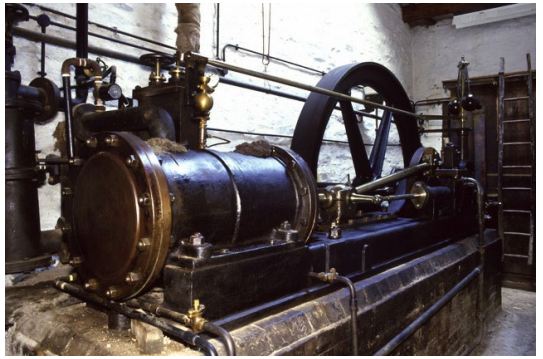
THE STEAM ENGINE

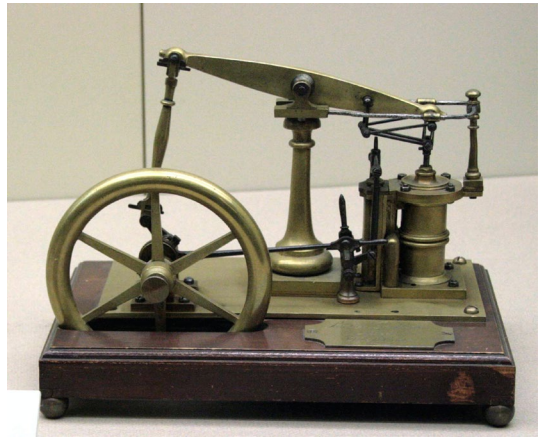



STEAM ENGINE
WILLIAM E. HILL
PATENTED MAY 8, 1883
NO. 277,034
Witnesses.
John C. Perkins
John H. Chase
Inventor.
William E. Hill.
By Lucius C. Read
Atty.

USES OF STEAM ENGINES







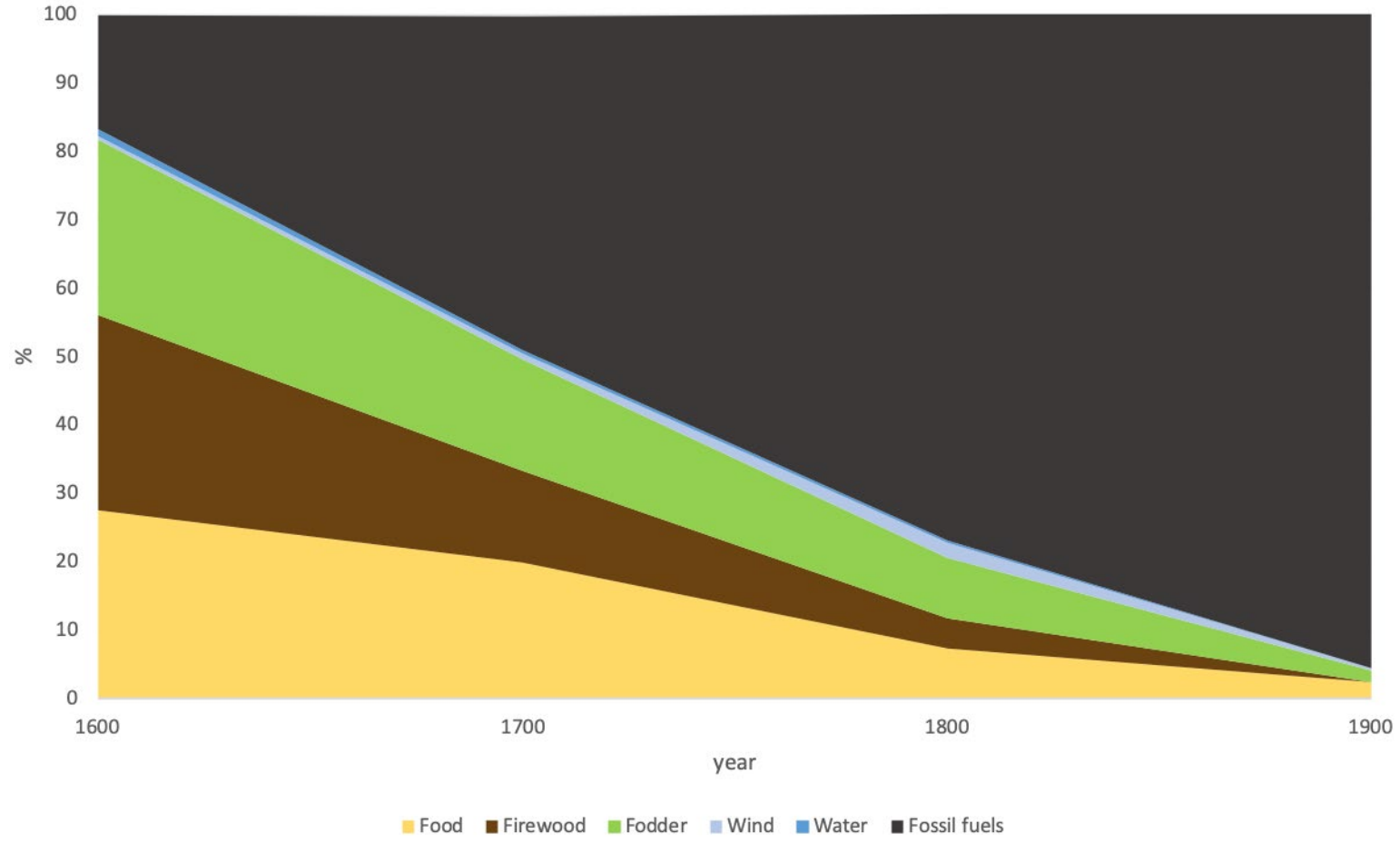
JEVONS PARADOX

English Economist Jevons 1865:

"…the reduction of the consumption of coal, per ton of iron, to less than one third of its former amount, has been followed….by a tenfold increase in total consumption, not to speak of the indirect effect of cheap iron in accelerating other coal consuming branches of industry."

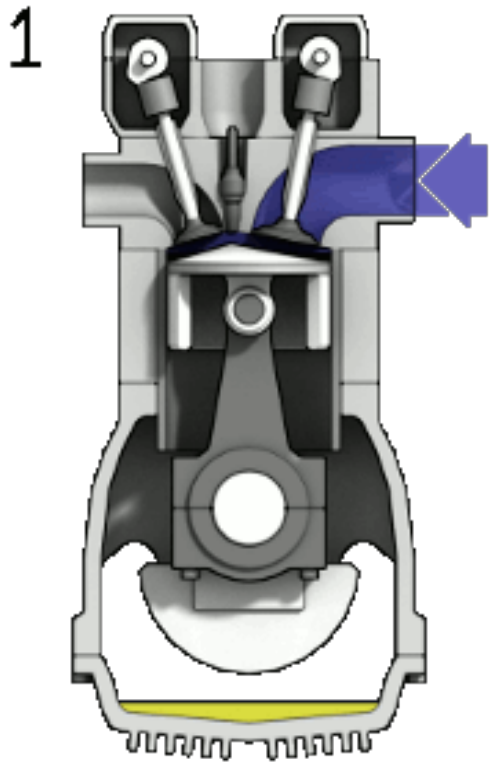
Source: Jevons 2007

COMPOSITION OF ENERGY CONSUMPTION



Source: Kander 2013

INTERNAL COMBUSTION ENGINE



USES OF INTERNAL COMBUSTION ENGINES

REBOUND LIGHT

Figure 10. Price of Lighting from Gas and Electricity in the United Kingdom (per million lumen-hours), 1900-2000

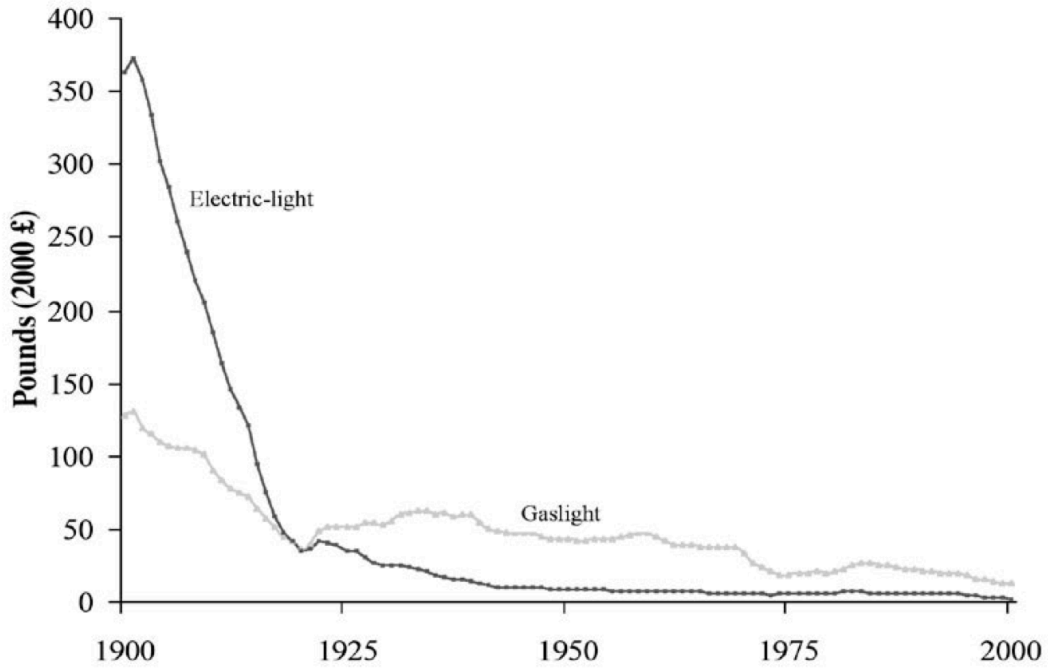
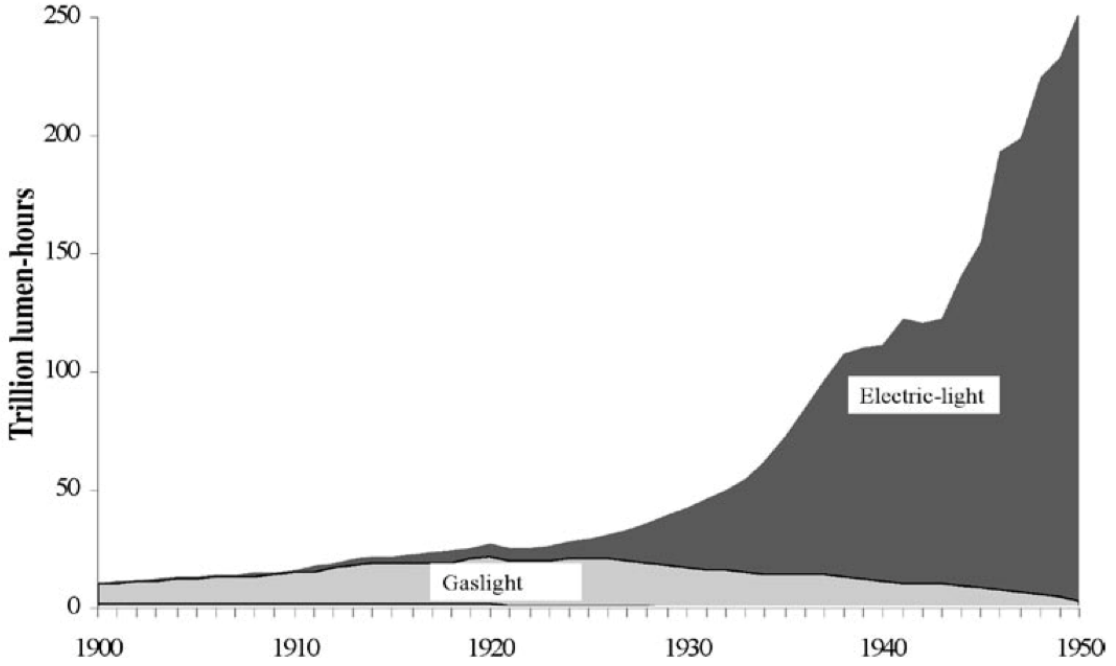
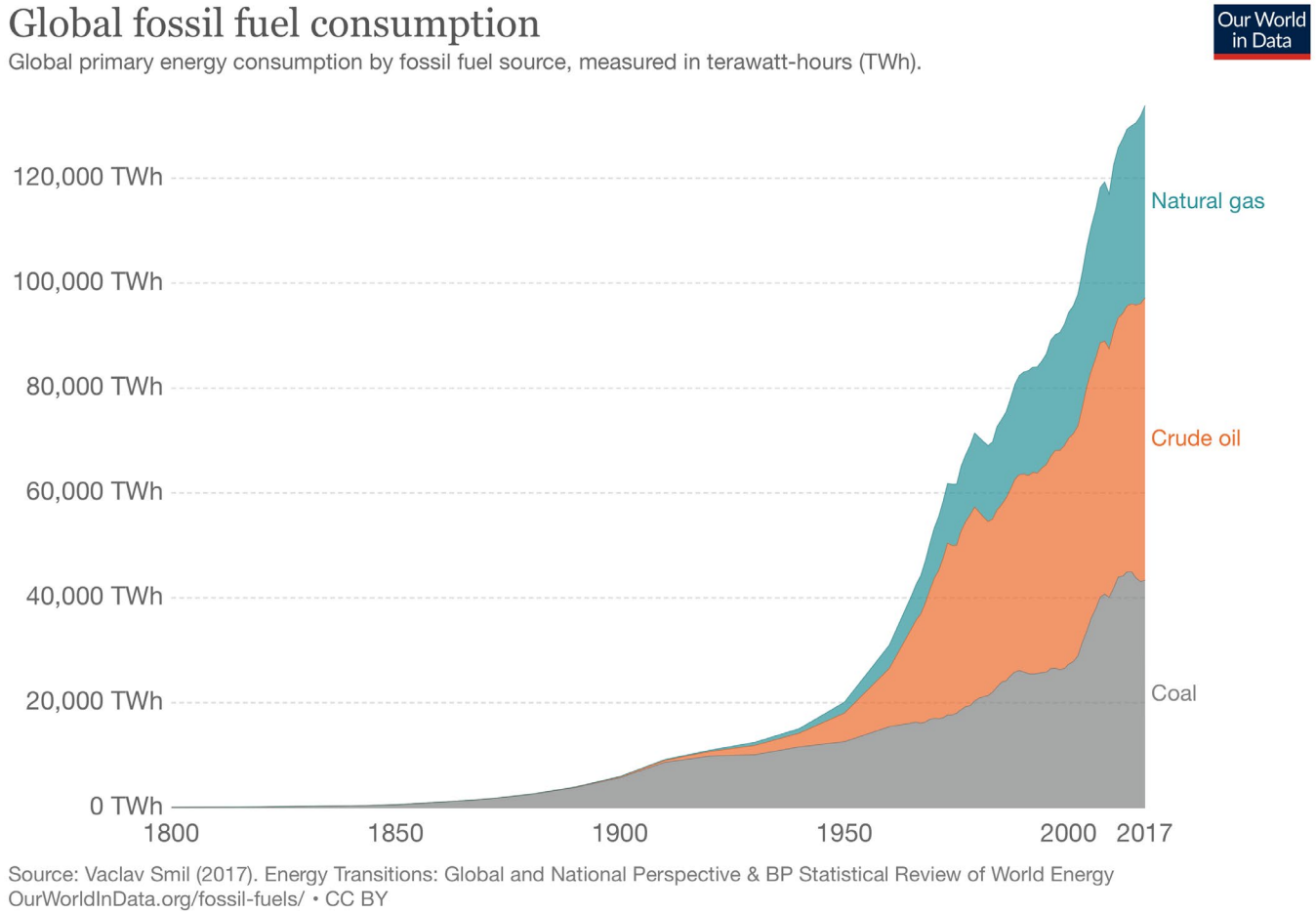


Figure 11. Consumption of Lighting from Gas and Electricity in the United Kingdom (per million lumen-hours), 1900-1950



Source: Fouquet 2006

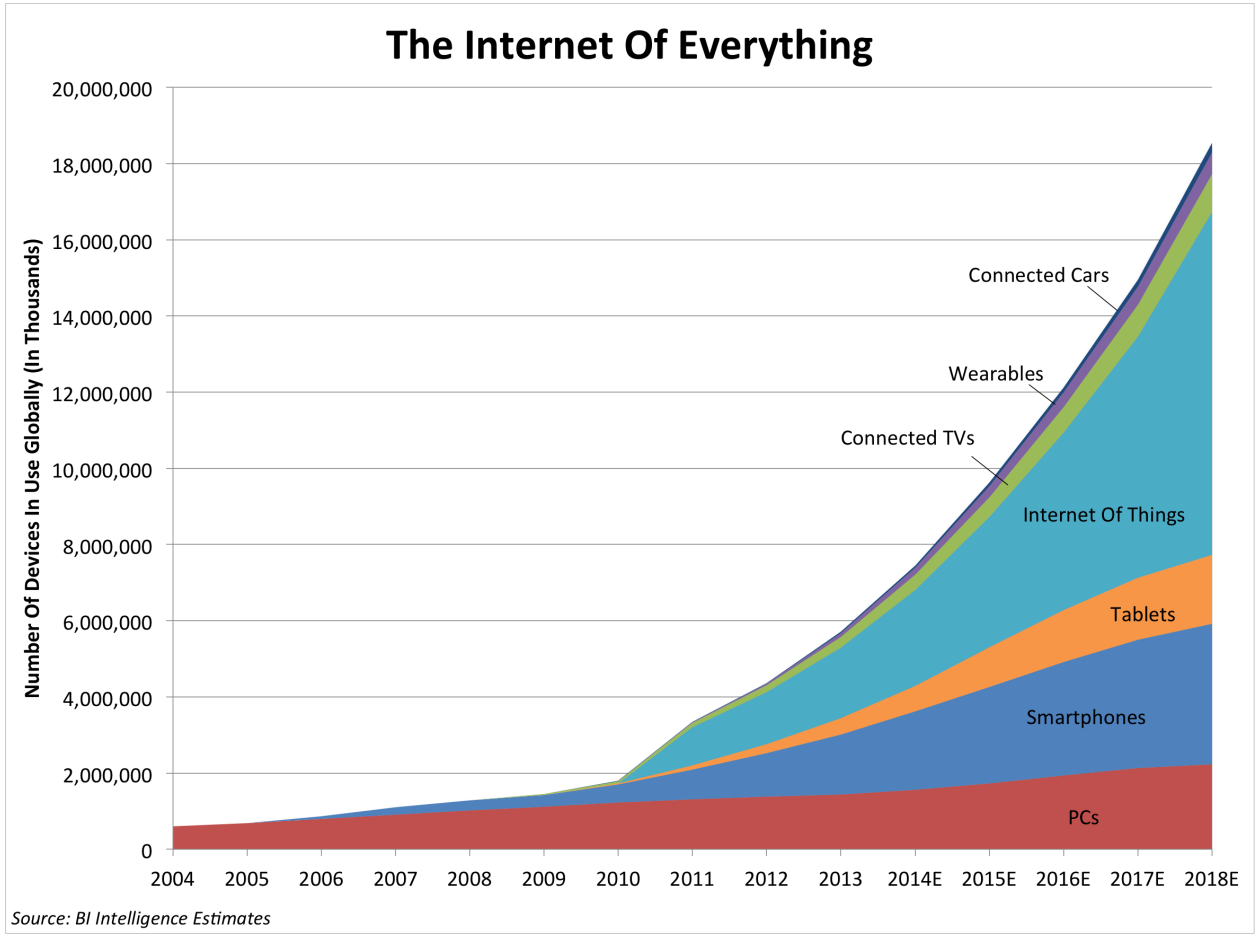
2. INDUSTRIAL REVOLUTION

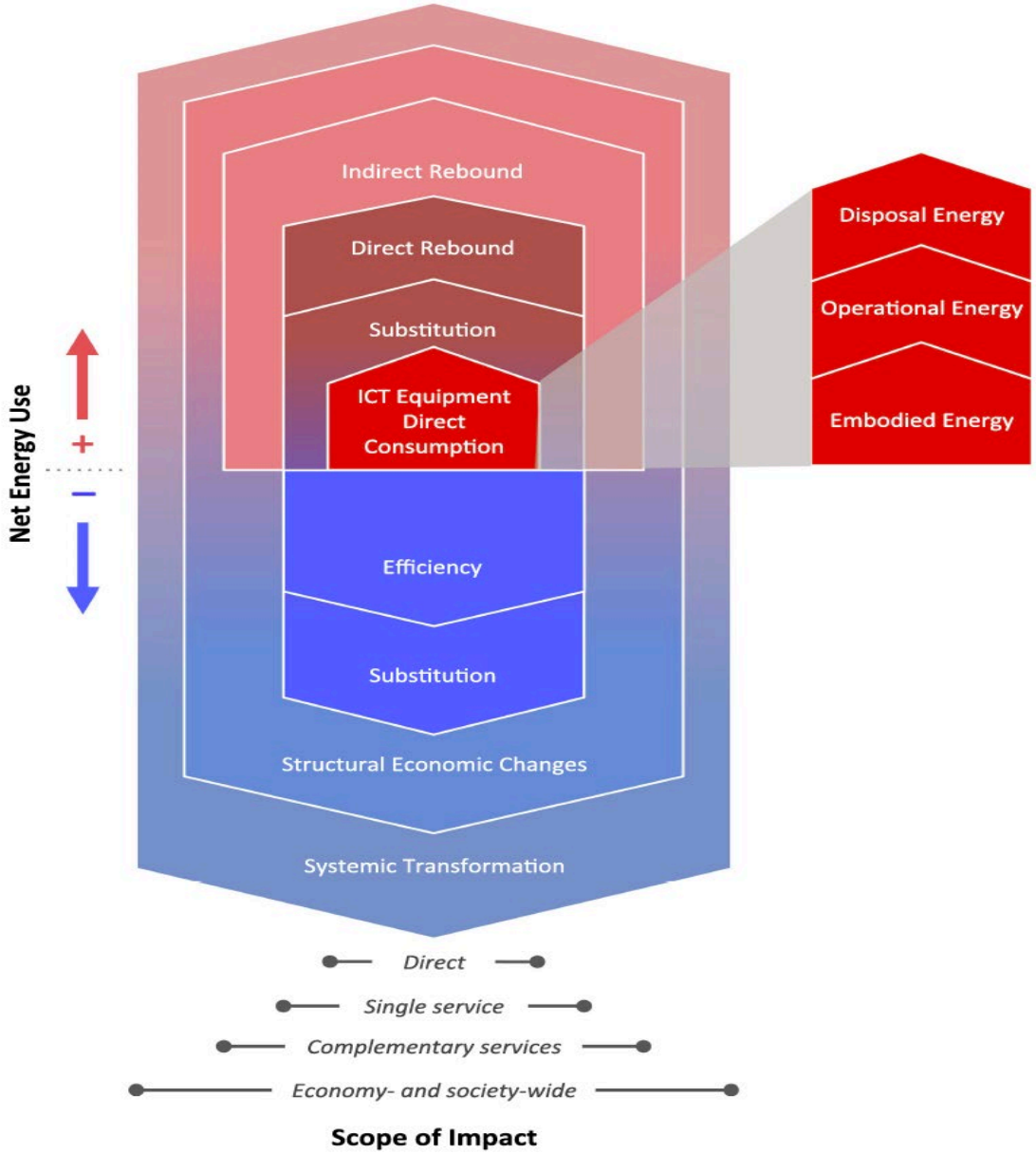


THE FIRST COMPUTER

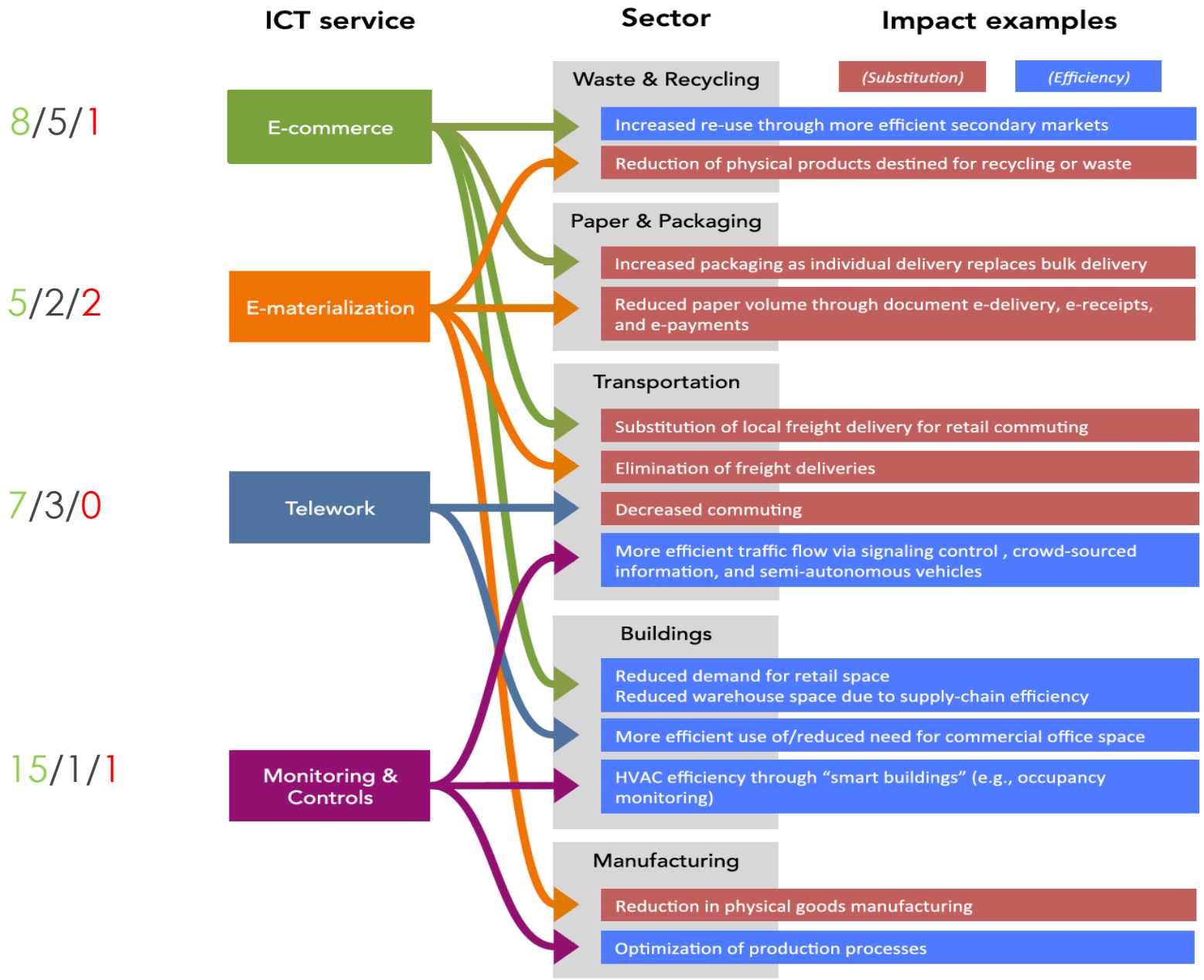
THE USE OF ICT

THE RISE OF ICT



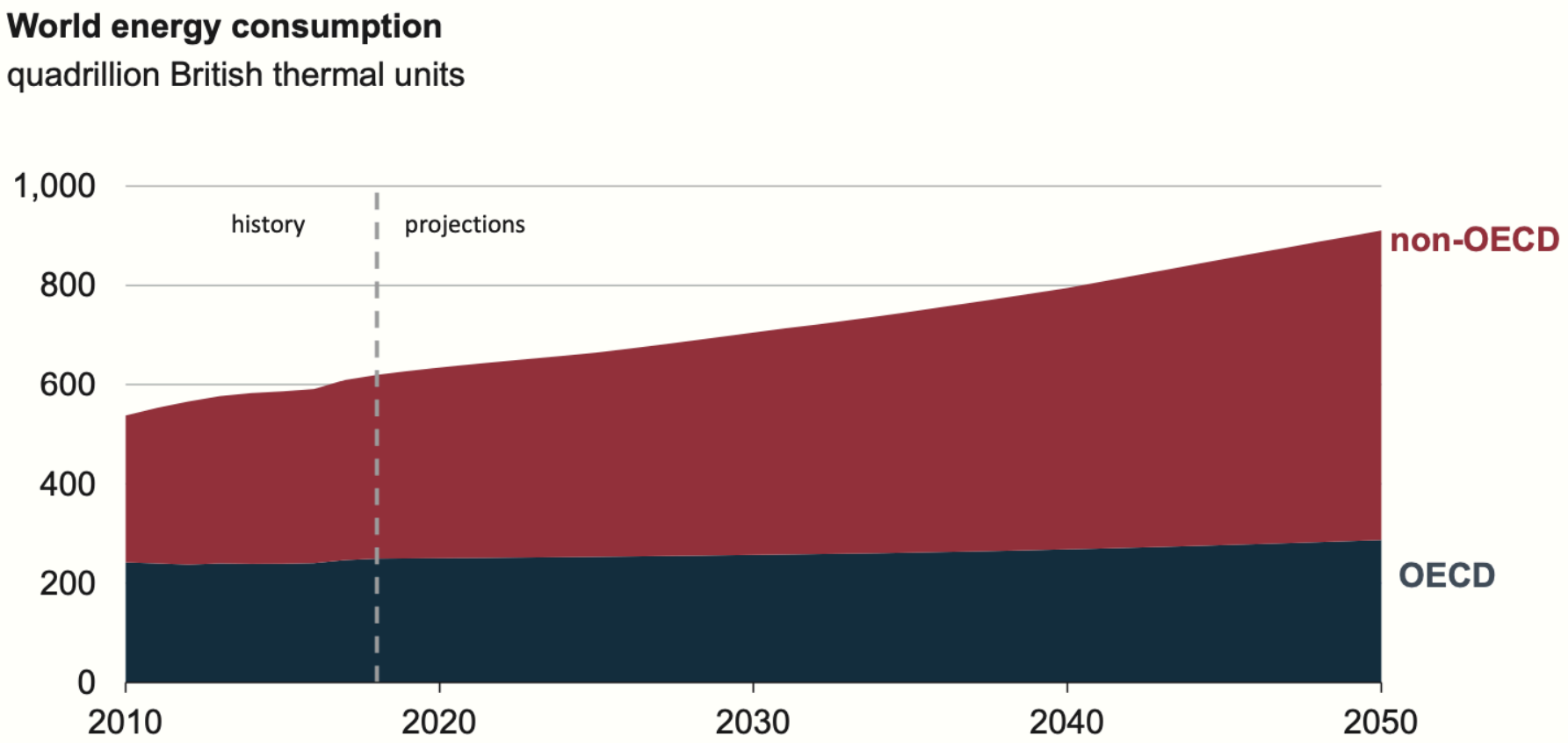


Source: Horner 2016



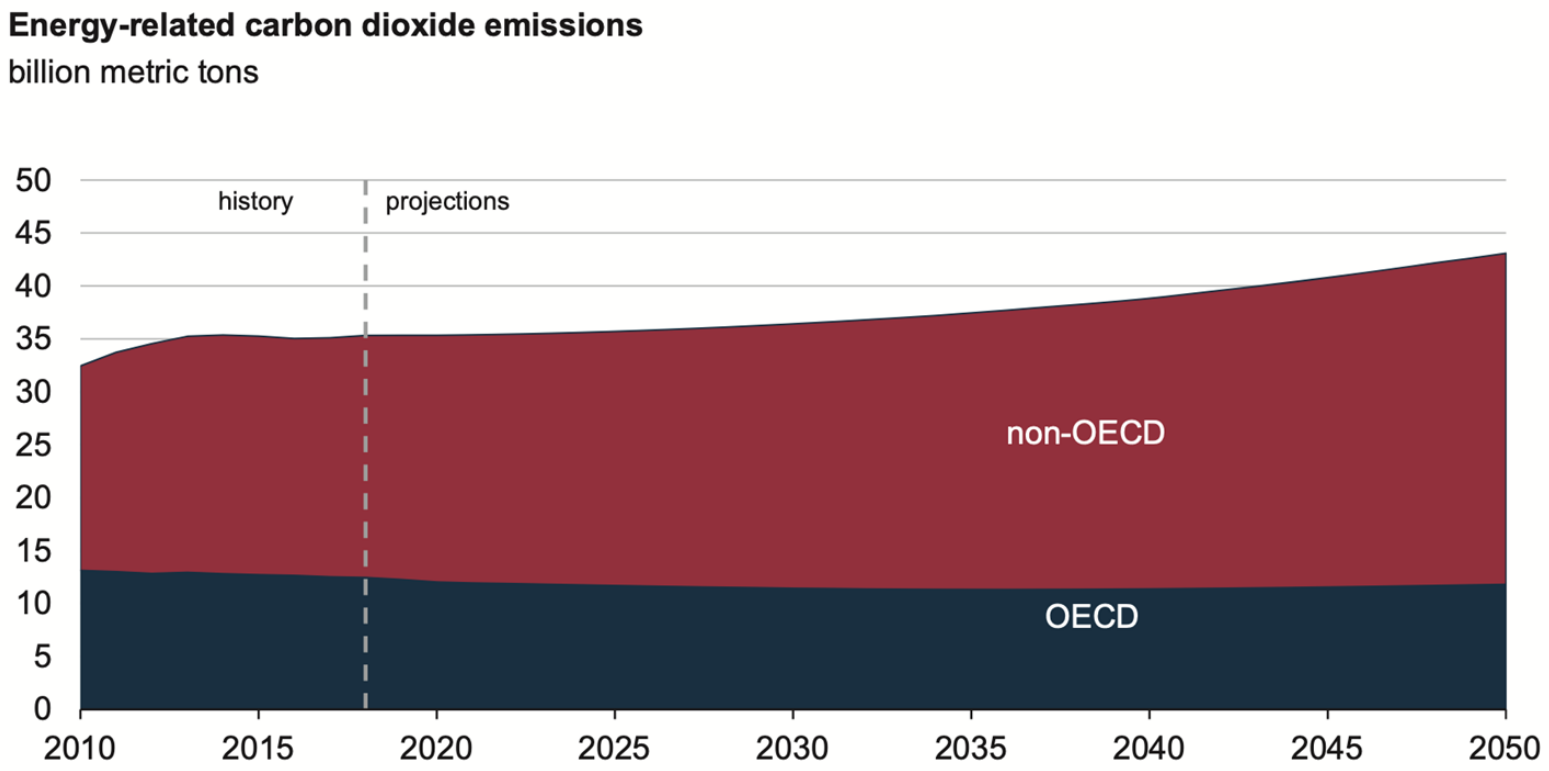
Source: Horner 2016

WORLD ENERGY CONSUMPTION



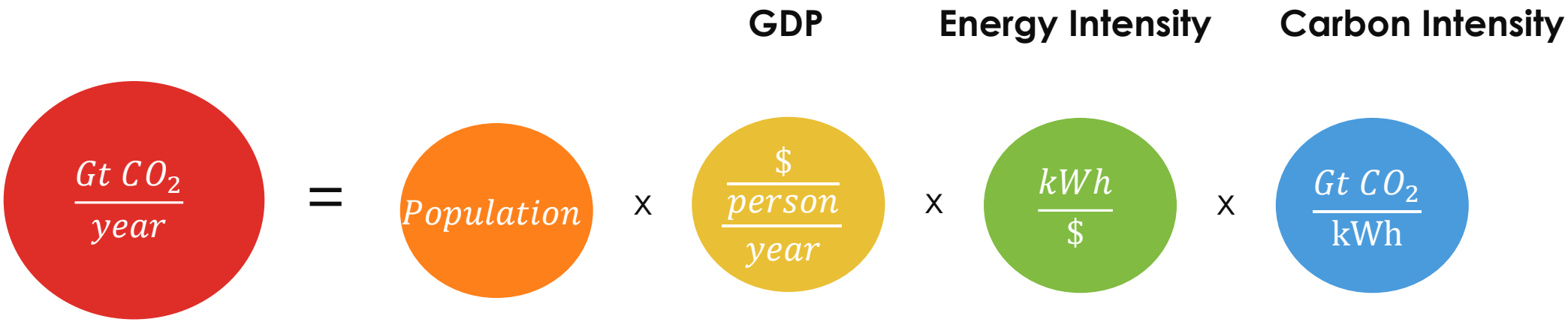
Source: U.S. Energy Information Administration

WORLD CARBON DIOXIDE EMISSIONS

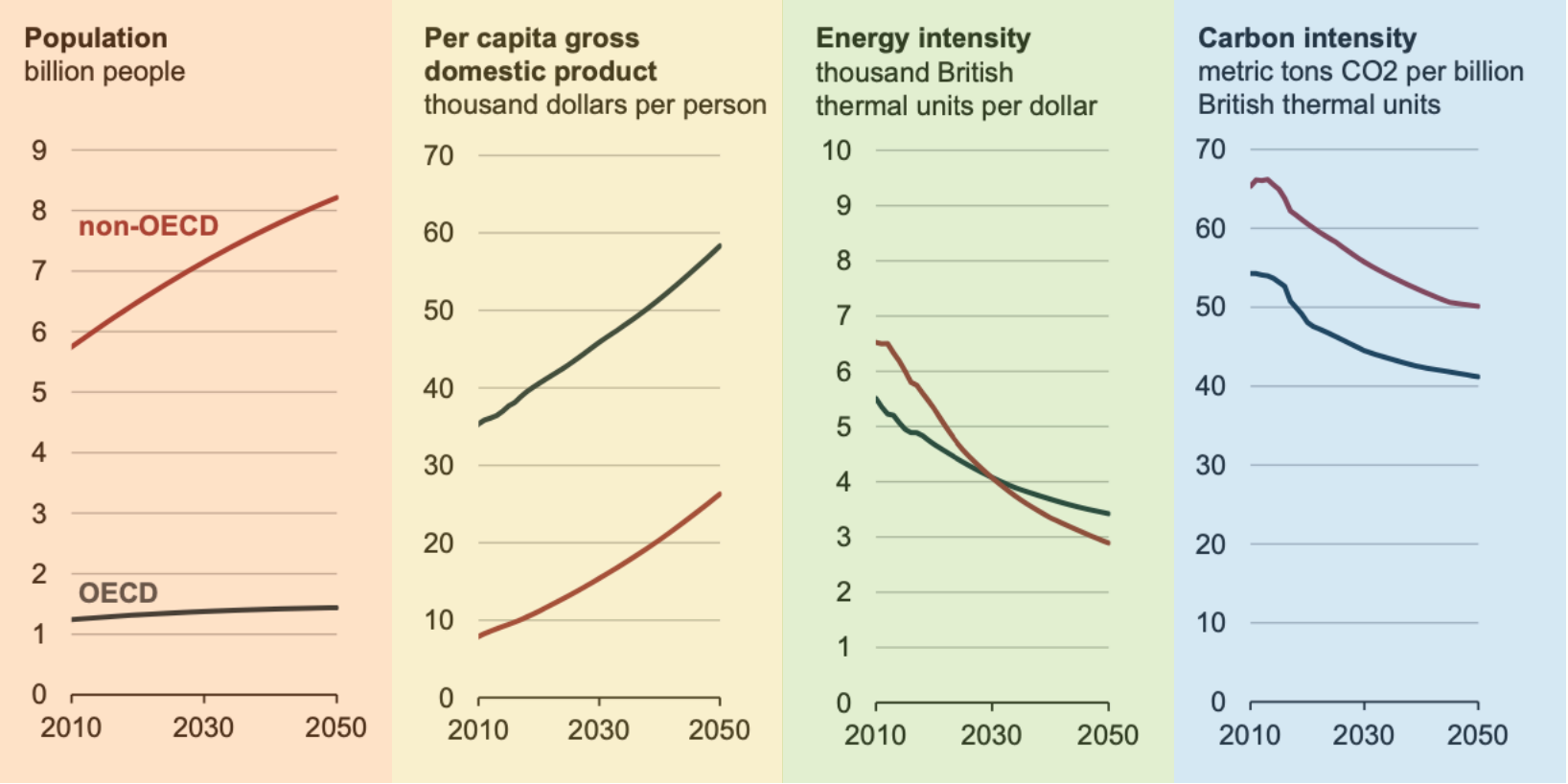


Source: U.S. Energy Information Administration

KAYA IDENTITY



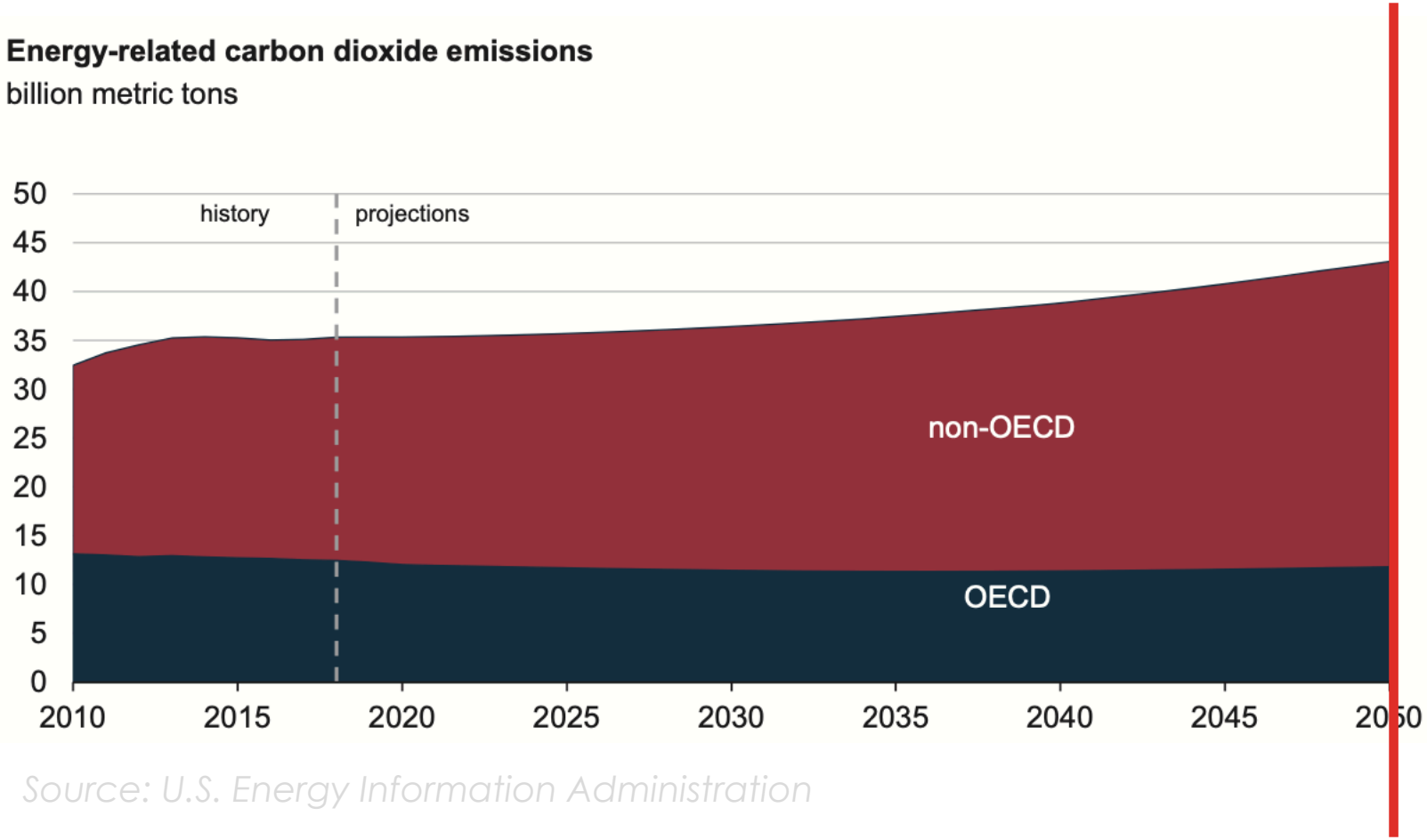
OVERVIEW



Source: U.S. Energy Information Administration

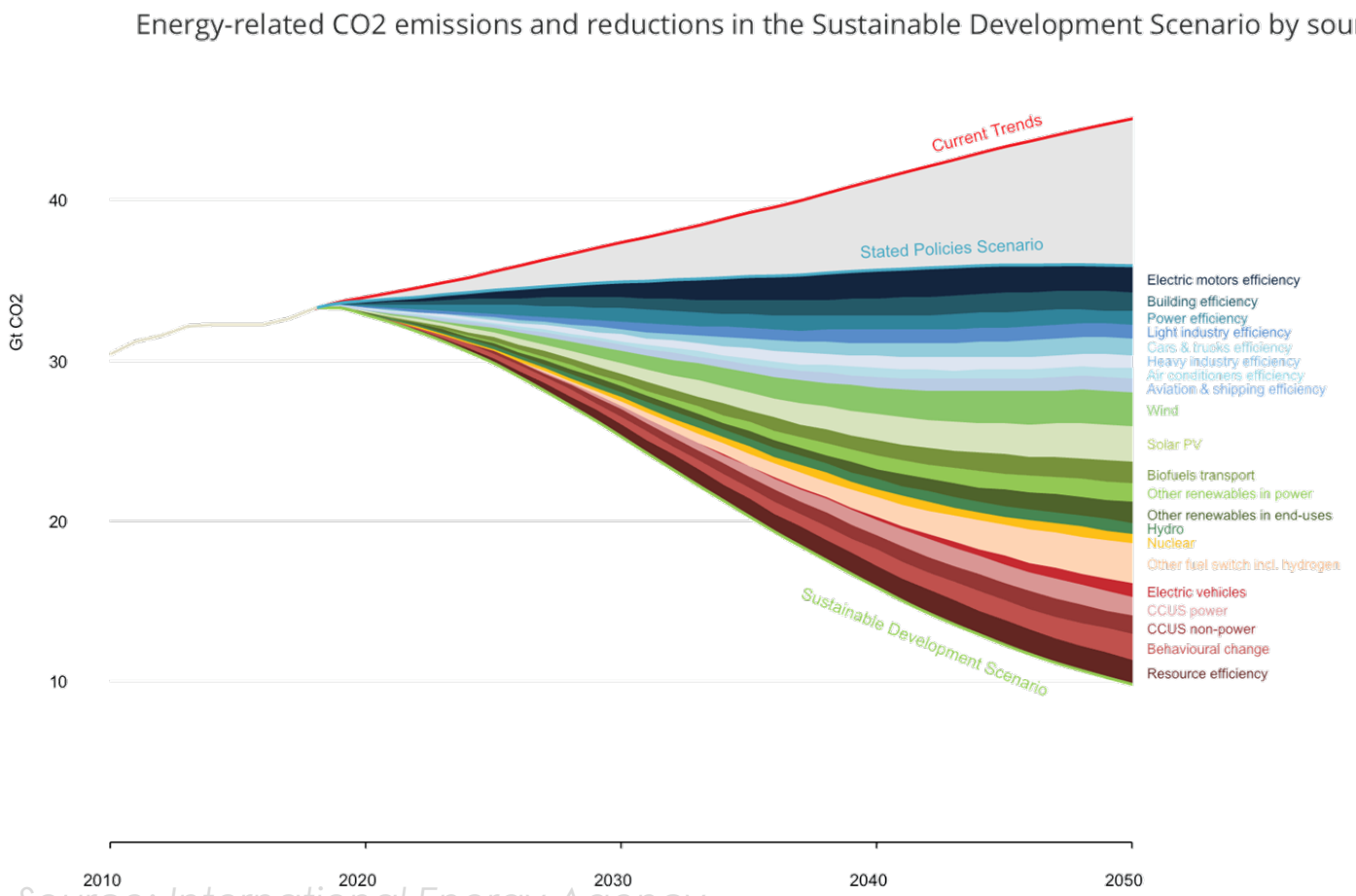
OVERVIEW

net-zero?



Source: U.S. Energy Information Administration

WHAT IS NEEDED?

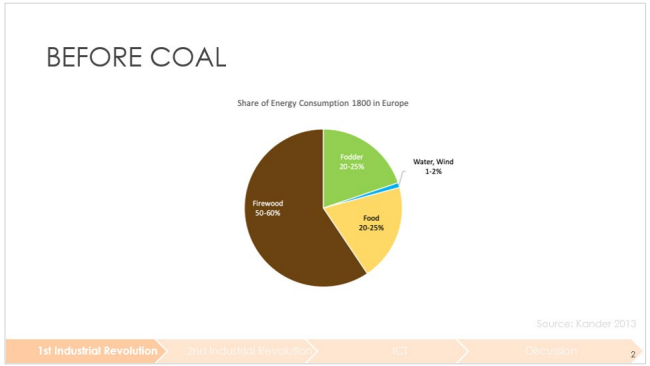


Source: International Energy Agency

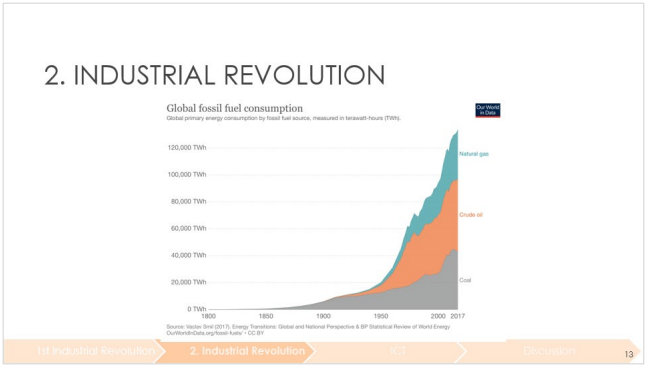
DISCUSSION – TAKE-AWAY MESSAGES?

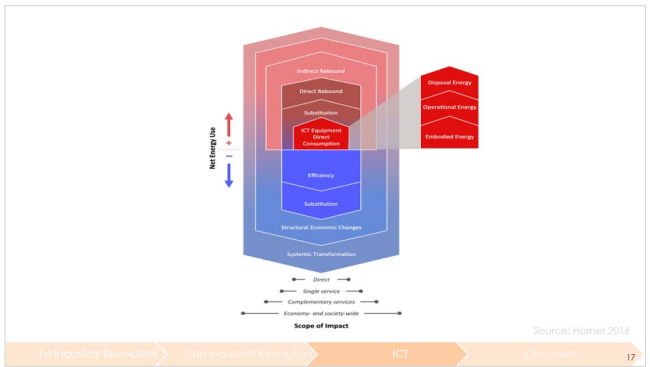
- Consumer-driven?
- Innovation!
- Rebound is not a new phenomenon

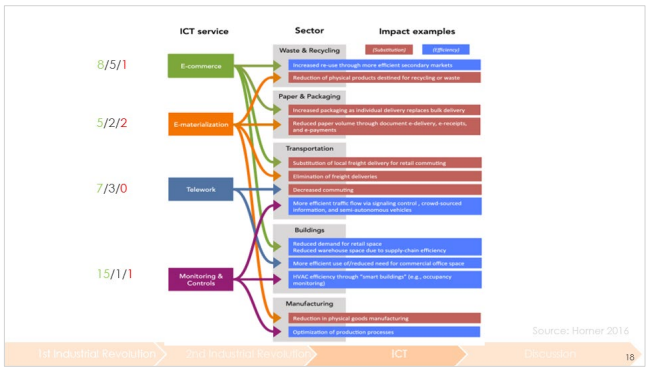
QUESTIONS?

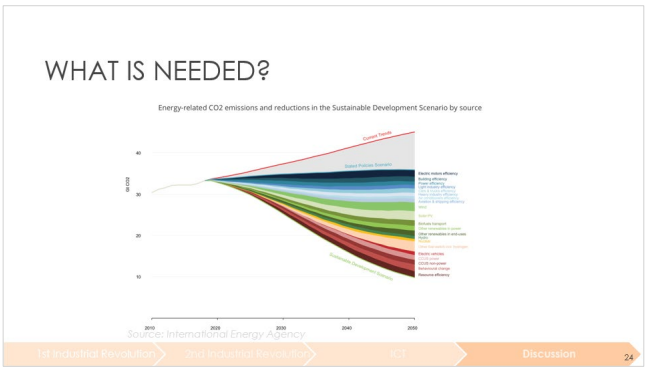

BEFORE COAL
Share of Energy Consumption 1800 in Europe
Fodder 20-25%
Water, Wind 1-2%
Firewood 50-60%
Food 20-25%
Source: Kander 2013
1st Industrial Revolution
2nd Industrial Revolution
ICT
Discussion
2


INTERNAL COMBUSTION ENGINE
1
1st Industrial Revolution
2nd Industrial Revolution
ICT
Discussion
10


2. INDUSTRIAL REVOLUTION
Global fossil fuel consumption
Global primary energy consumption by fossil fuel source, measured in terawatt-hours (TWh).
120,000 TWh
100,000 TWh
80,000 TWh
60,000 TWh
40,000 TWh
20,000 TWh
0 TWh
1800
1850
1900
1950
2000
2017
Natural gas
Crude oil
Coal
1st Industrial Revolution
2. Industrial Revolution
ICT
Discussion
13


Indirect Rebound
Direct Rebound
Substitution
ICT Equipment Direct Consumption
Efficiency
Substitution
Structural Economic Changes
Systemic Transformation
Disposal Energy
Operational Energy
Embodied Energy
Net Energy Use
Direct
Single service
Complementary services
Economy- and society-wide
Scope of Impact
Source: Horner 2016
1st Industrial Revolution
2nd Industrial Revolution
ICT
Discussion
17


ICT service
Sector
Impact examples
8/5/1
5/2/2
7/3/0
15/1/1
E-commerce
E-materialization
Telework
Monitoring & Controls
Waste & Recycling
Paper & Packaging
Transportation
Buildings
Manufacturing
Source: Horner 2016
1st Industrial Revolution
2nd Industrial Revolution
ICT
Discussion
18


WHAT IS NEEDED?
Energy-related CO2 emissions and reductions in the Sustainable Development Scenario by source
Source: International Energy Agency
1st Industrial Revolution
2nd Industrial Revolution
ICT
Discussion
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PICTURE SOURCES

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