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The Renewable Energy Dimension of Energy Security

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Outline

The research examines the contribution of renewable energy to energy security by:

1. Reviewing how renewable energy enters the dimensions, components and metrics used in measuring energy security.
2. Examining case studies of producer, consumer and transit countries perspective.

The traditional role of energy

Renewable Energy

“Energy is the precondition of all commodities, a basic factor equal with air, water, and earth”

E. F. Schumacher, Nobel laureate economist, 1977

Renewable energy:

“Energy derived from natural processes that are replenished at a faster rate than they are consumed”

Types of Renewable Energy Sources (RES)

Bioenergy, Geothermal, Hydropower, Ocean, Solar, Wind

Definition of Energy Security

IEA definition

“Energy security is the uninterrupted availability of energy sources at an affordable price”

The integration of renewable energy in the energy mix:

Can enhance energy security in

Electricity generation

Water heating/cooling

Transportation

Can help us meet three goals

1. Reduce greenhouse emissions

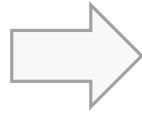
2. Ensure reliability

3. Ensure cost-efficient delivery of energy

Energy Security Dimensions & Components

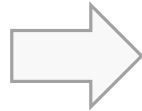
The 4A's of energy security (APEREC, 2007)

Availability



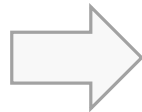
the physical existence of energy (energy supply and reserves)

Affordability



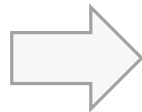
refers to the costs

Acceptability



associated with environmental concerns (CO₂ emissions)

Accessibility



the ability to access the energy resources (geopolitical factors)

Synthesizing an energy security index

Dimensions

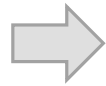
Components

Physical availability



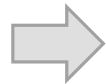
security of supply; self-sufficiency; energy diversification

Technology development



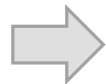
infrastructure; energy efficiency; development and innovation on energy

Economic affordability



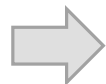
stability and predictability of prices; energy intensity; profitability

Social accessibility



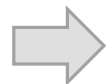
social equity; energy poverty; electrification

Governance



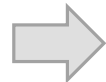
political stability; type of polity; good regulatory policies

Unconventional threats



revolutions; security of critical infrastructures

Natural environment



mitigation of climate change; natural disasters

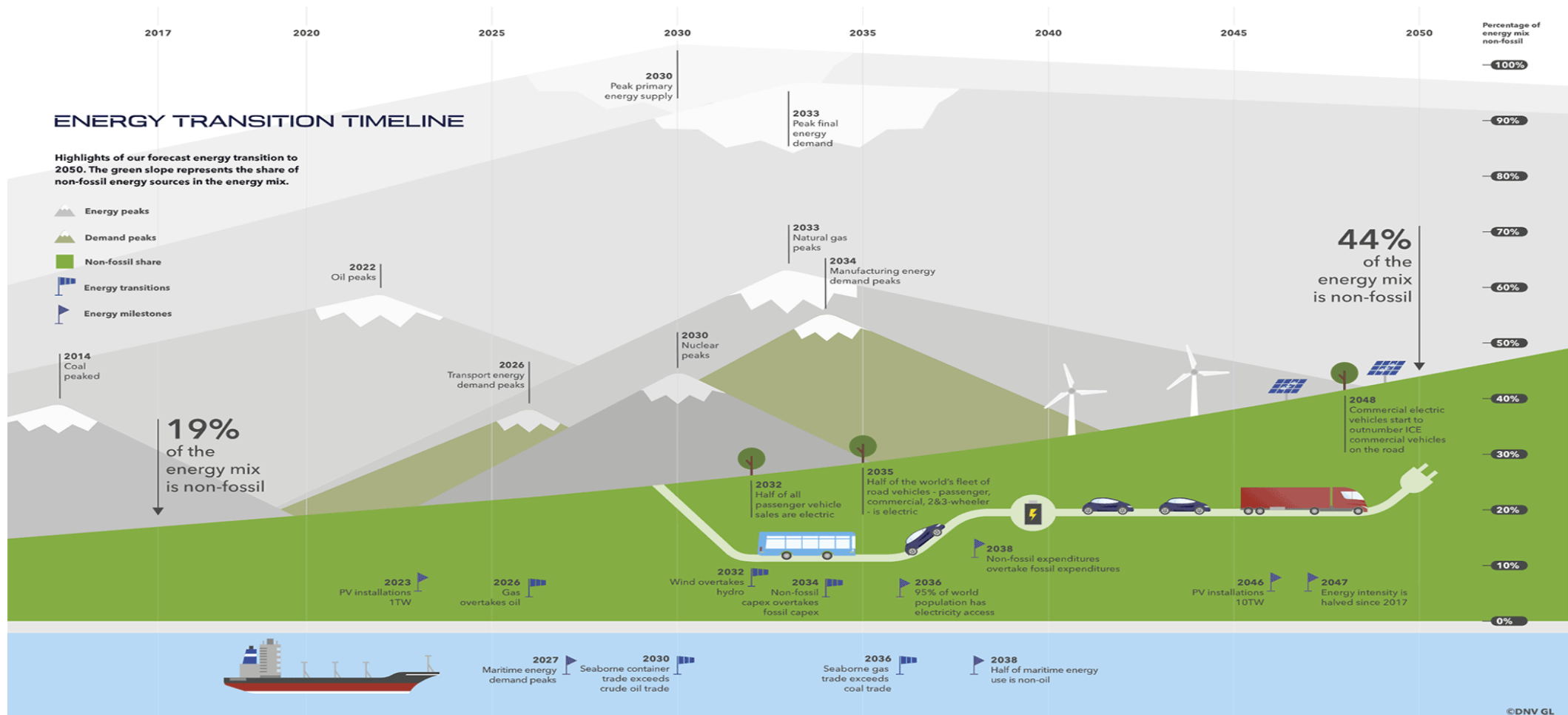
A new energy transition

IRENA defines the energy transition as *“a pathway toward transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century”*.

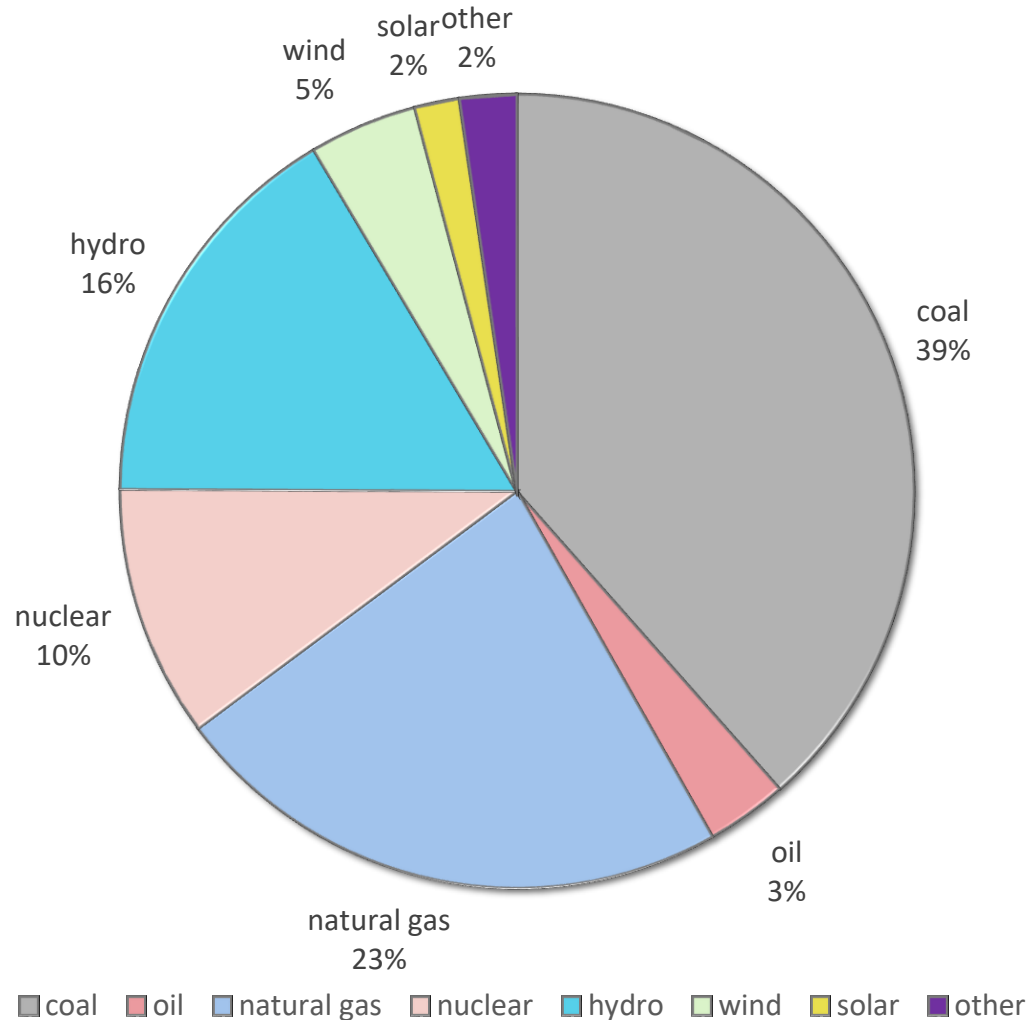
The entrance of renewables in the energy mix drives to another phase of traditional geopolitics:

- a. Focus on changes in the positions of countries in the international system.
- b. New energy standards for the exporting countries.

Energy Transition Timeline



Electricity production by source, IEA 2017



Energy mix

For each region/country, the composition of the energy mix depends on:

1. The availability of usable resources domestically or the possibility of importing them.
2. The extent and type of energy needs to be met.
3. Policy choices determined by historical, economic, social, demographic, environmental and geopolitical factors.

Energy mix of selected countries

Electricity production - Includes: fossil fuels, nuclear energy & renewables

COUNTRIES	OIL	GAS	COAL	NUCLEAR	HYDRO	RENEWABLES	TOTAL
US	23,0	1394,0	1310,0	847,3	296,8	417,8	4288,9
Denmark	0,3	1,9	6,2	0	^	21,9	30,3
Germany	5,6	86,7	241,9	76,3	20,2	196,2	626,9
Russia	10,7	515,9	168,9	203,1	185,3	1,1	1085,1
China	10,7	202,8	4445,5	248,1	1165,1	492,4	6564,6

source: BP Statistical Review 2019 & Danish Energy Agency 2017. Unit: TWh

^ less than 0,05

Different perspectives of energy security

Three different groups of countries:

Consumers → Security of supply

Producers (“prosumers”) → Security of demand

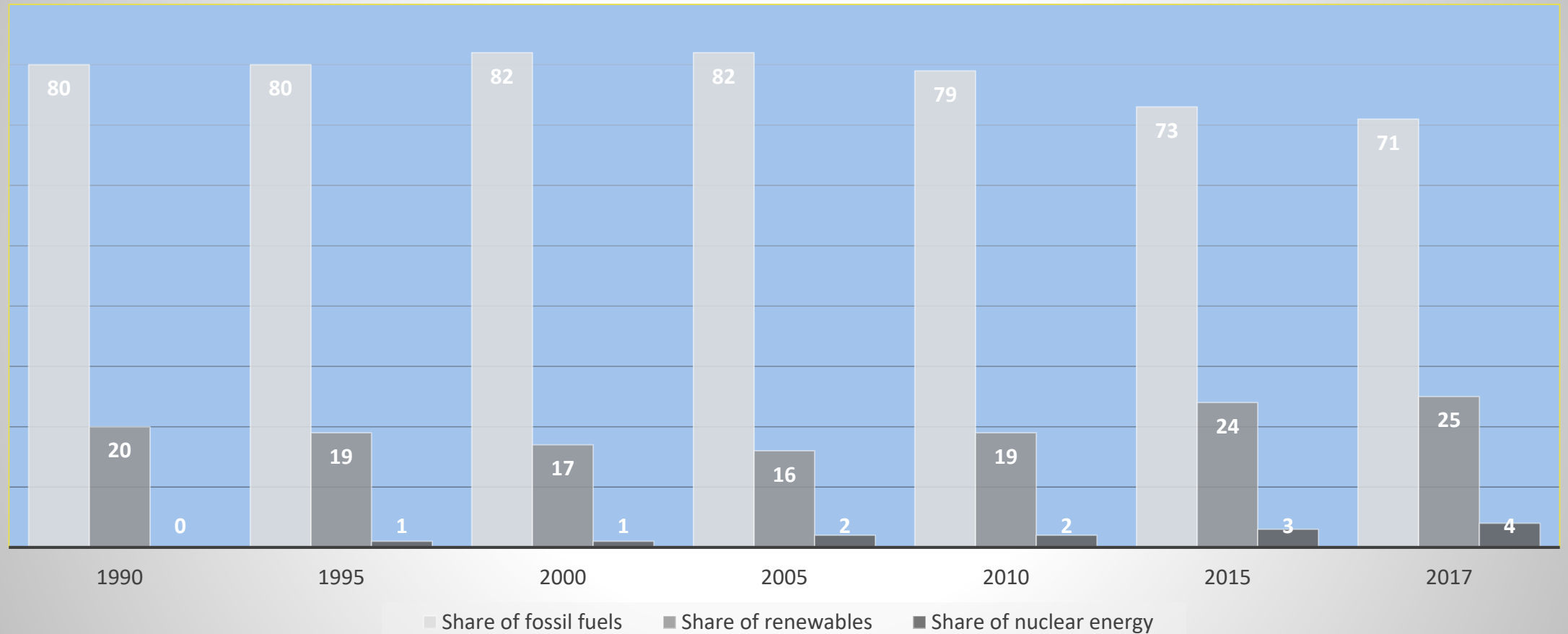
Transit countries → Security of energy transition

Geographical & Technical Characteristics of Renewable Energy

1. The availability of RES, especially that of wind and solar, far outstrips that of fossil fuels and uranium.
2. Every country has access to at least some form and amount of renewable energy. Thereby all countries could become energy producers.
3. Renewable energy can be more efficiently harvested at certain locations than others, some countries can generate energy cheaper than others.
4. Electricity is the energy carrier for most renewables and especially those with the most potential (solar and wind).

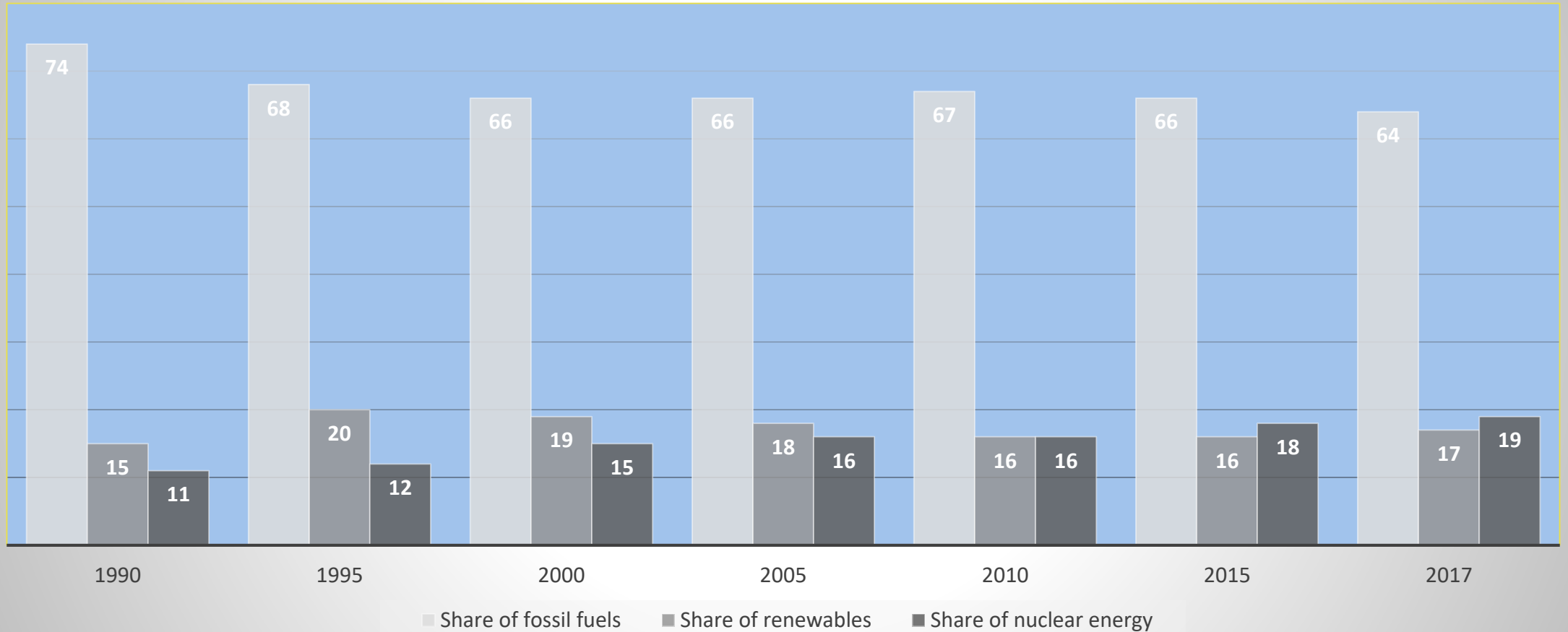
China

Share in electricity production (%)



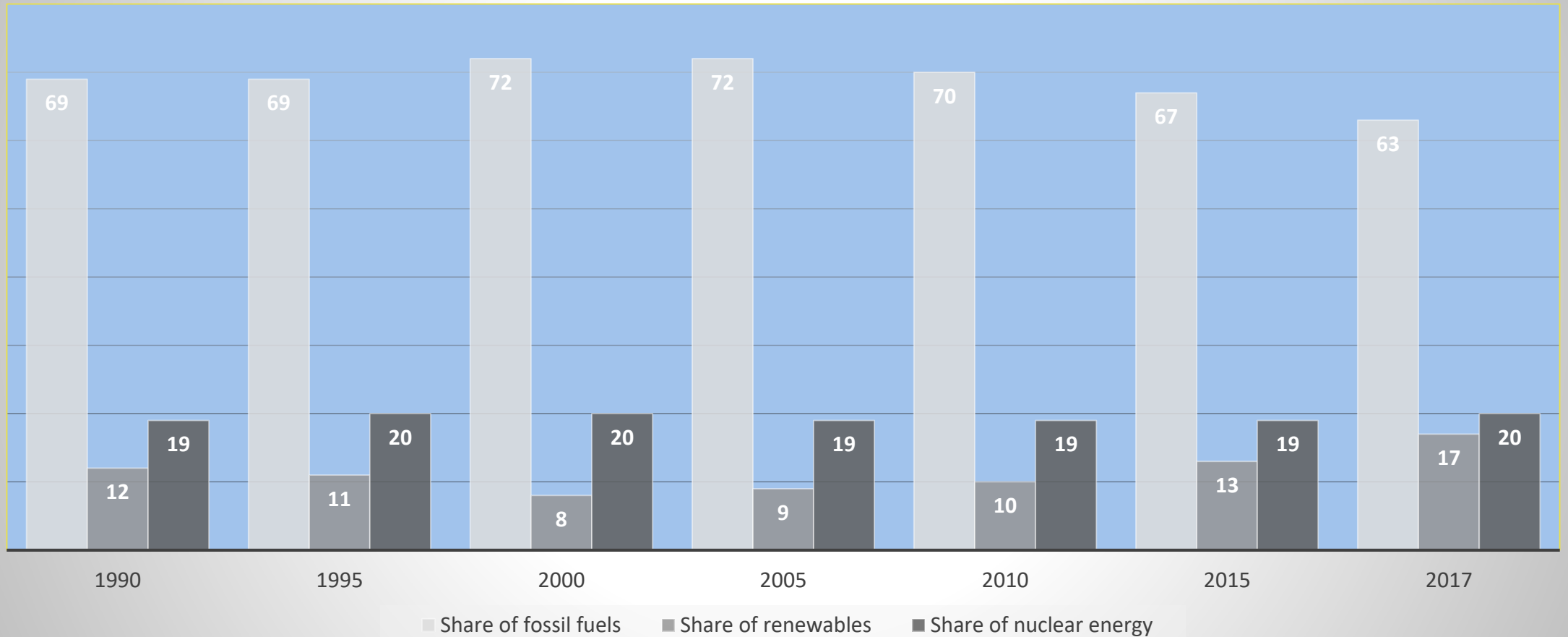
Russia

Share in electricity production (%)

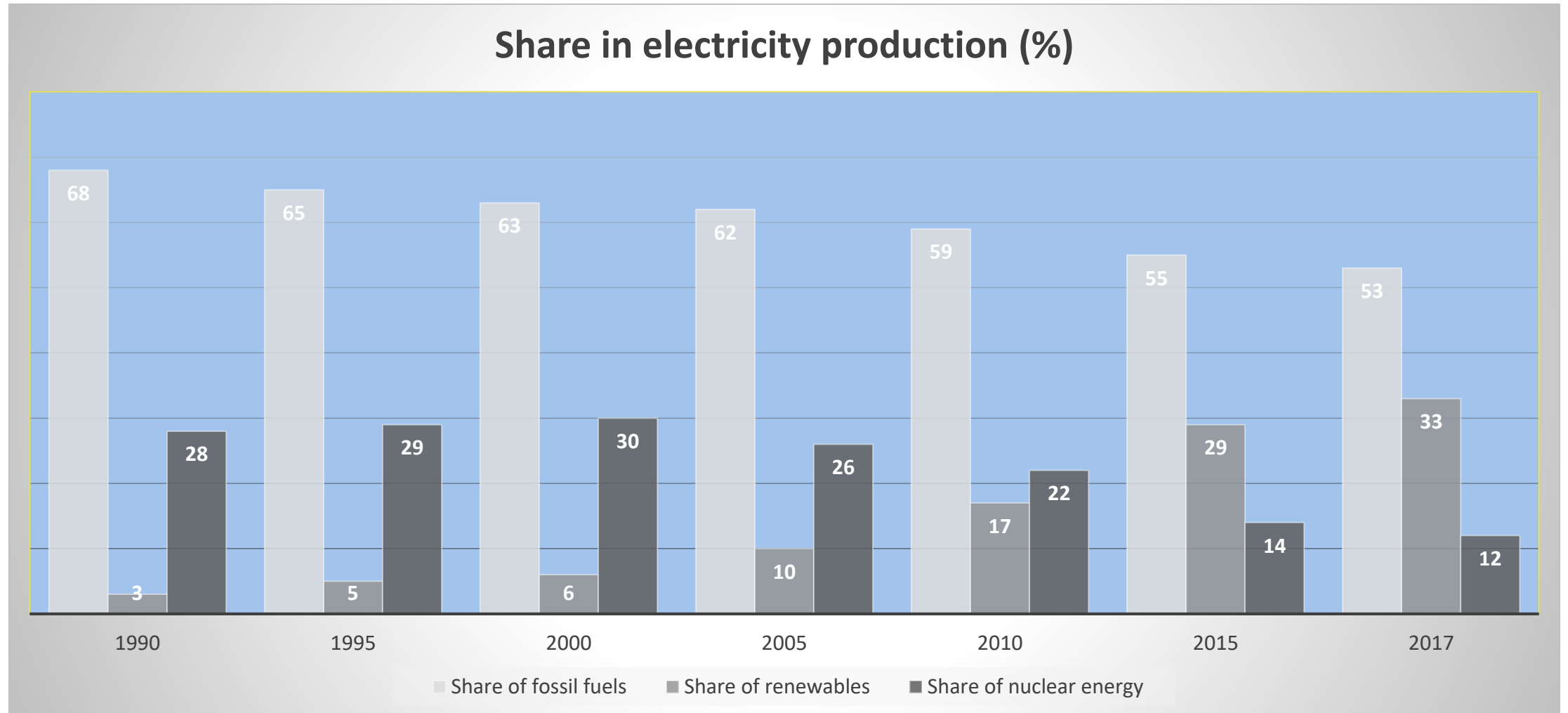


USA

Share in electricity production (%)

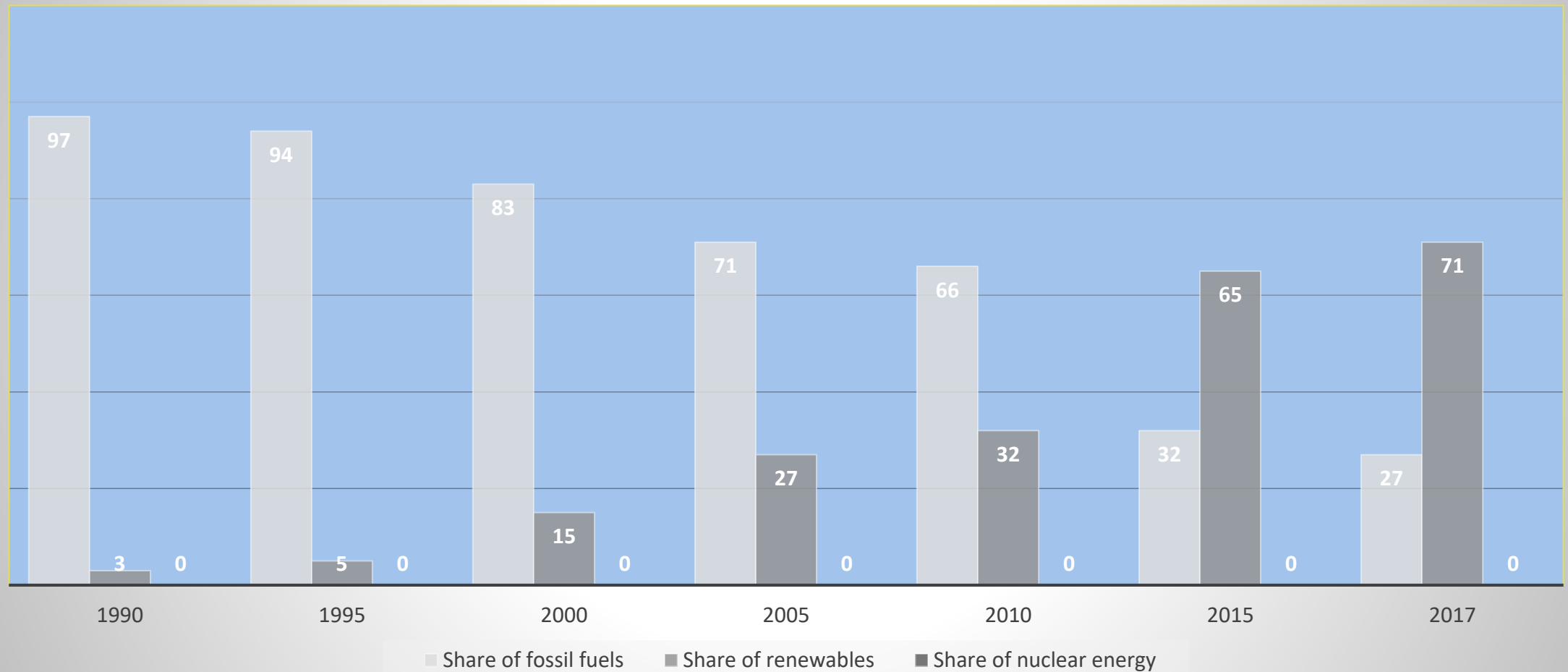


Germany



Denmark

Share in electricity production (%)



Perspective of the consumers & transit states

Why it is crucial to use renewable energy?

1. Renewable energy reduces the need for energy imports.
2. Renewable energy is produced from the local natural resources.
3. Renewable energy is environmental friendly.
4. Renewable energy mitigates the risk in the reliability of energy markets.
5. The research & the technology development push down the cost.

Perspective of the producer

Why it is crucial to use renewable energy?

1. Producers can benefit economically from giving greater priority to renewable energy sources. This will improve their opportunities for energy exports by decreasing the domestic use of fossil fuels.
2. By being proactive in renewable energy development they will undoubtedly have an advantage in the future among other producers.
3. It is foreseen that traditional sources and renewables will be two intertwined energy sources.

Conclusions

- Renewable energy resources are crucial for lowering carbon dioxide emissions and enabling a secure energy future.
- **China** and **Russia** are not expected to use a diversified energy mix, in contrary to the **US** and the **EU** who are expected to use a diversified energy mix by using science and technology.
- Especially the **EU**, is expected to continue to improve renewables due to the high dependency of the EU countries on fossil fuel imports.
- We propose an **energy security index** based on the contribution of renewables in the energy mix.

Thank you for your attention

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