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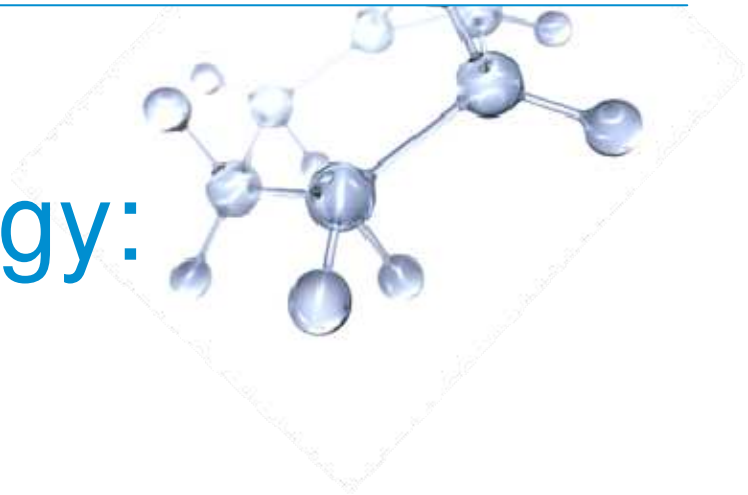
Taking on the world's toughest energy challenges.™



the outlook for energy:

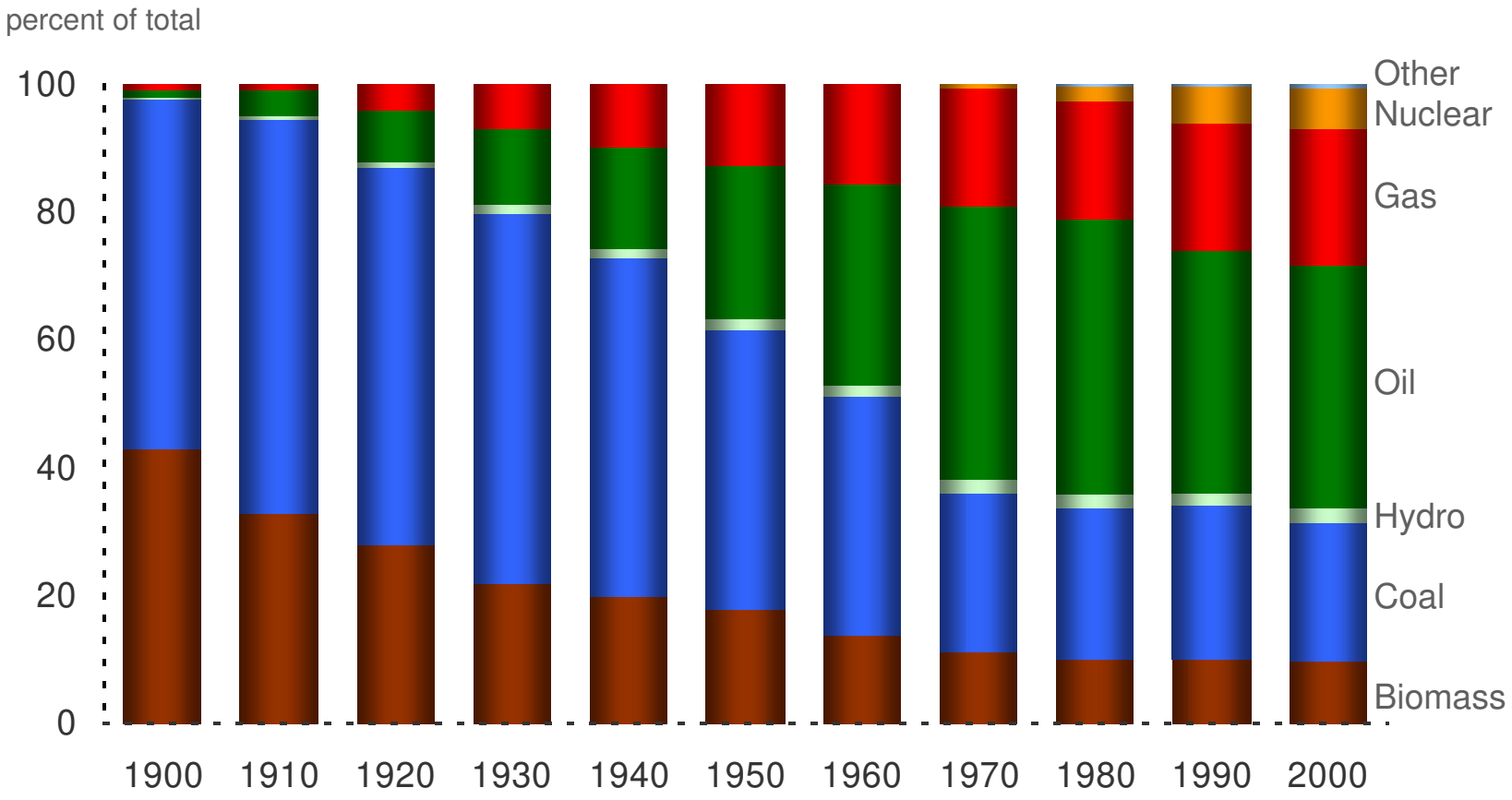
a view to 2030

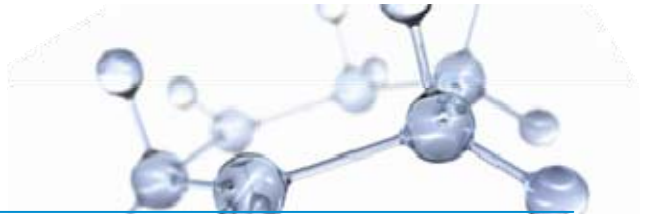
Todd Onderdonk

2009 STI/SPFA Fall Conference

September 24, 2009

evolving energy sources



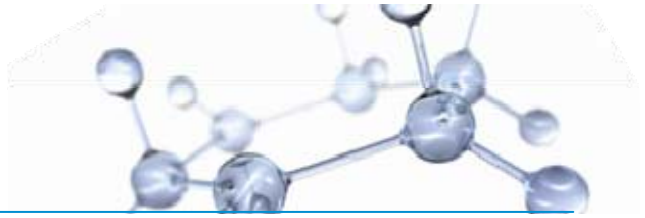


100 countries

15 demand sectors

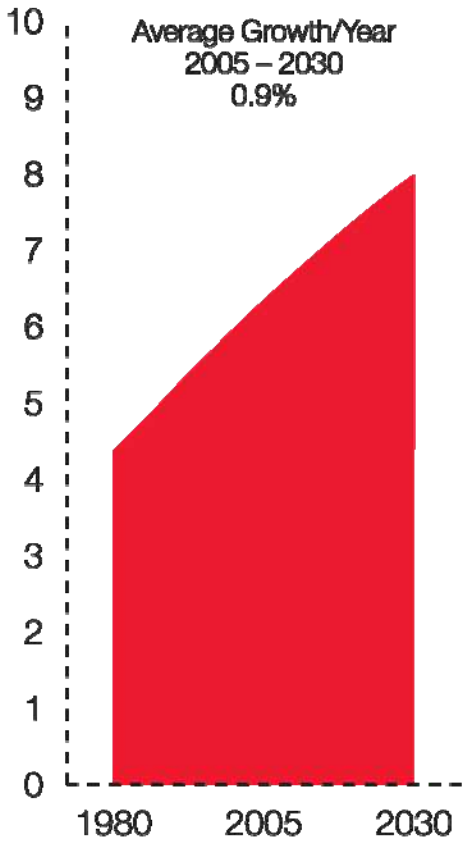
20 fuel types

global economics and energy



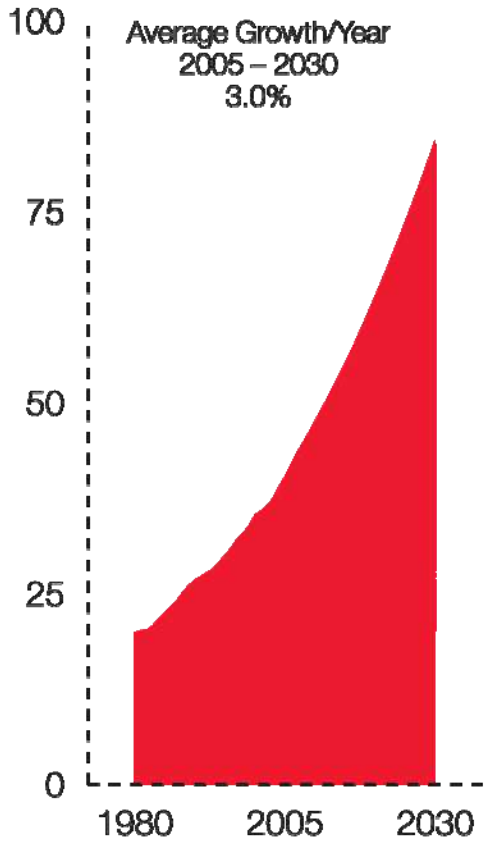
population

billion



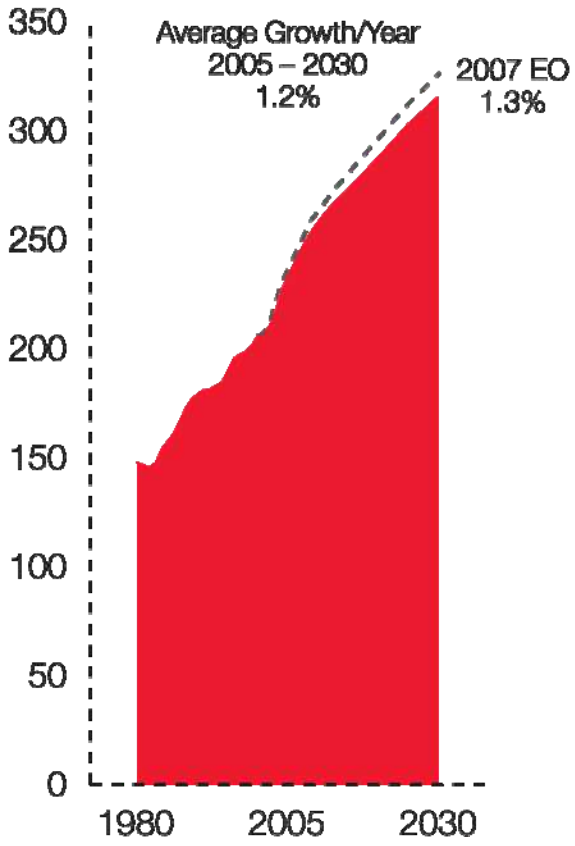
GDP

trillion 2005$

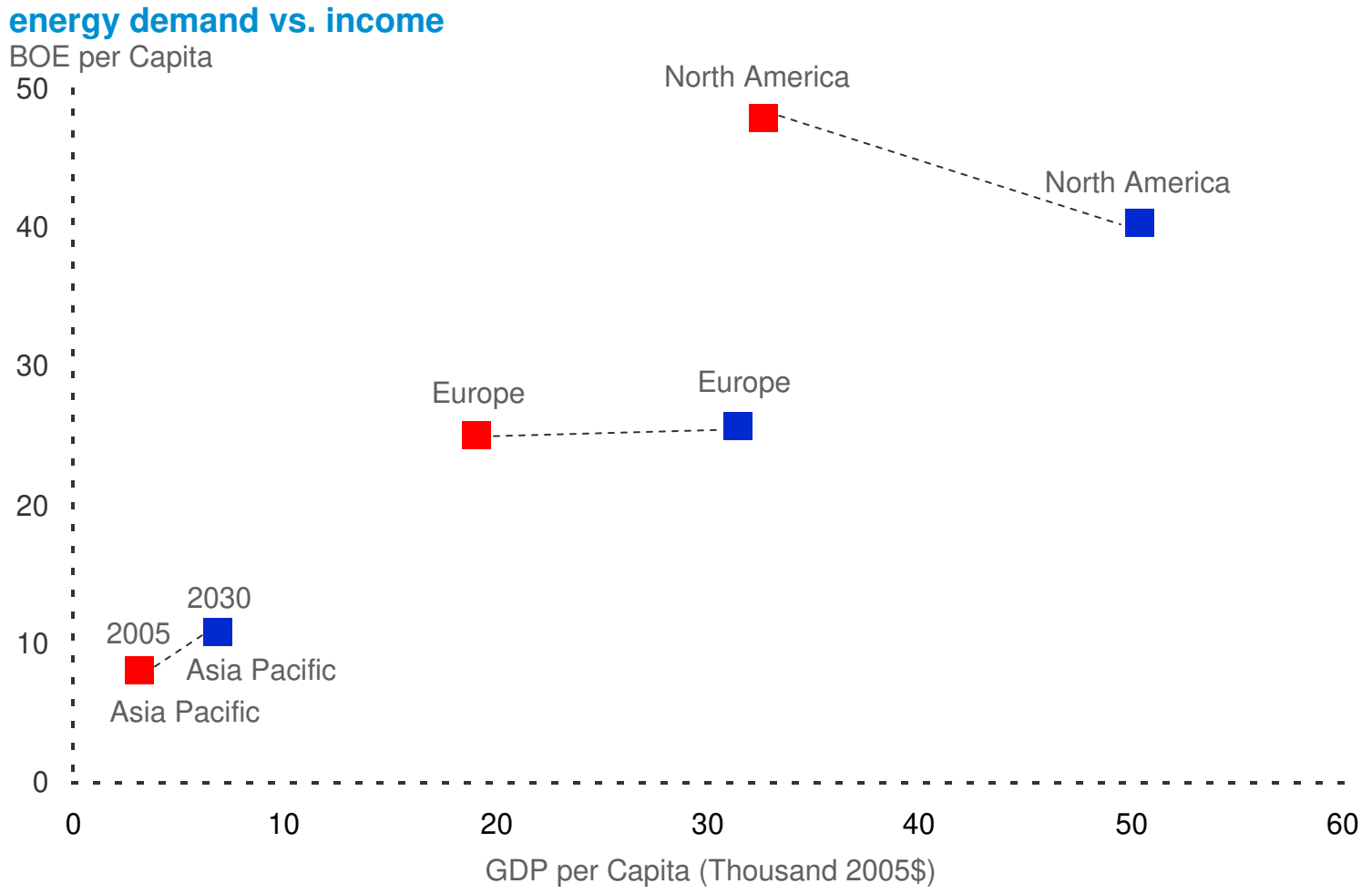


energy demand

MBDOE

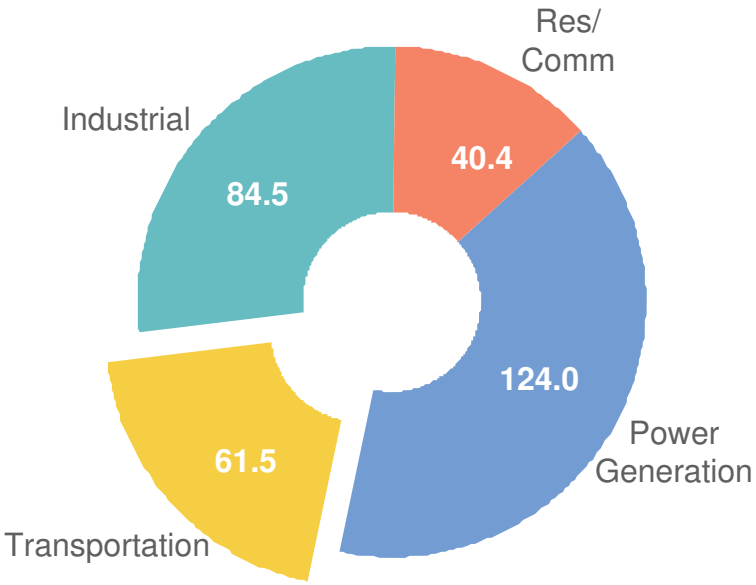


energy demand vs. income



global – transportation

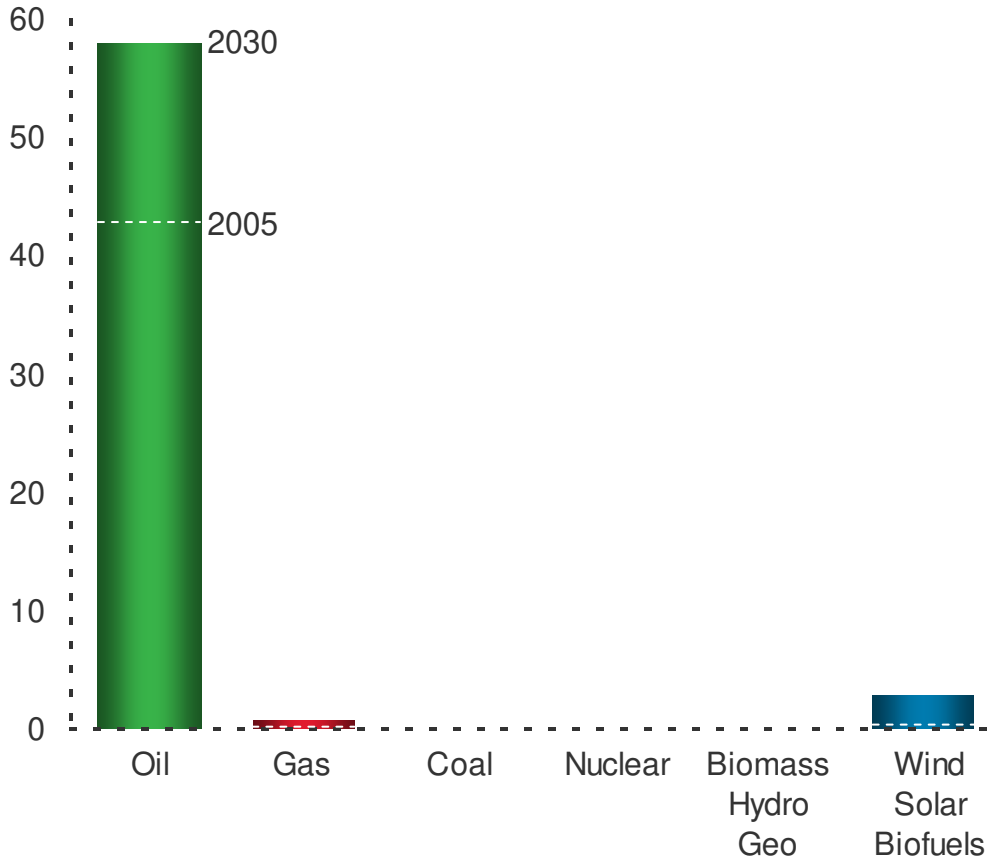
global transportation
by sector
MBDOE



2030: ~310 MBDOE

global transportation
by fuel
MBDOE

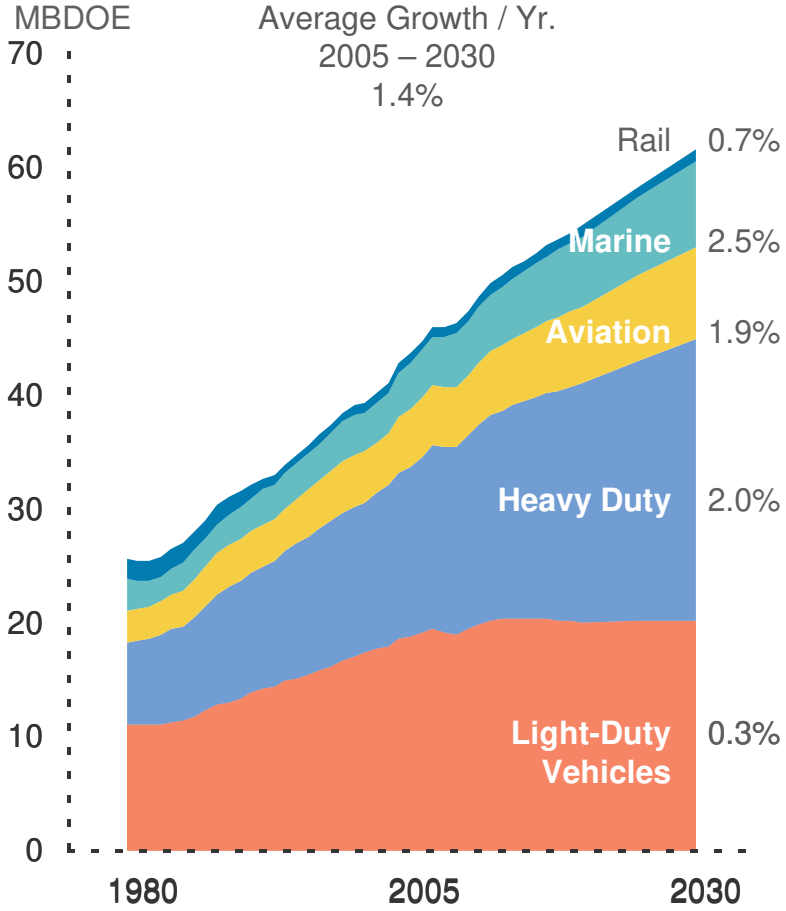
Average Growth / Yr.
2005 – 2030
1.4%



global – transportation

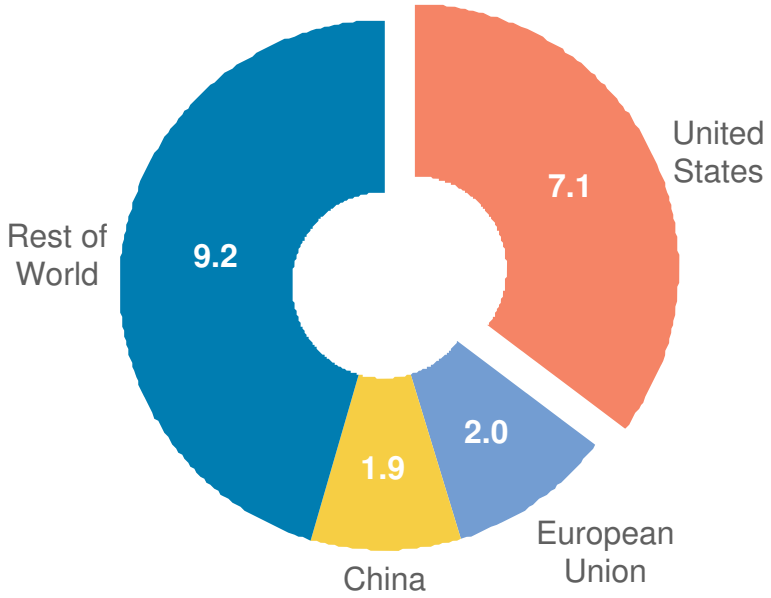
global transportation

by sector



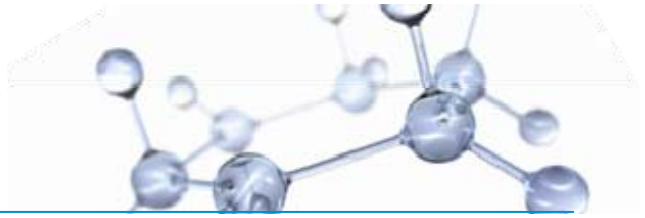
2030 - LDV fuel demand

by region

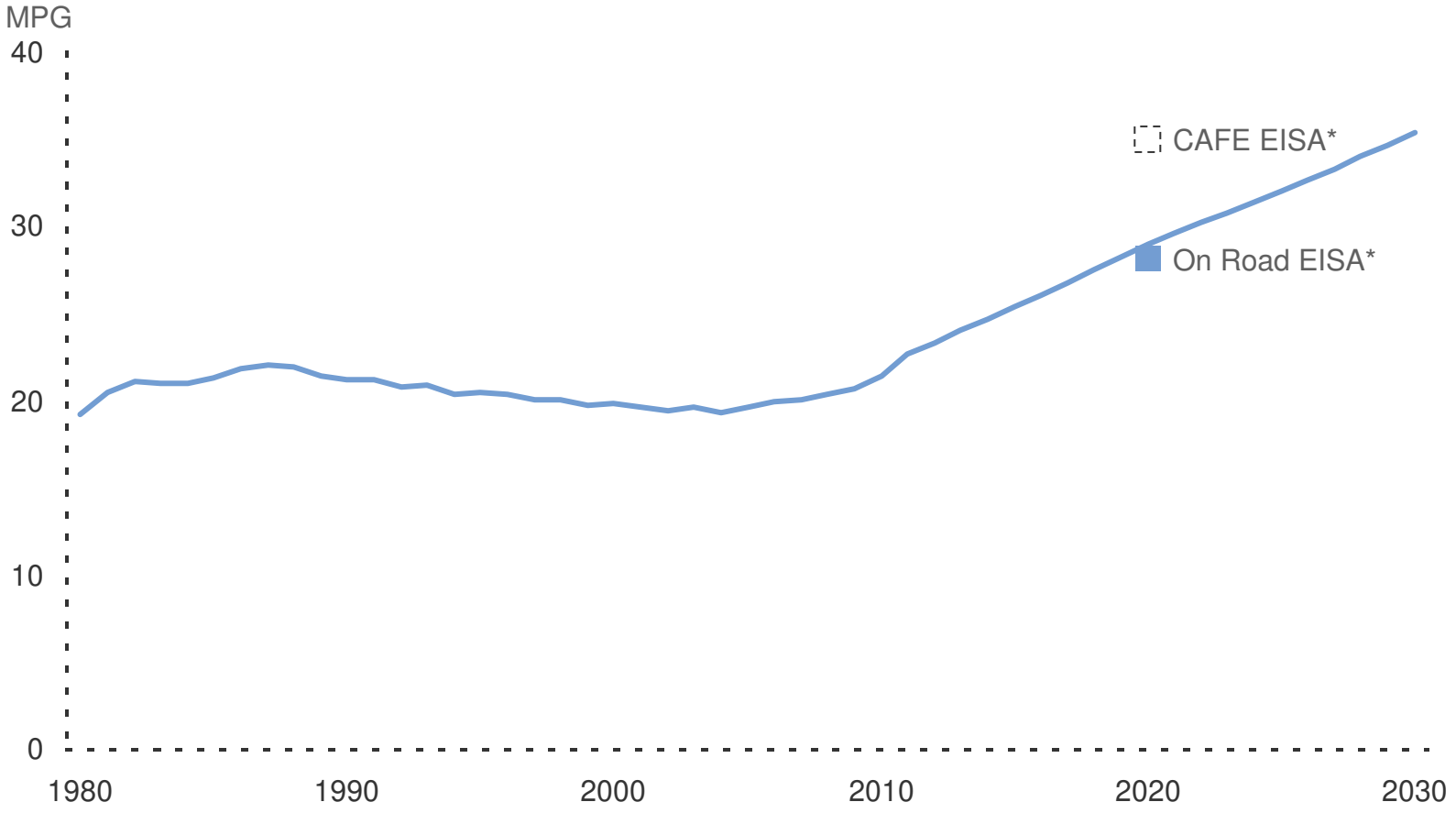


20.2 MBDOE

U.S. new light-duty vehicles

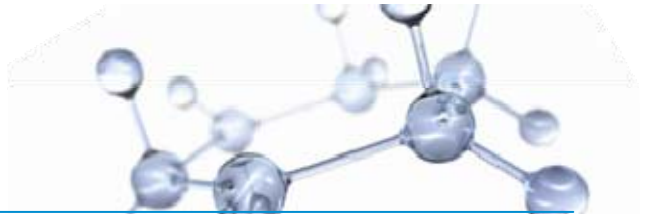


U.S. new light-duty vehicle MPG



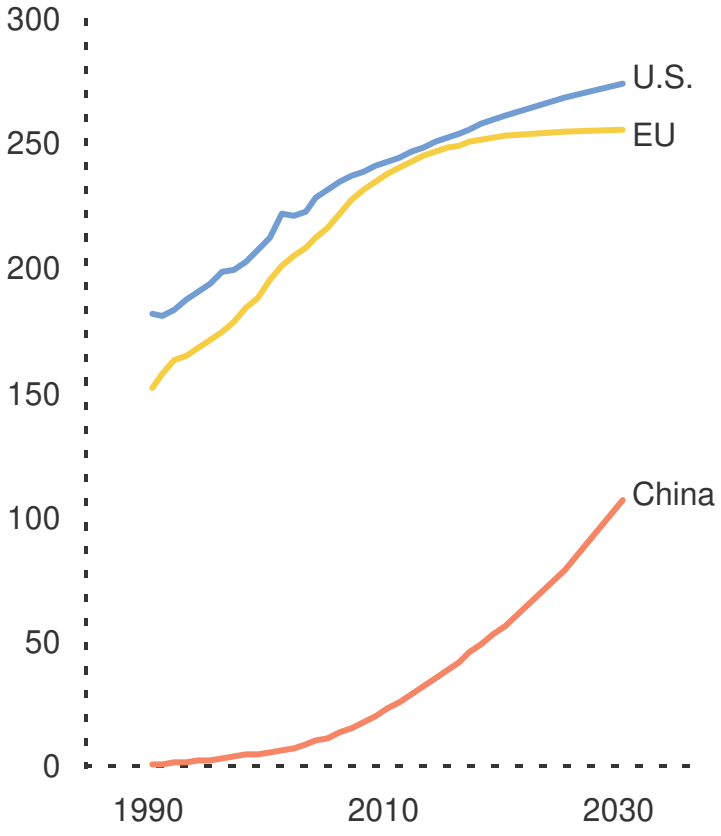
*EISA – Energy Independence and Security Act

light-duty vehicles



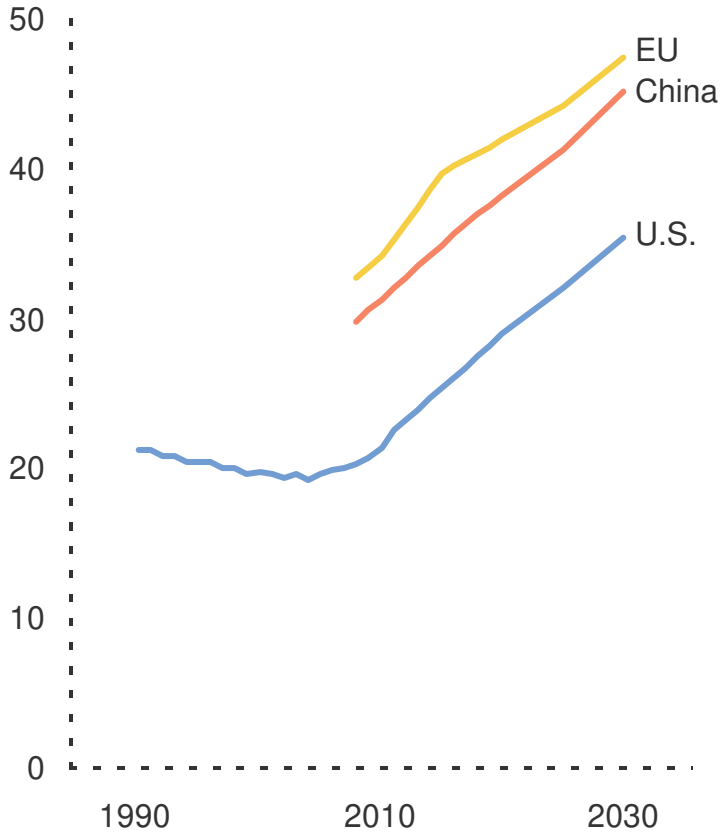
total fleet size

millions of vehicles

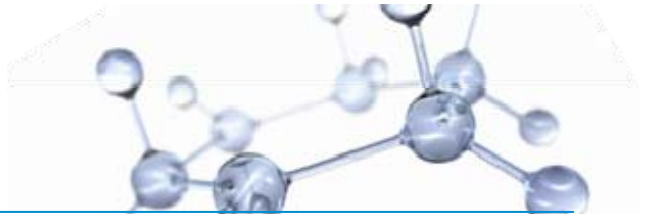


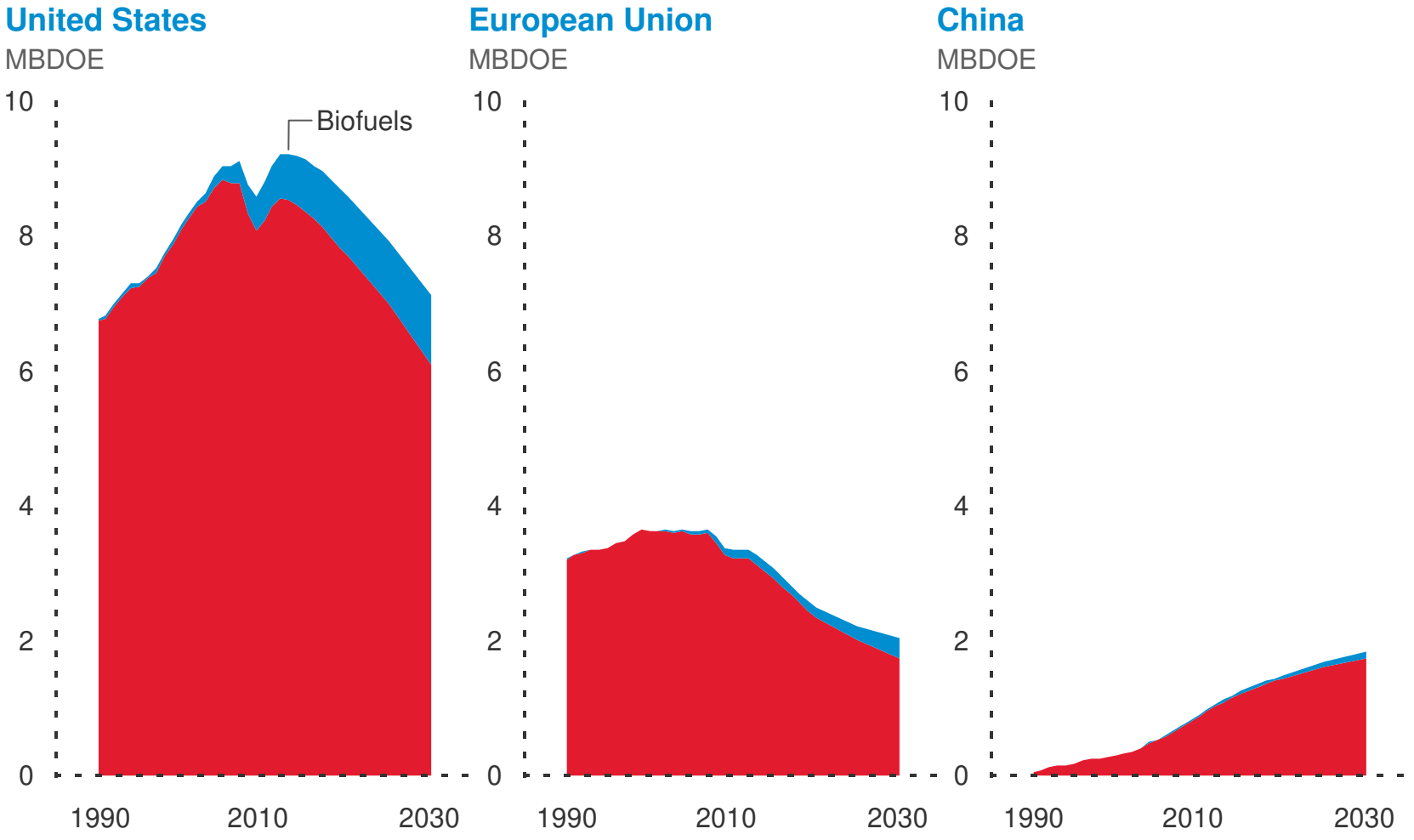
new vehicle mpg

miles / gallon



light-duty-vehicle fuel demand





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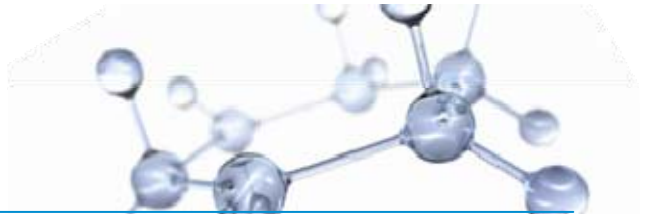
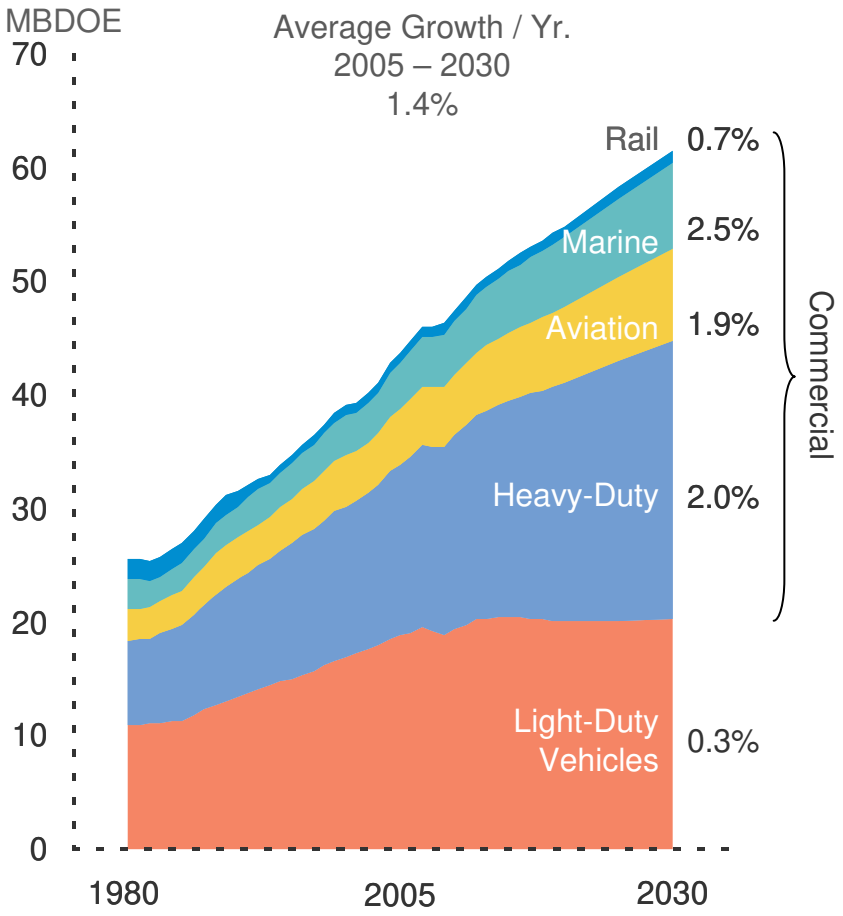
global commercial transportation

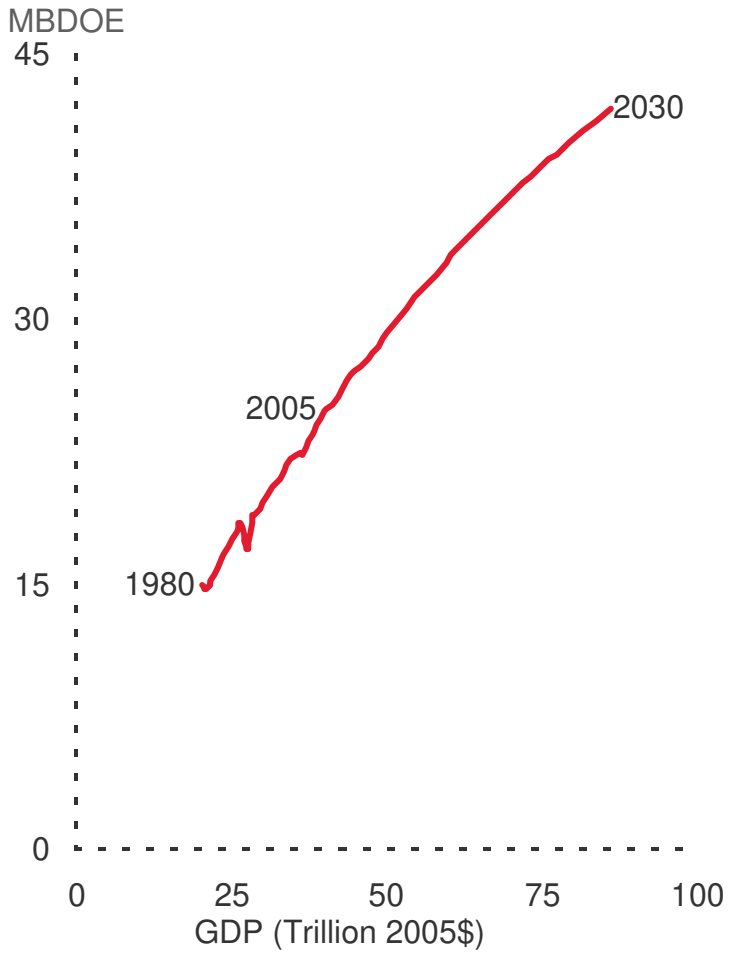


global commercial transportation

by sector



commercial transportation v. GDP



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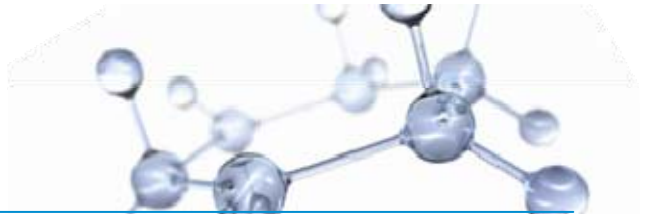
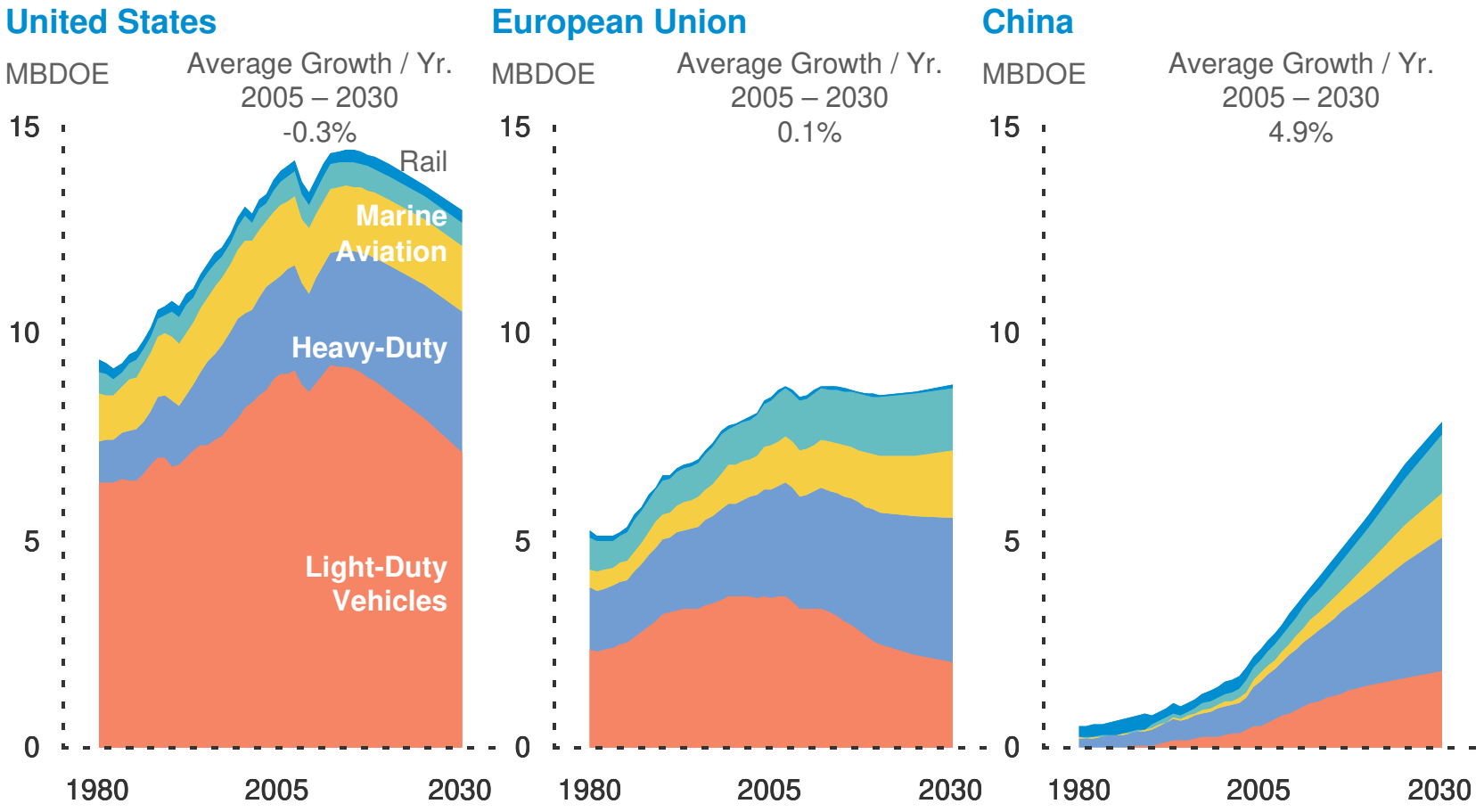
transportation by sector

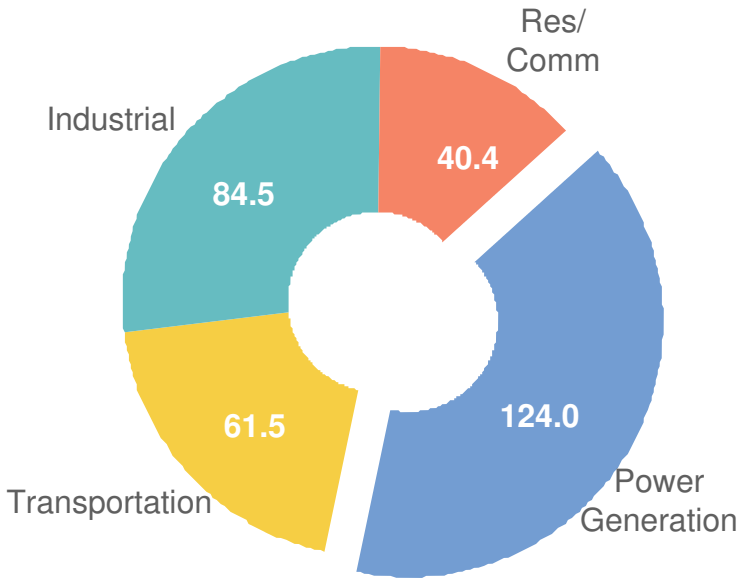




global – power generation

global power generation

by sector
MBDOE

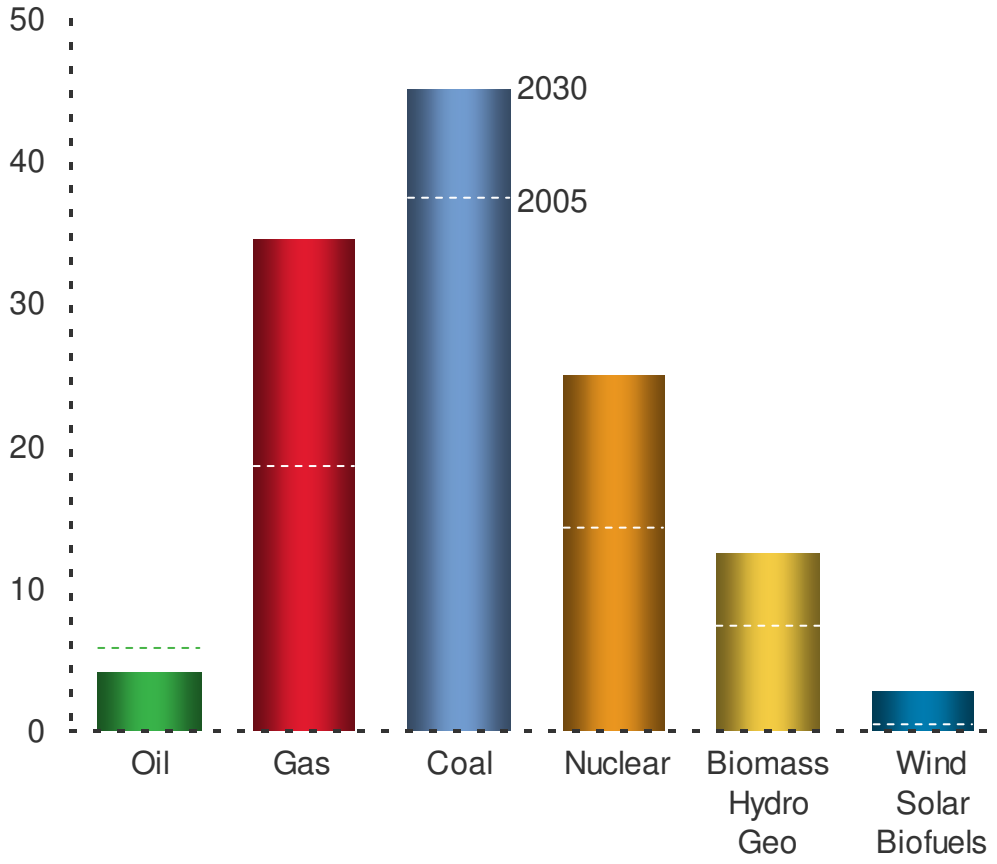


2030: ~310 MBDOE

global power generation

by fuel
MBDOE

Average Growth / Yr.
2005 – 2030
1.6%

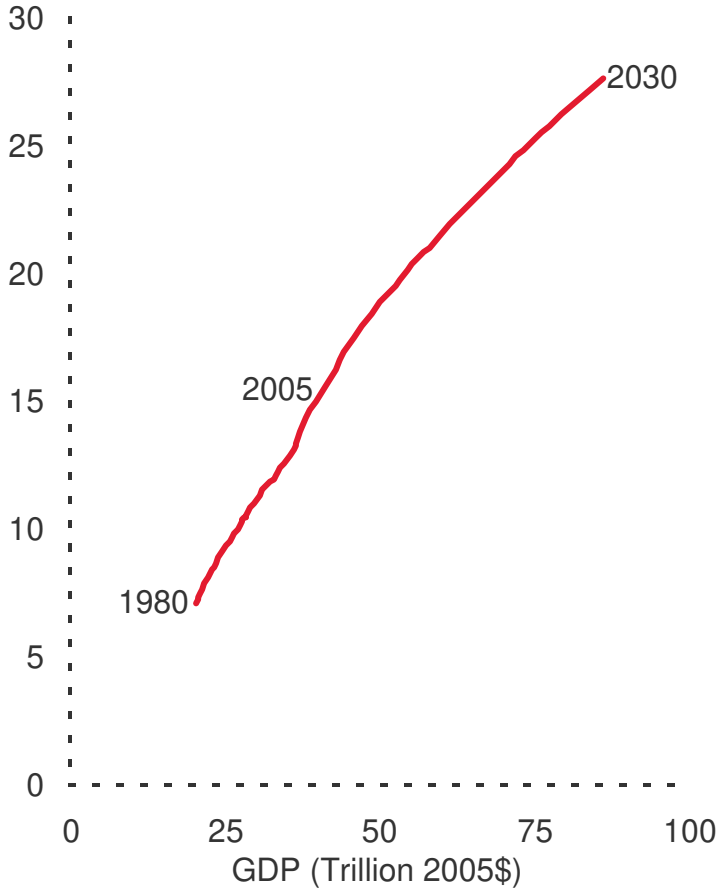


global power generation

global electricity use

electricity demand v. GDP

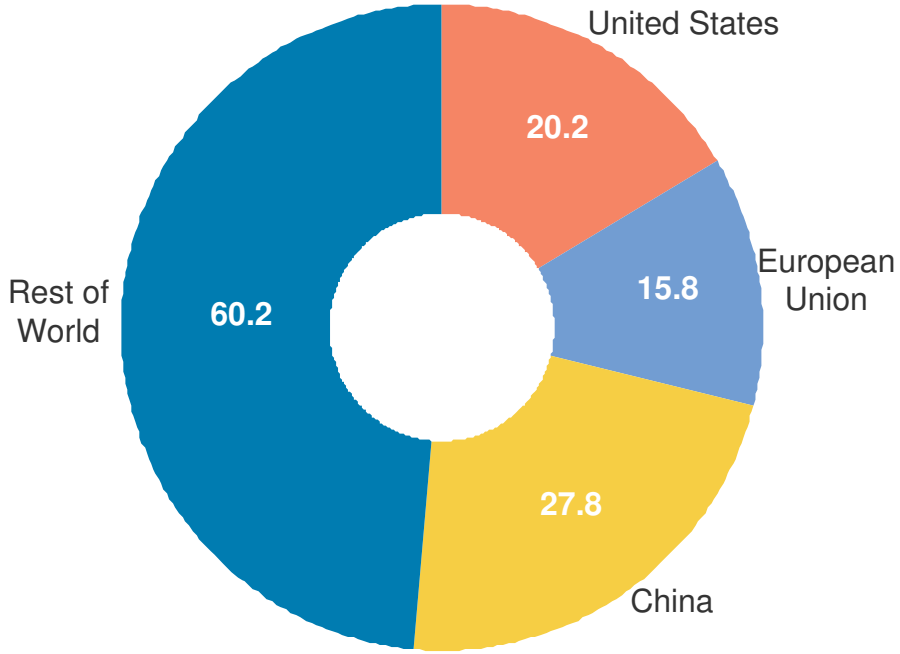
K Terawatt hours



global power generation fuel demand

by region

MBDOE



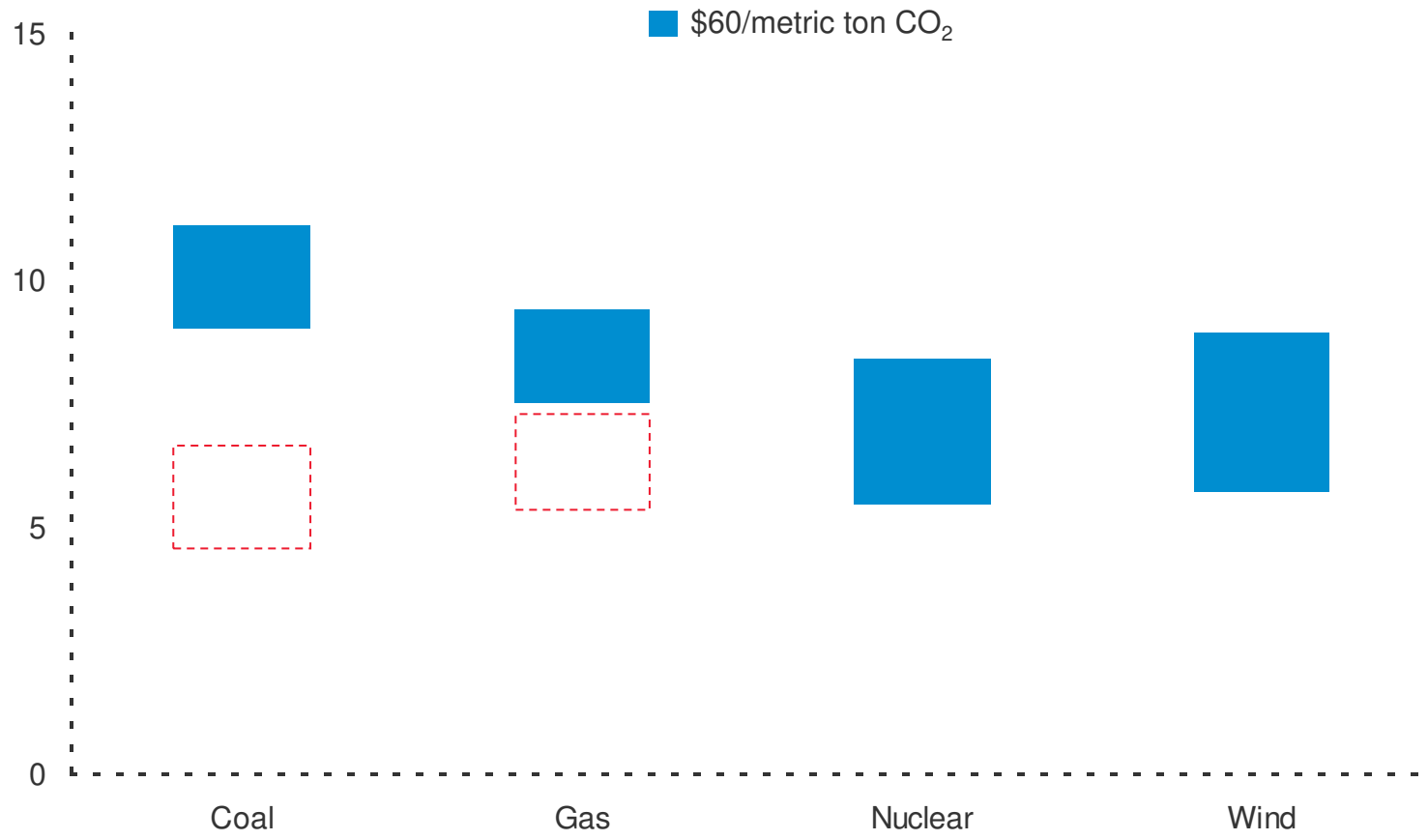
2030: ~124 MBDOE

United States power generation cost

United States power generation cost

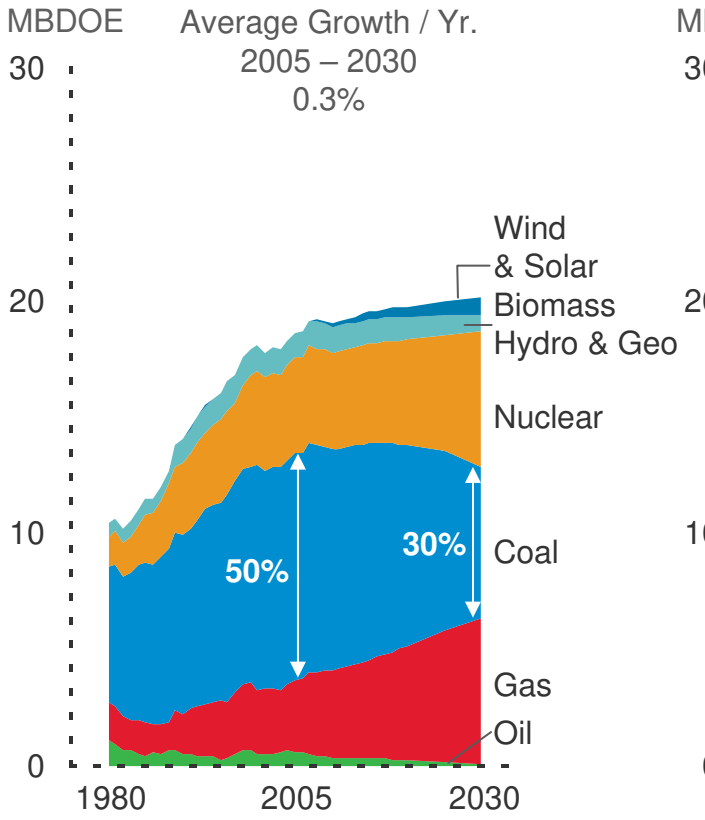
U.S. baseload, startup 2025

2005 cents/ kWhr

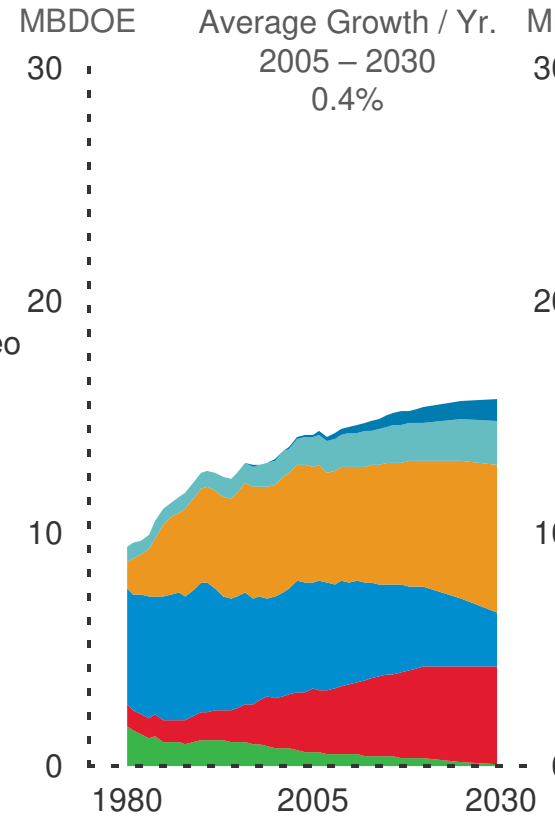


power generation by region

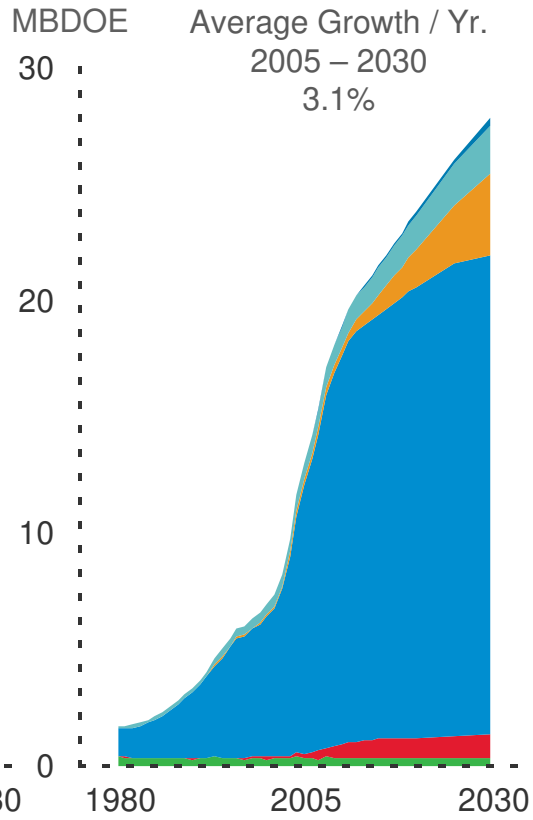
United States



European Union



China

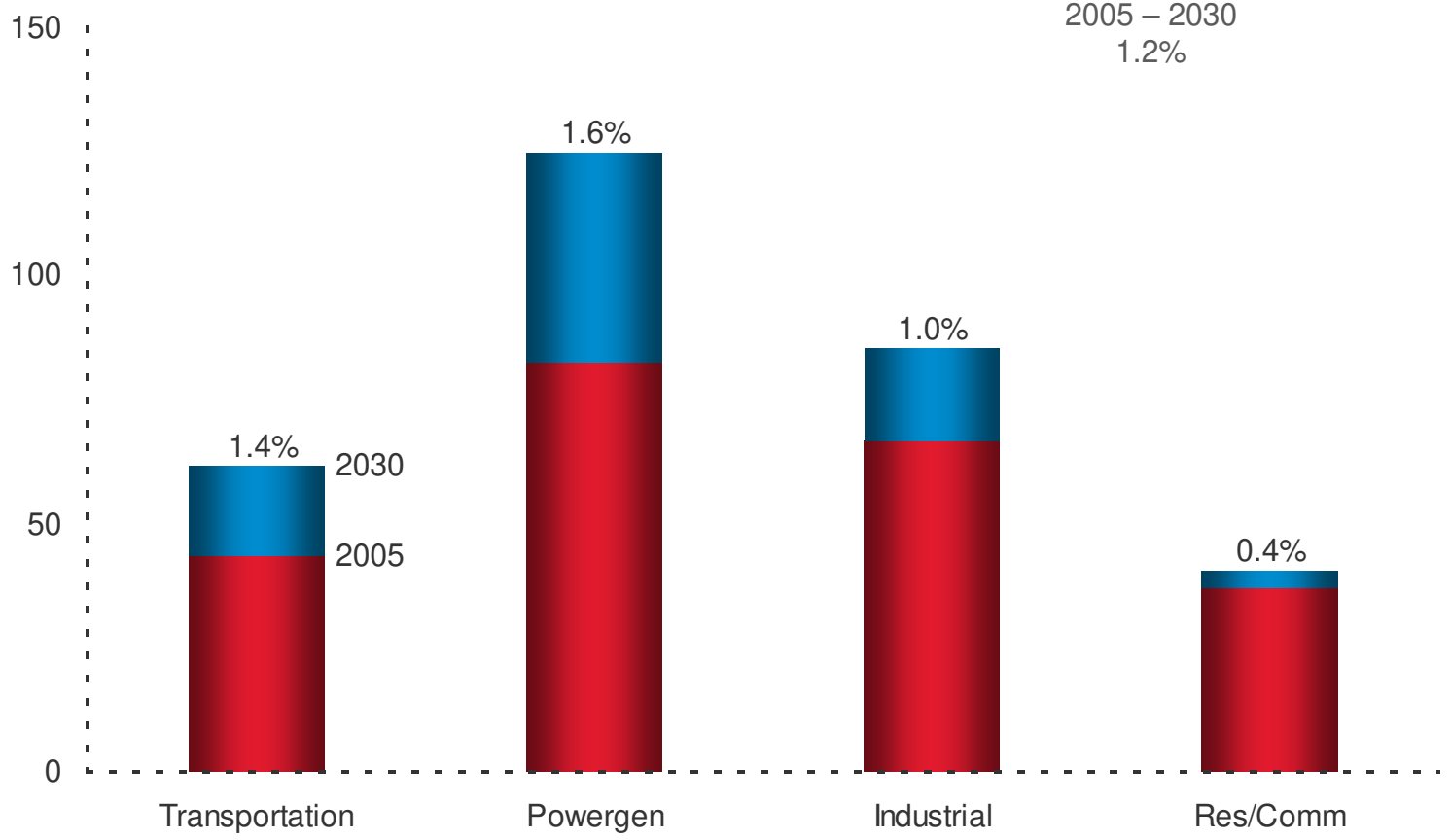


growing global energy demand by sector

global energy demand

by sector

MBDOE

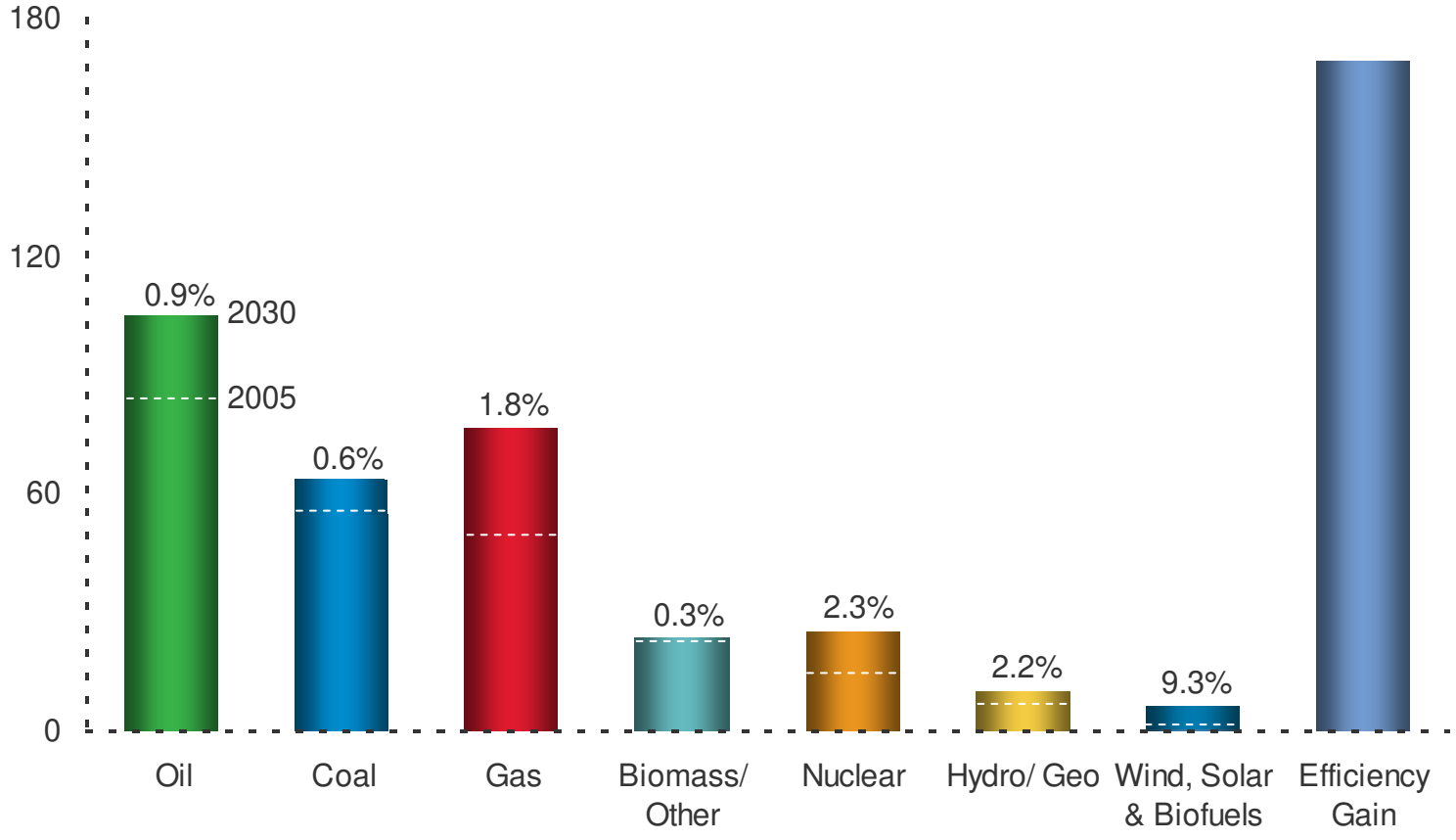


growing global energy demand

growing global energy demand

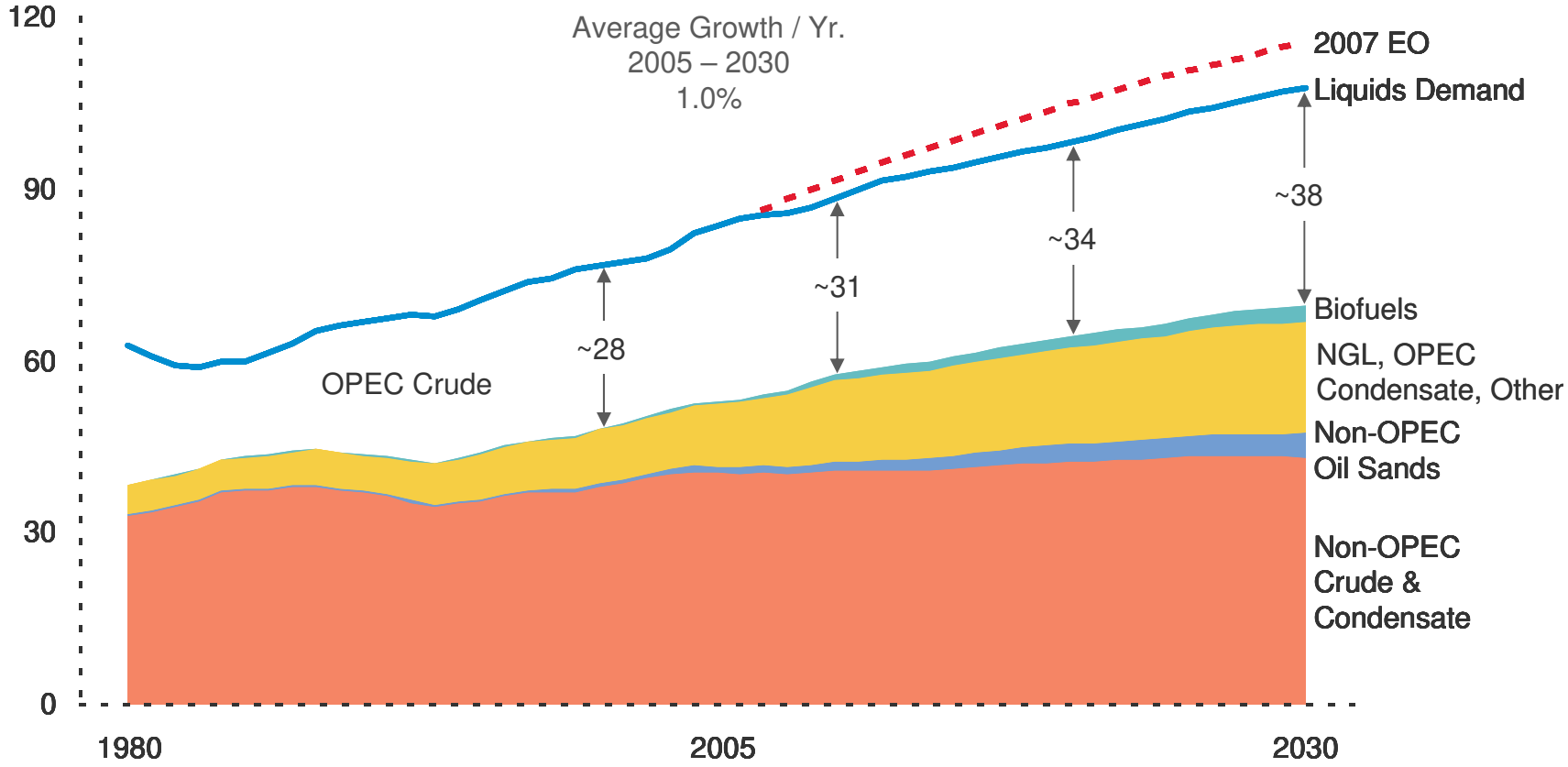
by fuel

MBDOE

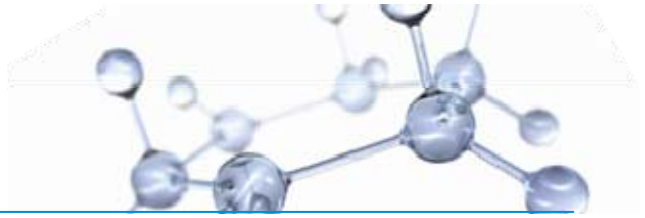


global liquids supply and demand

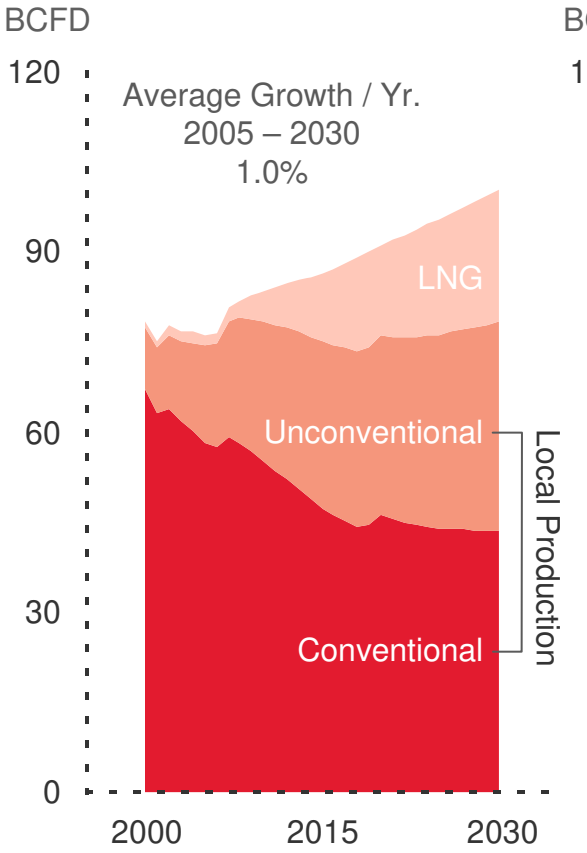
global liquids supply and demand



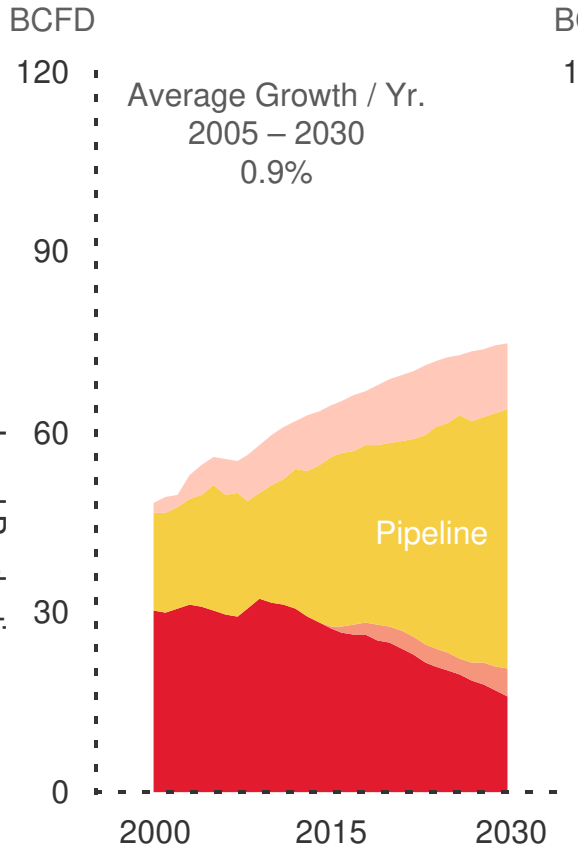
gas supply / demand balance



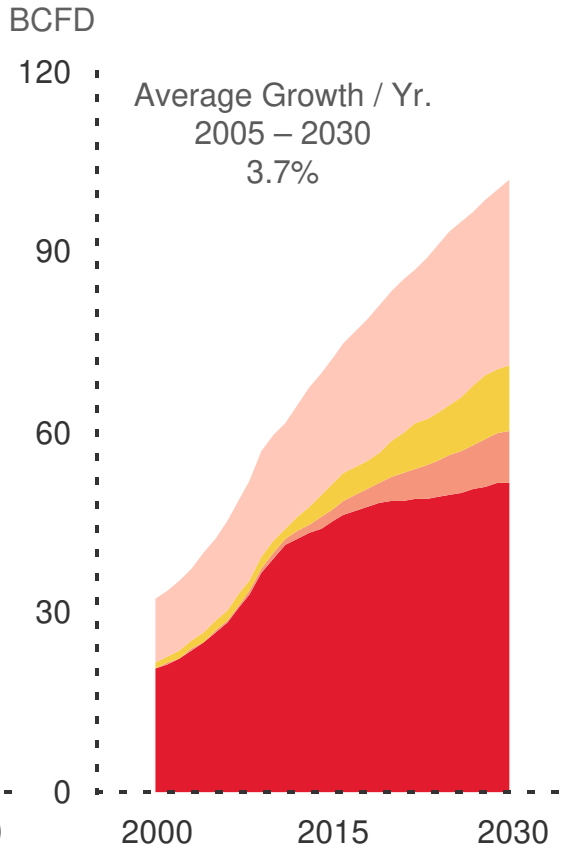
North America



Europe



Asia Pacific



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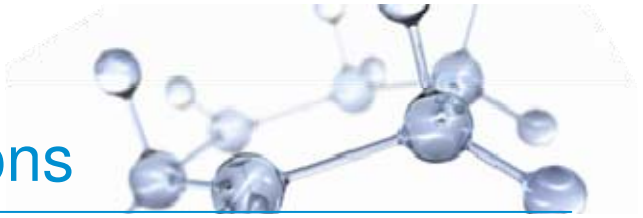
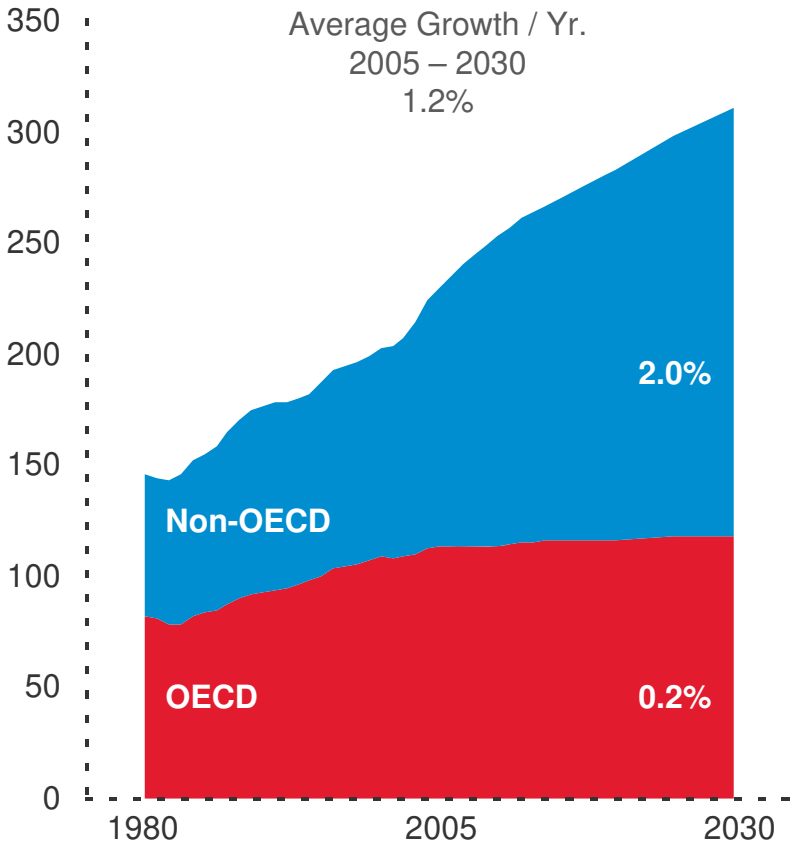
global energy demand & CO_2 emissions



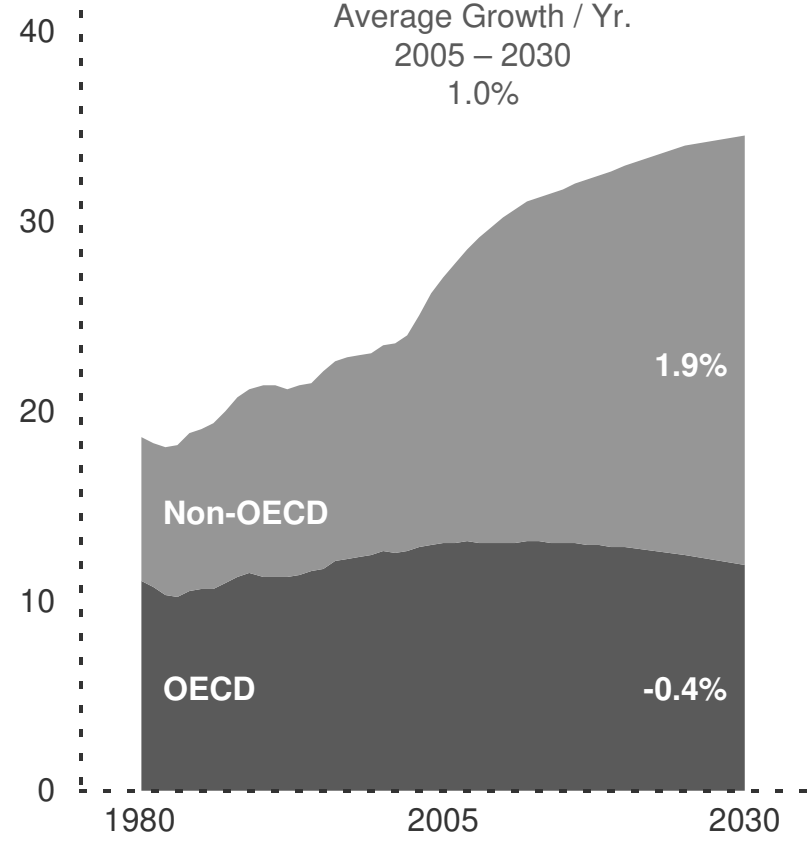
energy demand

MBDOE



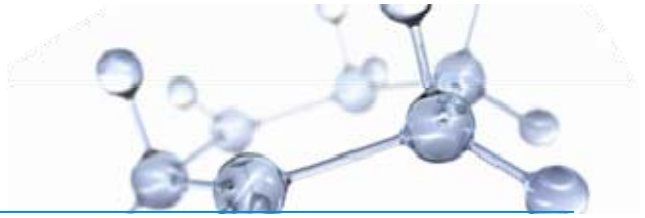
CO_2 emissions

billion tonnes



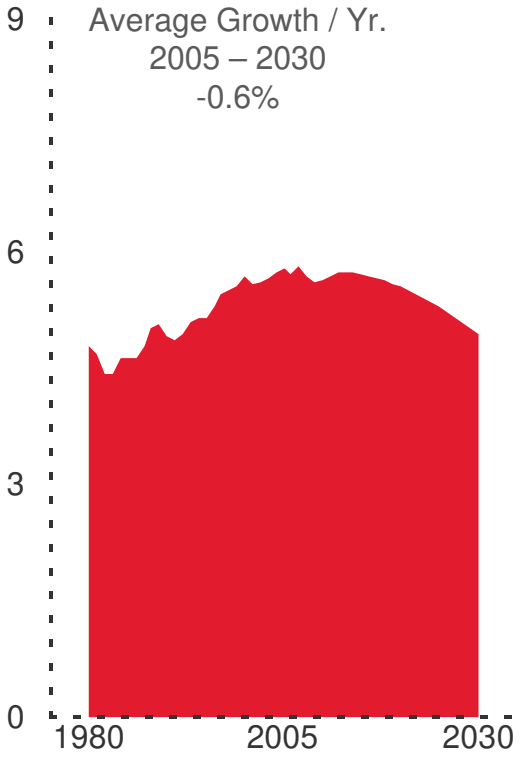
*OECD: Organization for Economic Co-operation and Development

CO_2 outlook by region



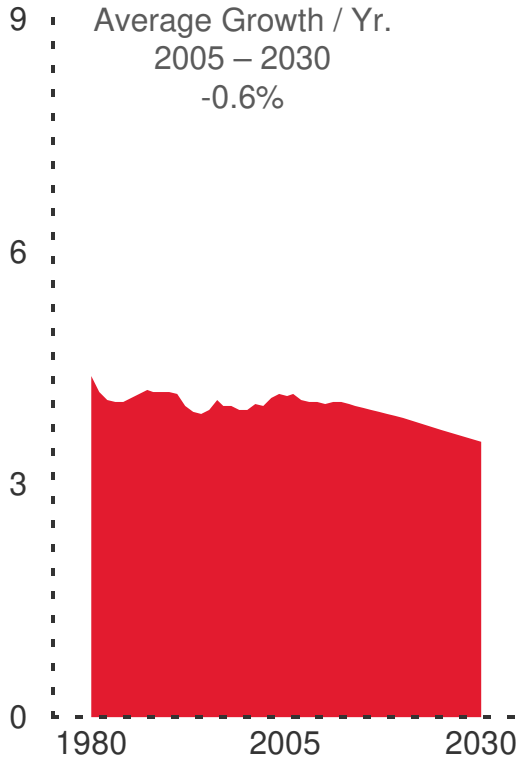
United States

billion tonnes



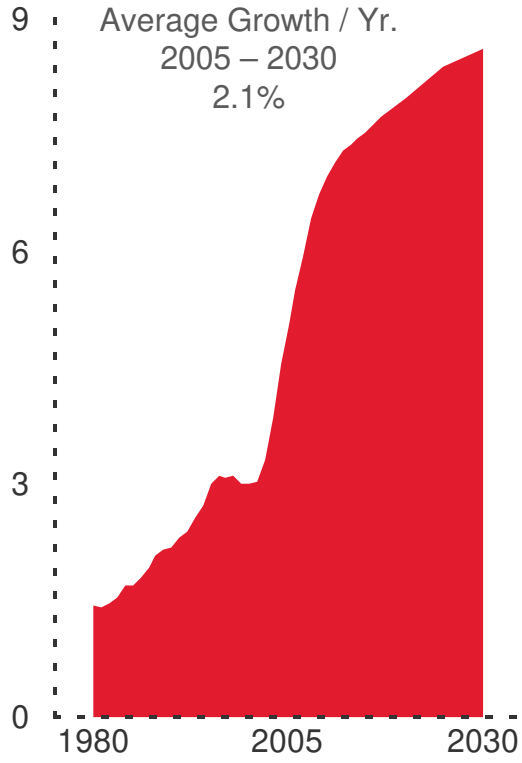
European Union

billion tonnes



China

billion tonnes



the energy imperative

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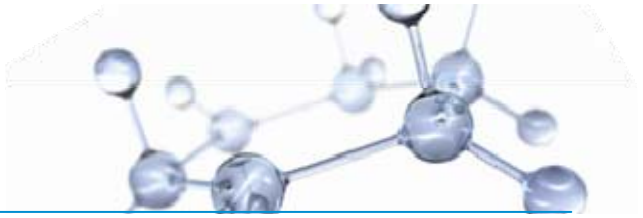
integrated set of solutions

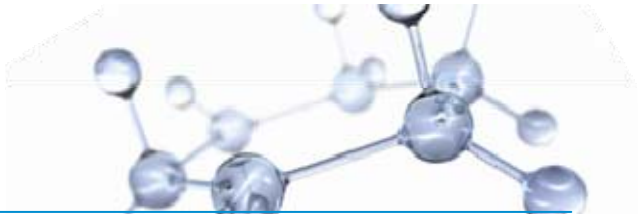


increase efficiency

mitigate emissions

expand supply

conclusion



- population and economies will expand; energy demand and CO_2 emissions will rise
- integrated set of solutions required
  - increase efficiency
  - expand supply
  - mitigate emissions
- technology breakthroughs are critical
- meeting this demand will require a global effort