Special Programme for Journalists

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Technology

- Technology development necessary but not sufficient
- Political framework needed to drive technology implementation
- Set within market framework to deliver least-cost solutions
- Energy supply and use is key

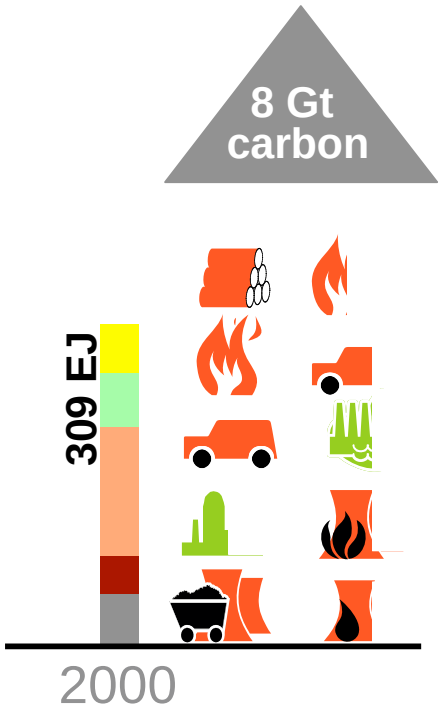
Energy

- Energy conservation
  - Use less, drive less, etc
- Supply side
  - Nuclear
  - Coal with carbon capture & storage (CCS)
  - Renewables
  - Gas (short to medium term + CCS long term)
- Demand side
  - Energy efficiency – lights, motors, etc
  - Plug-in hybrid cars
  - Heat pumps, etc

Today's energy infrastructure

Final Energy

- Electricity
- Gas
- Liquids
- Solids
- Non-commercial



Direct burning of fuel	3-4 Gt
800 million vehicles	1+ Gt
700+ coal power stations	1.5 Gt
Non-commercial biomass	1 Gt
800 gas or oil power stations	0.7 Gt
Non emmitting technologies	0 Gt
	8.0 Gt

25EJ per year solar

500,000 5MW wind turbines

1000 1GW coal power stations

1000 1GW coal stations with sequestration

1000 1GW oil power stations

1000 1GW gas power stations

1000 1GW nuclear plants

1000 1GW hydro/ tidal /geothermal

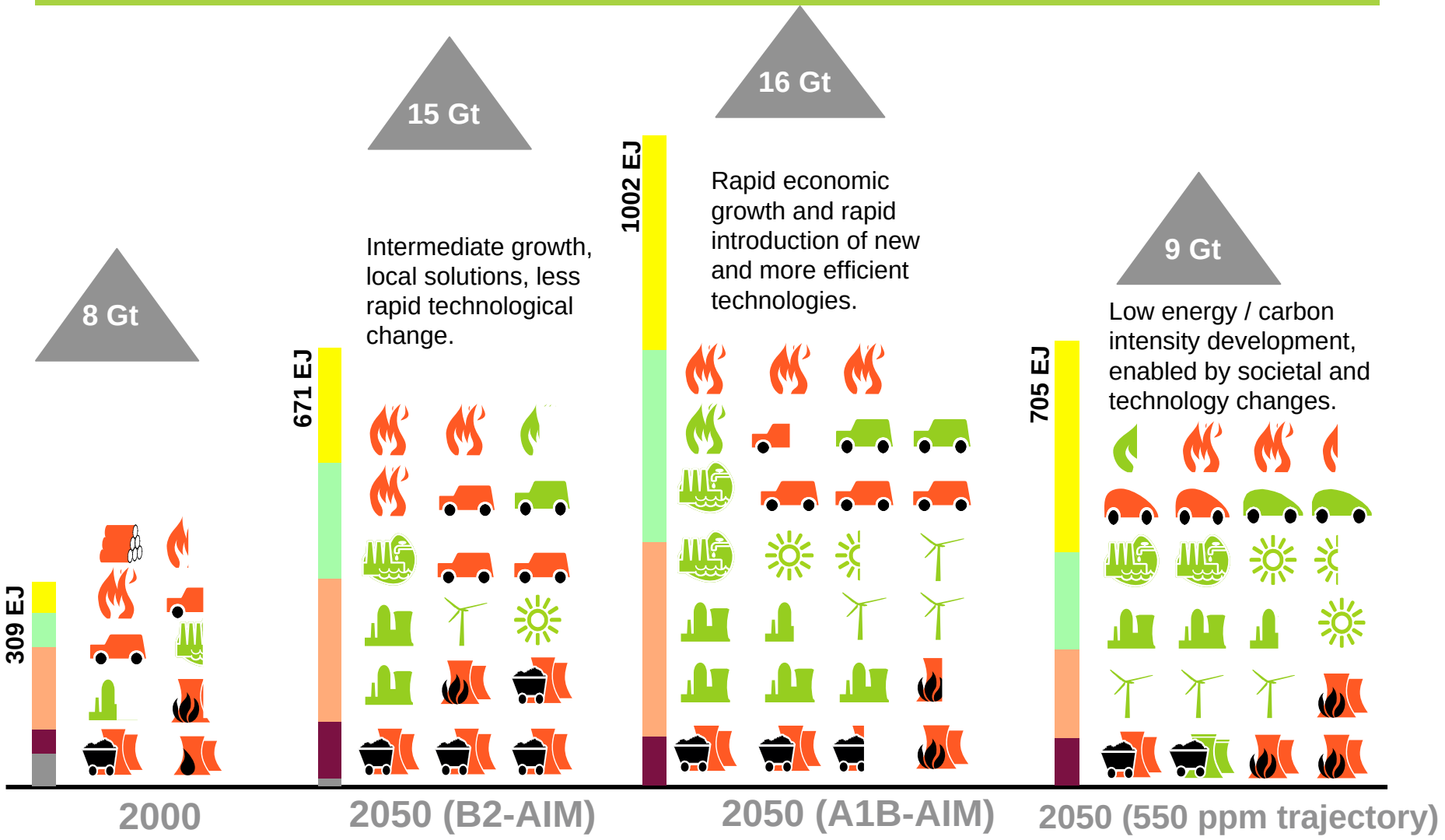
500 million vehicles (Biofuels)

500 million low CO_2 (Biofuels)

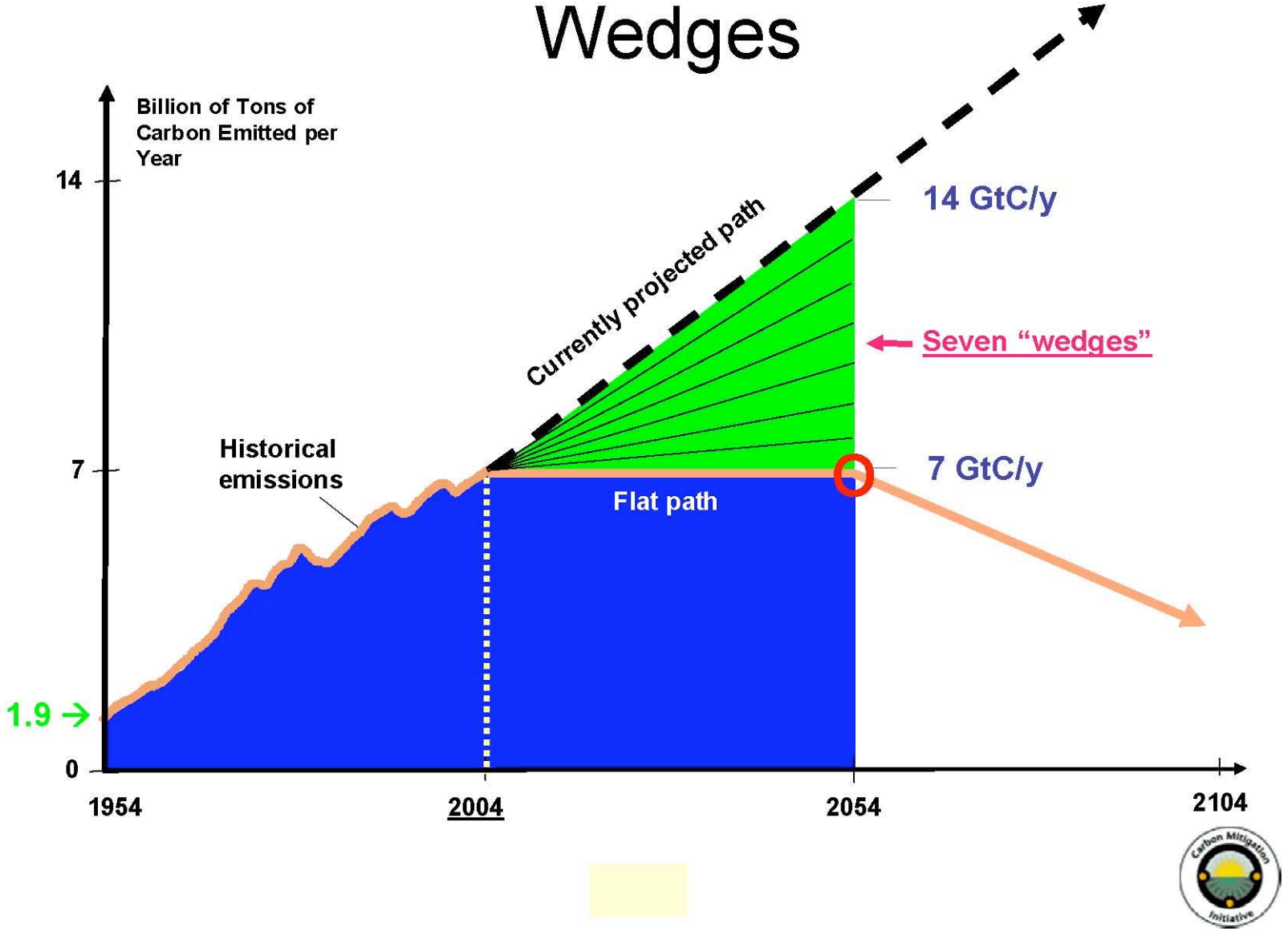
50EJ non-commercial fuel

100 EJ direct fuel use (Biofuels)

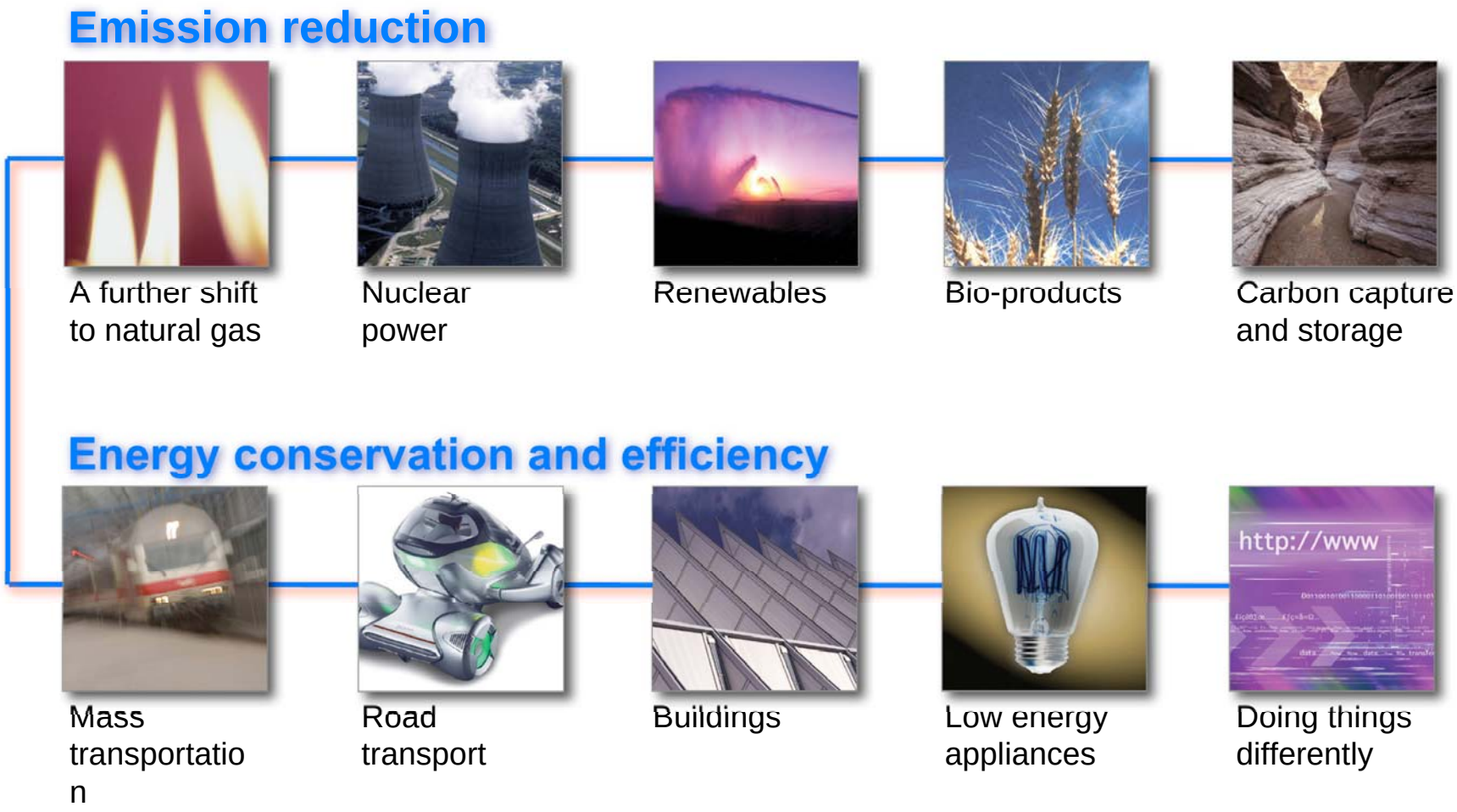
Some options at a glance



Wedges


Billion of Tons of Carbon Emitted per Year
14
7
1.9
0
1954
2004
2054
2104
Historical emissions
Currently projected path
Flat path
14 GtC/y
Seven "wedges"
7 GtC/y

Options for change – enabling technologies



Wind Electricity

Effort needed by 2054 for 1 wedge:

Two million 1 MW windmills.

Today: 40,000 (2%)

Land cover 30 million hectares

Prototype of 80 m tall Nordex 2,5 MW wind turbine located in Grevenbroich, Germany (Danish Wind Industry Association)

PV Solar Electricity

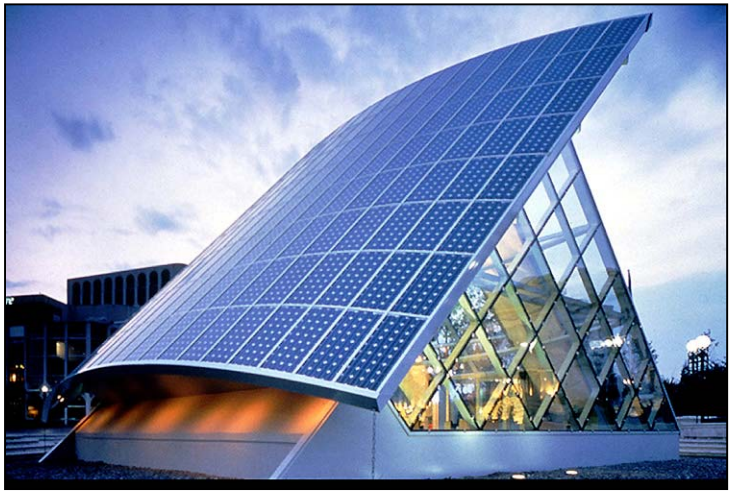


Photo courtesy of BP

Effort needed by 2054 for 1 wedge:

700 times current capacity

= 60 times faster (linear) growth rate than current

10 million hectares of land

Biofuels

Usina Santa Elisa mill in Sertaozinho, Brazil
(http://www.nrel.gov/data/pix/searchpix.cgi?getrec=5691971&display_type=verbose&search_reverse=1_

Effort needed by 2054 for 1 wedge:

Two billion 60 mpg cars running on biofuels

250 million hectares of high-yield crops (one sixth of world cropland).

Buildings / Low Energy Appliances

Space heating/cooling

Water heating

Lighting

Appliances

Example:

10 billion incandescent lamps today

⇒50 billion by 2050

⇒Full replacement with efficient bulbs would reduce 0.5 Gt/yr C in 2054, assuming existing carbon intensity of power generation

Effort needed by 2054 for 1 wedge:

Buildings emit 3.9 Gt/yr carbon = 20% of total

Cutting emissions from buildings by 25% from 2054 BAU = 1 Gt/yr C

More than half the potential in developing regions

Doing things differently

Urban Design

Telecommuting

Radical business models

Low-carbon wealth creation

Not a capping or reduction in valuable activity.

Reducing unnecessary, and unvalued waste: eg current standby capacity in USA = xx large power stations running at full capacity.

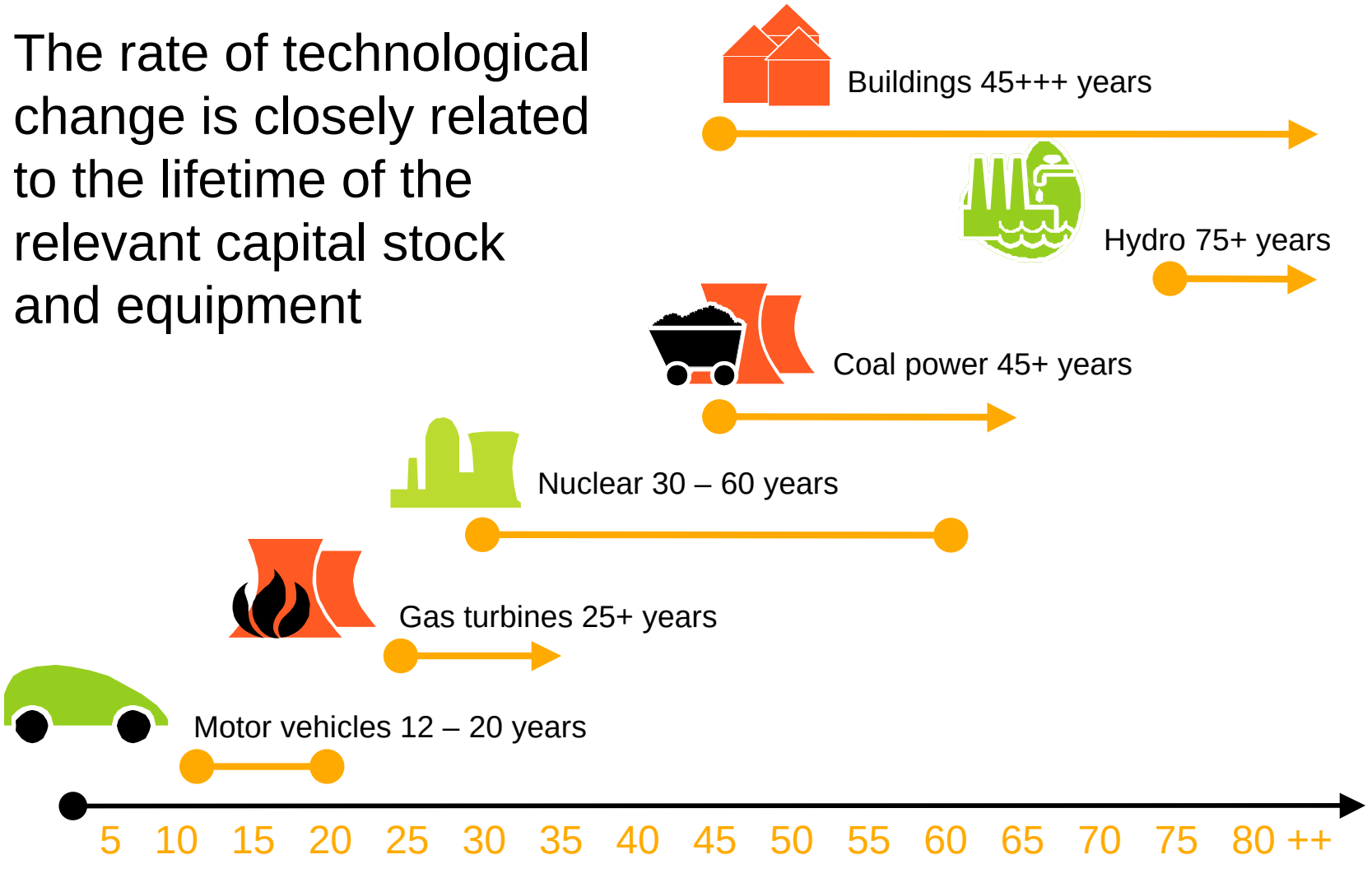
A shift in perception of “wealth” and “value” – recent examples of low-carbon wealth creation:

- cell phones

- IT / software / computer games

The lifetime of energy infrastructure

The rate of technological change is closely related to the lifetime of the relevant capital stock and equipment



Humanity Already has the Tools

We have the:

- **READINESS:** All wedge technologies are already deployed somewhere at, or near, commercial scale;
- **PORTFOLIO:** No single wedge technology can do the whole job;
- **CAPITAL:** There is no significant lack of investment.

But, there are significant constraints:

- **POLITICAL:** There is a lack of global political will;
- **TIME:** Decades are needed to change infrastructure;
- **CAPACITY:** Skills and industrial capacity shortage.