Consolidation after WW2

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Changes introduced by/throughout the war

What were they?

Changes introduced by/throughout the war

Regimes, institutions and economy

- War economy – nationalization of resources and supply chains (US/UK)
- US turns net energy importer – further pressure on relations with producing countries
- Emergence of „operations research“

Technological advancement

- ICT – radar, remote control, guiding systems, electrical computation, network communication
- Transportation – ICS-based mobility, jet engine-based aviation
- Rocket science – space program

- Chemical engineering – plastics (substitutes for rubber and glass)
- Piping/welding – oil and gas transfers
- Nuclear energy

Consolidating energy industries (region-specific)

Established industries

- Coal, oil, electricity

Emerging industries

- Nuclear energy, natural gas

Consolidating energy industries

Centralized approach

- Vertically integrated national monopolies
- Stable, secure, affordable supply of energy to the national economy

Market-based approach

- Market competition (or fragmentation)
- Energy supply as a by-product of a profit-seeking behavior

Lecture outline

Case studies illustrating the two approaches:

- Nuclear industry in the U. S. (mixed approach)
  - Regulated utilities – costs recovered in bills paid by customers
  - Deregulated utilities – costs paid directly by the utilities

- Natural gas industry in Europe (centralized approach)

Consolidating the power industry: the business model

Year	Rated power (MW)	Thermal efficiency (%)	Price (USD1992/kWh)
1892		2.5	4.00
1907	12		1.56
1927	110	20	0.55
1947			0.19
1967	1,000	40	0.09

The “Grow and build“ strategy
(technological progress + cost/price decline)

- Promote electricity usage
- Build bigger and more efficient plants
- Bring down the costs and sell more electricity
- Promote further electricity usage
- …

The consolidation of nuclear industry in the U. S.

“The energy produced by breaking down the atom is a very poor kind of thing. Anyone who expects a source of power from the transformations of these atoms is talking moonshine.”

Lord Ernest Rutherford, 1933.

“It is not too much to expect that our children will enjoy in their homes [nuclear generated] electrical energy too cheap to meter.”

Lewis Strauss, Chairman, US Atomic Energy Commission, 1954.

„The failure of the U.S. nuclear power program ranks as the largest managerial disaster in business history, a disaster on a monumental scale … only the blind, or the biased, can now think that the money has been well spent. It is a defeat for the U.S. consumer and for the competitiveness of U.S. industry, for the utilities that undertook the program and for the private enterprise system that made it possible.“

*Forbes cover story “*Nuclear Follies“, February 11, 1985

The origins

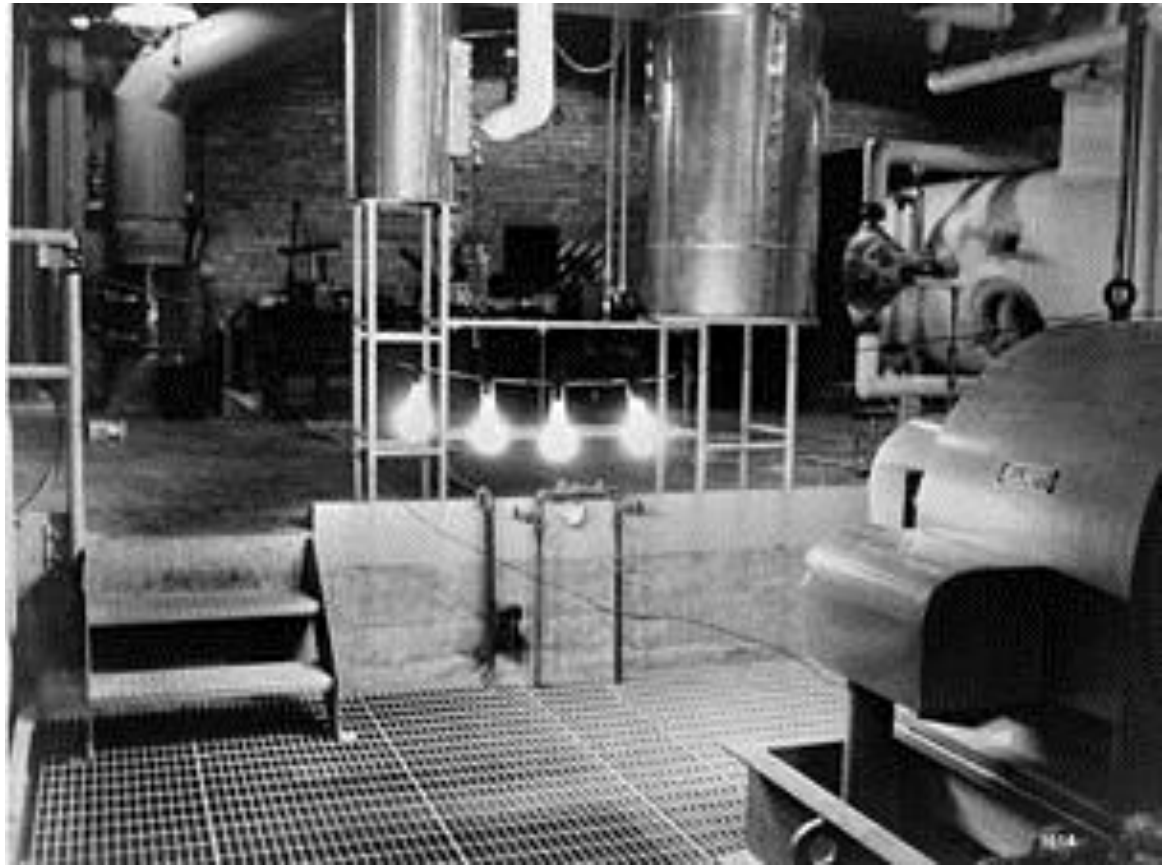
The Manhattan project (1942-1946)

The experimental breeder reactor (1951)

Atoms for Peace (1953)

Atomic Energy Act of 1954

- Regulatory oversight over nuclear energy assigned to the Atomic Energy Commission (AEC)



Commercialization of nuclear energy

- AEC‘s role: „*To ensure public health and safety from the hazards of nuclear power without imposing excessive requirements that would inhibit the growth of the industry*“ (NRC 2017)

- Insufficiently rigorous regulations in several important areas, including radiation protection standards, reactor safety, plant siting, and environmental protection

Commercialization of nuclear energy

- Rapid increase in power output
  - 1953-1962: below 300 MW
  - 1965: average 660 MW
  - 1970: average above 1,000 MW

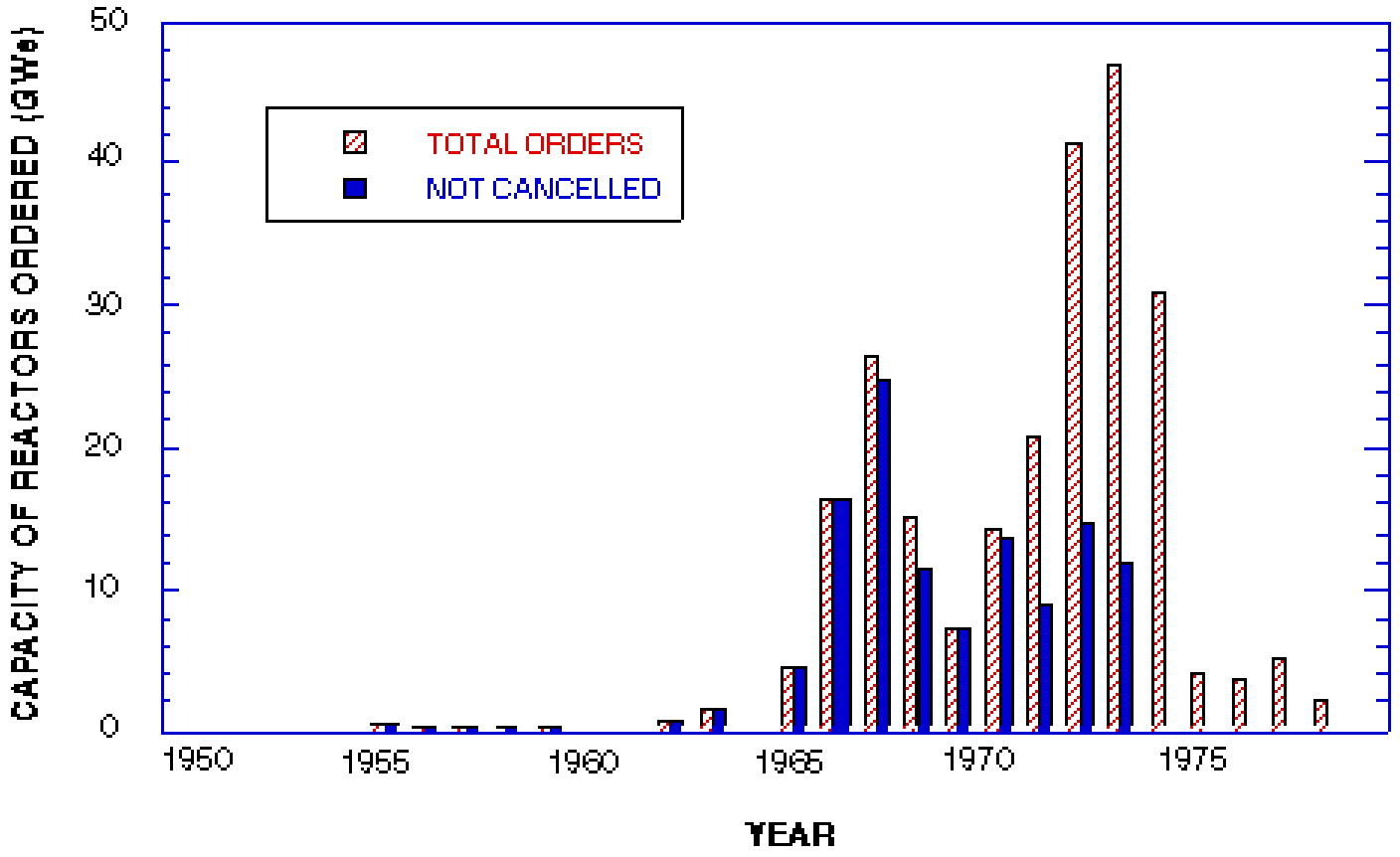
- Upscaling perhaps too fast to facilitate learning

- Multiple manufacturers (Westinghouse, Argonne National Laboratory, General Electrics, BWXT,…) => multiple reactor designs and sub-designs (each unit a prototype)

=> Economy of scale has not been achieved

1970s: industry in crisis

- Electricity demand increases with a slower pace
- Costs of nuclear power increase
- Political and local opposition towards nuclear



Shoreham NPP (Long Island, USA)

- Announced in 1965 by Long Island Light Company
- Expected to come on line by 1973 at $65 - $75 million

- 1968 LILCO decides to increase the unit‘s size from 540 to 820 MW
  - Cost overrun
  - Construction delay => more time for anti-nuclear movement to spread across Long Island

- 1979 Public opposition intensifies after the Three Mile Island accident => 1983 the county legislature does not approve the plant‘s evacuation plans
  - Costs reach $2 bn (low productivity and design changes ordered by federal regulators)

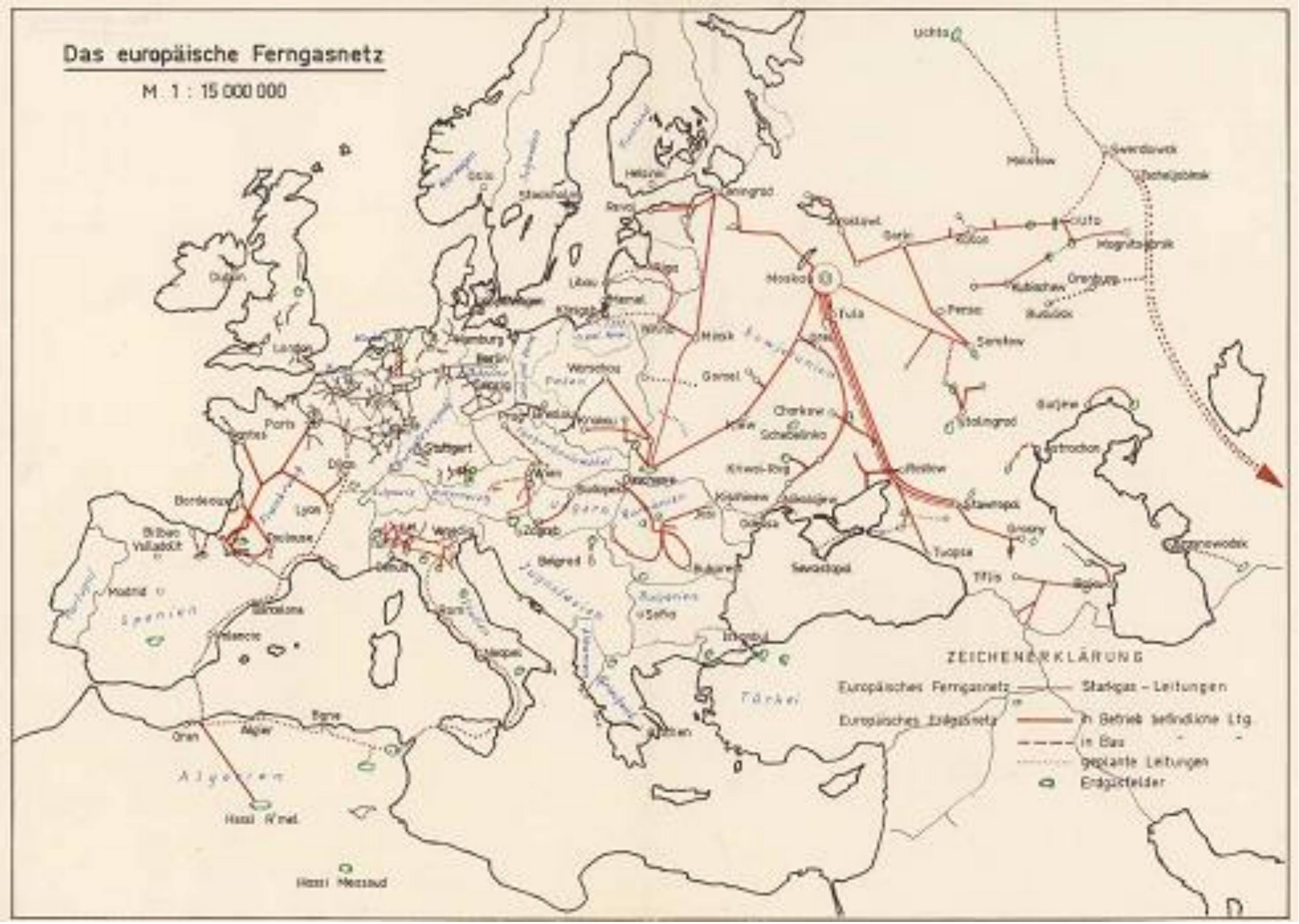
- 1984 The plant is completed, but does not receive operation license due to the unapproved evacuation plans

- 1994: The plant is fully decommissioned, the total costs reach $6 billion (covered by the LI consumers)

The consolidation of gas industry in Europe

The consolidation of gas industry in Europe

- 1920s – 1930s: first experiments with natural gas as a substitute for manufactured gas in Europe
- WW II: scarce oil, coal locally unavailable (Romania, Austria, N. Italy, SW. France, E. Poland)
- 1960s: before Dutch, Algerian, Ukrainian, Siberian, Central Asian discoveries the markets were scattered and localized.
- 1970s: rapid growth in gas use and network development
  - 1965: EU consumption of 39 bcm
  - 1975: EU consumption of 216 bcm
- wider portfolio of customers (fuel, feedstock)


Das europäische Ferngasnetz
M 1 : 15 000 000
ZEICHENERKLÄRUNG
Europäisches Ferngasnetz
Starkgas – Leitungen
Europäisches Erdgasnetz
in Betrieb befindliche Ltg.
in Bau
geplante Leitungen
Erdgasfelder
London
Paris
Madrid
Spanien
Barcelona
Bordeaux
Toulouse
Lyon
Dijon
Nantes
Stuttgart
Wien
Budapest
Belgrad
Sofia
Bukarest
Warschau
Minsk
Kiew
Charkow
Moskau
Tula
Stalingrad
Rostow
Tiflis
Baku
Tuapse
Sewastopol
Odessa
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Prag
Berlin
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Genua
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Orenburg
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ROMANIA
MOLDOVA
GEORGIA
ITALY
SERBIA
BULGARIA
Black Sea
PORTUGAL
SPAIN
CORSICA
SARDINIA
TURKEY

The formative years of transnational links

- 1966: Groningen – Germany,
- 1967: Groningen – Belgium, Ukraine – Czechoslovakia

- Gas interaction between policaly similar countries
  - Netherlands ,W. Germany, Belgium, France (NATO, ECSC, EURATOM)
  - SU, Czechoslovakia, Poland (COMECON)

The formative years of transnational links

Late 1960s: gas emerges as an „European issue“

- Competition between Dutch, Libyan and Algerian gas
- Two pan-European pipelines planned
  - Algeria – Spain – France – Britain
  - Algeria – Italy
- First LNG projects on stream (Britain, France, Italy, Yugoslavia, Spain)
- The Soviet Union steps in…

Soviet gas in Western Europe

- Initiator: Austria
  - No coal
  - A forerunner of European gas industry
  - ÖMV struggling to meet demand
  - The Brotherhood ppl passing just 16 km away from Austrian network
  - Established cooperation with CS over joint development of border-situated large gas field
- The SU lacks spare export capacity

Soviet gas in Western Europe

- 1965: Italian ENI starts negotiations over development of recently discovered W. Siberian fields
- Italy/ENI
  - Best relations with the SU among the W. European companies
  - Oil importer and exporter of oil industry equipment to the communist block
  - Strong Italian CP seeking stronger relations with the SU
- Trans-European Pipeline project (SU-Hungary-Yugoslavia-Italy)

Soviet gas in Western Europe

Austrian reaction: new series of negotiation with the SU.

- Austrian steel company VÖEST will provide the SU with large-diameter steel pipes in exchange for re-routing the pipeline
- Germany (the supplier of the pipes) decided not to back up the plan, despite strong Bavarian support
- The Soviets finally agree after Austria getting closer to EEC.

Soviet gas in Western Europe

The results

- 1968: Soviet supplies to Austria come on stream
- 1970: agreements with Italy and Germany (Ost Politik)
- 1973: First Soviet deliveries to Germany, GDR also linked to the system
- 1974: First Soviet deliveries to France
- All through the same pipeline


Norwegian Sea
Ísland
Iceland
Sverige
Sweden
Suomi
Finland
Norge
Norway
Россия
Russia
Danmark
Denmark
United
Kingdom
Ireland
Éire
Беларусь
Belarus
Polska
Poland
Deutschland
Germany
Україна
Ukraine
Österreich
Austria
Қазақстан
Kazakhstan
Монгол
Улс
Mongolia
France
România
Romania
Italia
Italy
España
Spain
Portugal
Ελλάδα
Hellas
Greece
Türkiye
Turkey
O`zbekiston
Uzbekistan
Кыргызстан
Kyrgyzstan
Sea of
中国
China
대한민국
South Korea
تونس
Tunisia
المغرب
Morocco
العراق
Iraq
ایران
Iran
افغانستان
Afghanistan
پاکستان
Pakistan
नेपाल
Nepal
East China Sea
الجزائر
Algeria
ليبيا
Libya
مصر
Egypt
الصحراء
الغربية
Western
Sahara
السعودية
Saudi Arabia
India
عمان
Oman

Summary

- The post-war growth of energy demand facilitated source diversification and triggered development of new technologies.
- The case of nuclear power development in the U.S. highlights the importance of regulation.
- The formative years of the European gas market show the importance of both domestic and international political setting.

- New path-dependencies
  - Heterogeneous reactor design prevents the nuclear industry from achieving economy of scale
  - Natural gas relations in Europe are strongly (geo)politically laden