

SOVIET CIVILIAN NUCLEAR POWER

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GUEST LECTURE IN NE290D: SPECIAL TOPICS IN NUCLEAR HISTORY, POLITICS, AND FUTURES



MARCH 16, 2021

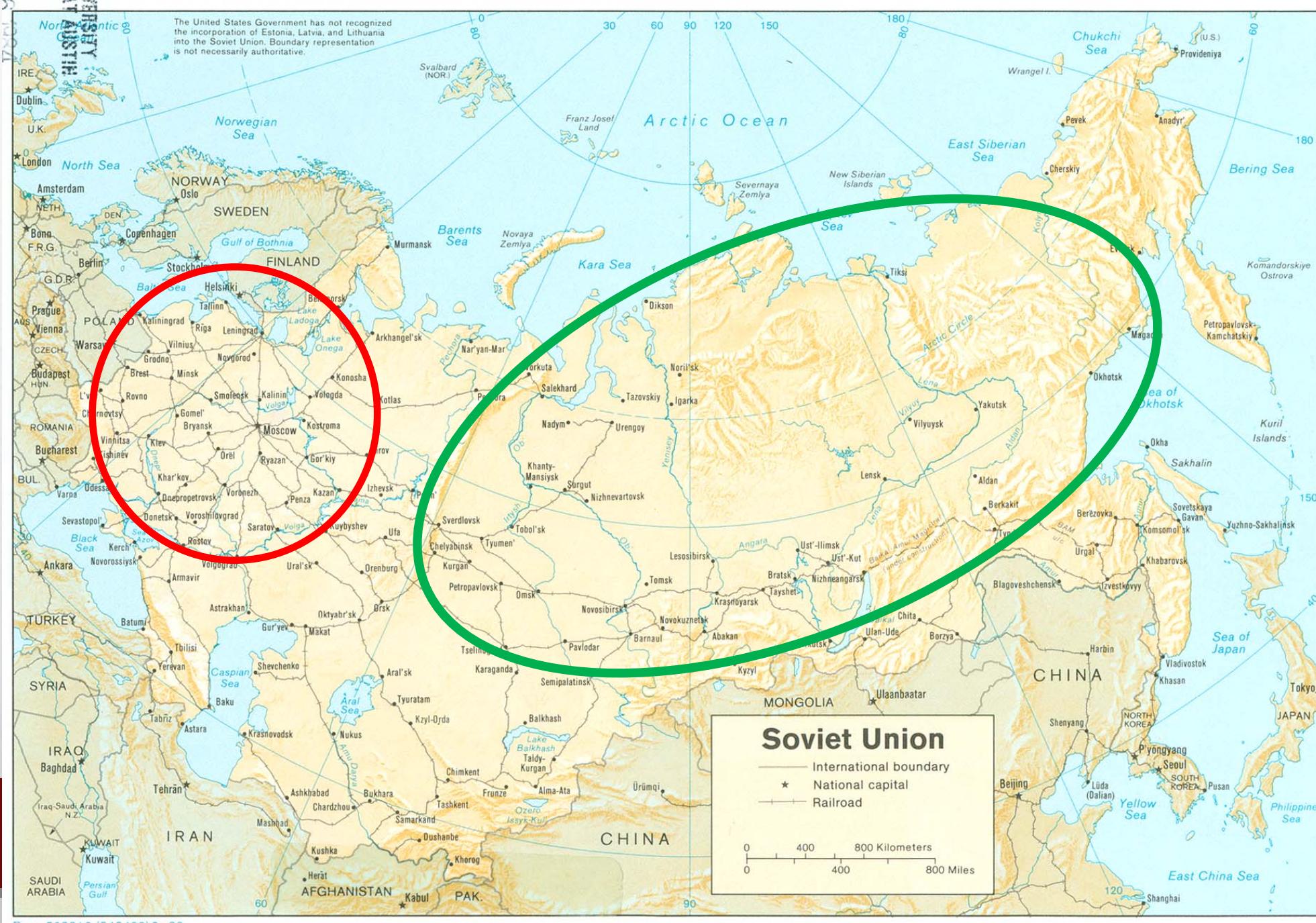
OUTLINE

- Overview
- 1. Technology**
- 2. Organization**
- 3. Training**
- Conclusions & Questions



OVERVIEW

- **Planned Economy**
- **Geography**



OVERVIEW (cont.)

- Planned Economy
- Geography
- Two tributaries

NUCLEAR WEAPONS & GOELRO



ПЛАН ГОЭЛРО

22 ДЕКАБРЯ ГЛЕБ КРЖИЖАНОВСКИЙ на VIII Всероссийском съезде Советов доложил о плане электрификации, подготовленном комиссией ГОЭЛРО.

План был рассчитан на **10–15 лет**.

• В **1,8–2 раза** по сравнению с **1913-м**

увеличить мощность районных электростанций.

• В **10 раз** увеличить общую

годовую выработку электроэнергии.

• Построить **30** крупных районных электростанций,

из них **20** паровых и **10** гидростанций.

В Северном районе

4

Центральном

6

Южном

5

Волжском

4

на Урале

4

на Кавказе

4

в Сибири, Туркестане

3

	1913	1920	1930	1935
Валовая продукция промышленности	1	0,14	2,5	5
Мощность районных электростанций (млн кВт)	0,2	0,25	14	14
Производство электроэнергии (млрд. кВт·ч)	2,0	0,5	8,4	2
Уголь (млн тонн)	29,2	8,7	47,8	10
Нефть	—	3,9	18,5	2
Торф (млн тонн)	17	14	8,1	1

В **1935** году план
электрификации был
ПЕРЕВЫПОЛНЕН

ПОЧТИ В **3** РАЗА

КОММУНИЗМ – ЭТО
СОВЕТСКАЯ ВЛАСТЬ +
ЭЛЕКТРИФИКАЦИЯ ВСЕЙ СТРАНЫ

Г. М. Кржижановский

В. И. Ульянов-Ленин

ПЕРЕТОК.РУ

ЭНЕРГЕТИКА В РОССИИ И МИРЕ

 VIRGINIA TECH

I. V. KURCHATOV

1903-1960

“Father” of the Soviet A-bomb

**Director of the Institute of Atomic Energy (IAE,
named after him in 1960)**



OVERVIEW (cont.)

- Planned Economy
- Geography
- Two tributaries
- Export

Figure 30. Soviet-Designed Nuclear Power Plants



Source: CIA

OVERVIEW

- Planned Economy
- Geography
- Two tributaries
- Export
- Chernobyl



April 26, 1986



VIRGINIA TECH.



PRODUCING POWER

THE PRE-CHERNOBYL HISTORY
OF THE SOVIET NUCLEAR INDUSTRY

SONJA D. SCHMID

MIT Press 2015

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OVERVIEW

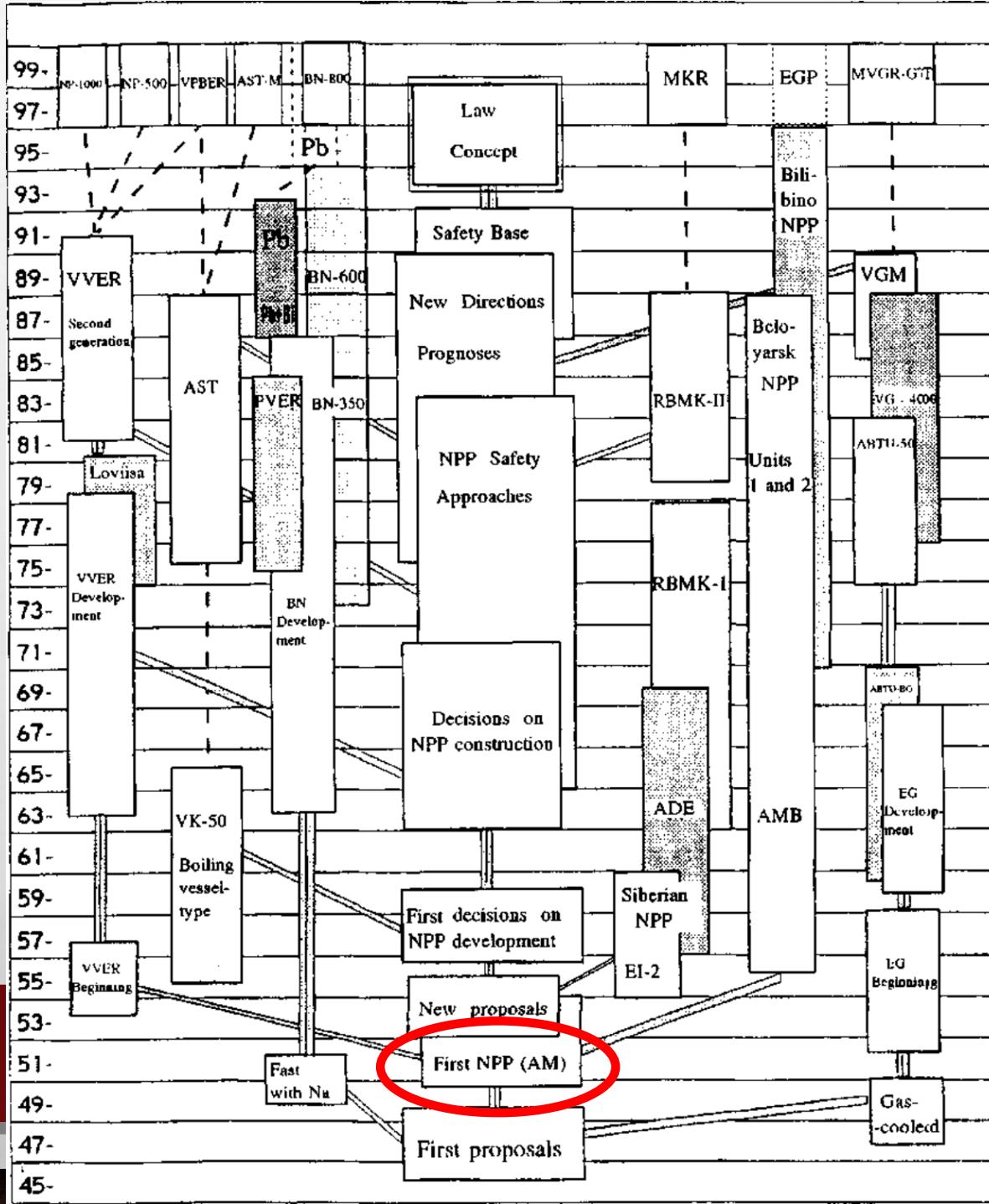
- Planned Economy
- Geography
- Two tributaries
- Export
- Chernobyl
- Rosatom



**Source:
Rosatom**

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1. TECHNOLOGY

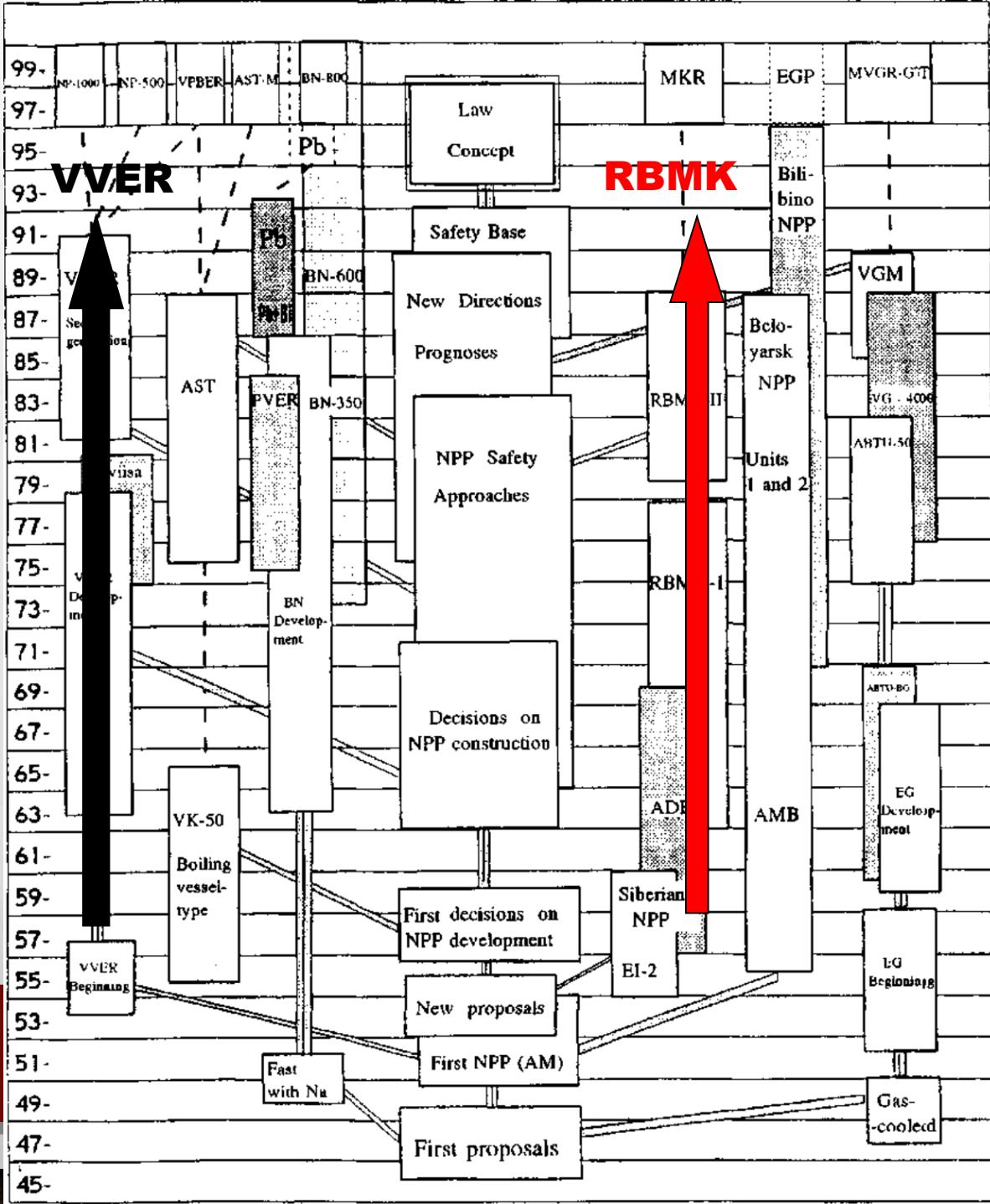


Source: Sidorenko 1997



VIRGINIA TECH.

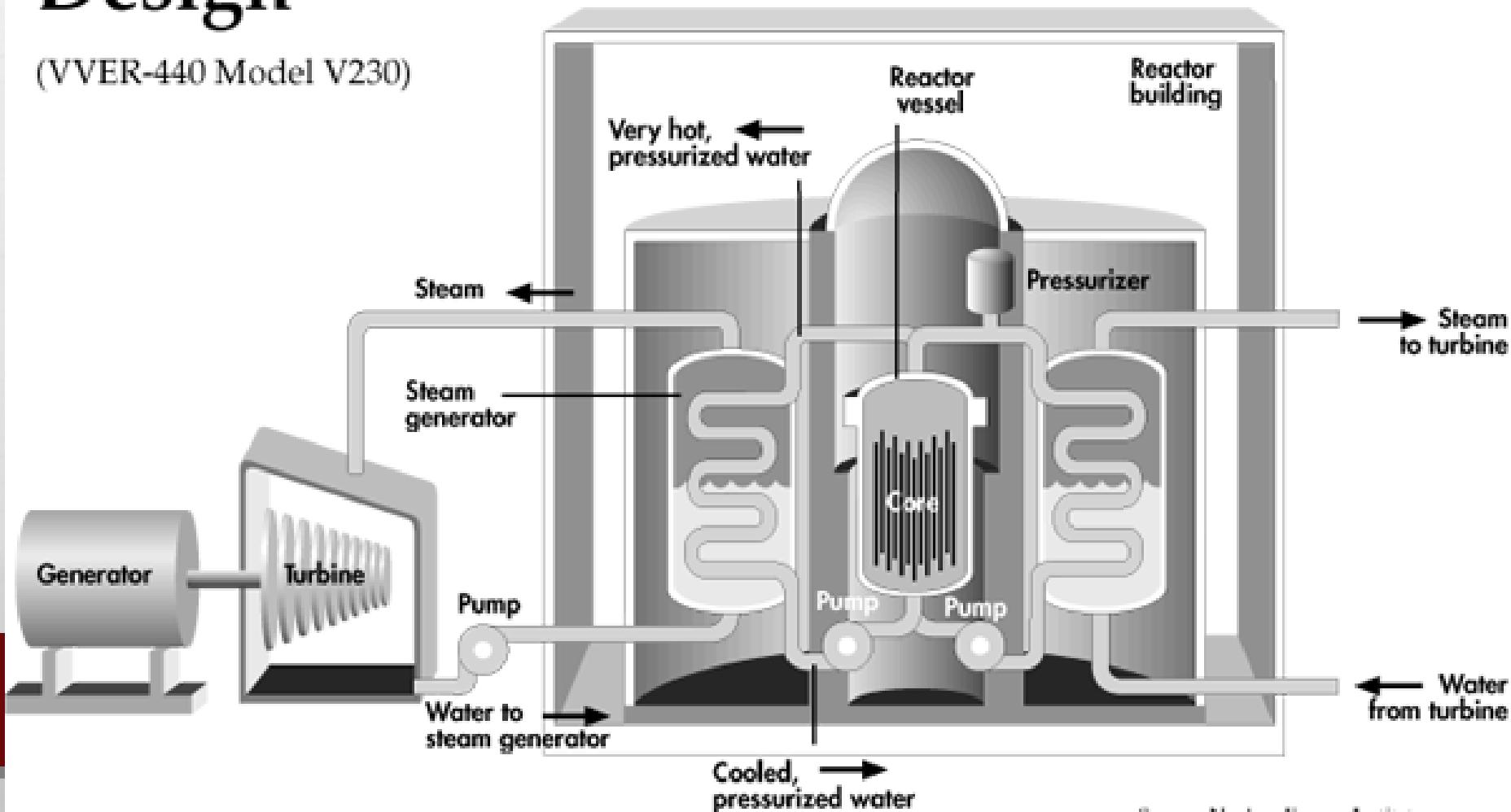




Source: Sidorenko 1997

VVER Reactor Design

(VVER-440 Model V230)



Source: Nuclear Energy Institute

Source: NEI





VVER reactor pressure vessel

V. A. SIDORENKO

*1929

Among lead designers of VVER @IAE

Deputy Director, Nuclear Regulatory Agency

First Deputy Minister (1989-1992)

Deputy Minister (1992-1997)





**"Second
Ivan" /
"Siberian
NPP"**

**Source:
Alekhin
&
Kiselev
2003**

N. A. DOLLEZHAL'

1899-2000

**Chief Engineer of Soviet graphite-moderated
reactors (including RBMK)**

Director, NIKIET (1952-1986)



A. P. ALEKSANDROV

1903-1994

**Deputy Director (1955-1960), and
Director (1960-1988), IAE**

**President, Soviet Academy of Sciences
(1975-1986)**

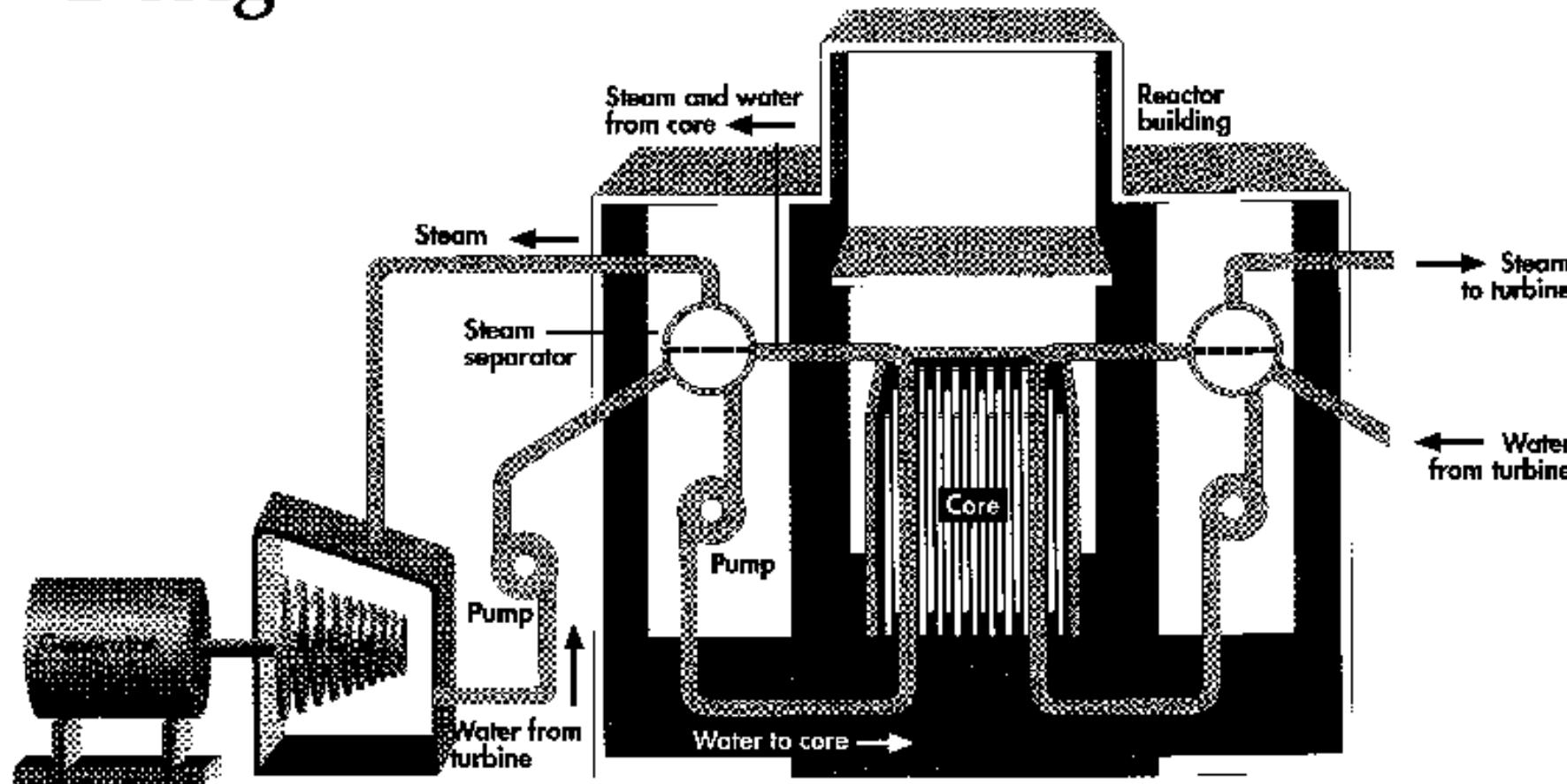




RBMK


VIRGINIA TECH.

RBMK Reactor Design



Source: Nuclear Energy Institute

Source: NEI

2. ORGANIZATION

ORIGINS

- First Chief Administration (under Beria)
- 1953: Ministry of Medium Machine Building (Sredmash)

E. P. SLAVSKII

1898-1991

**Minister of Medium Machine Building
(1957-1986)**



ORIGINS (cont.)

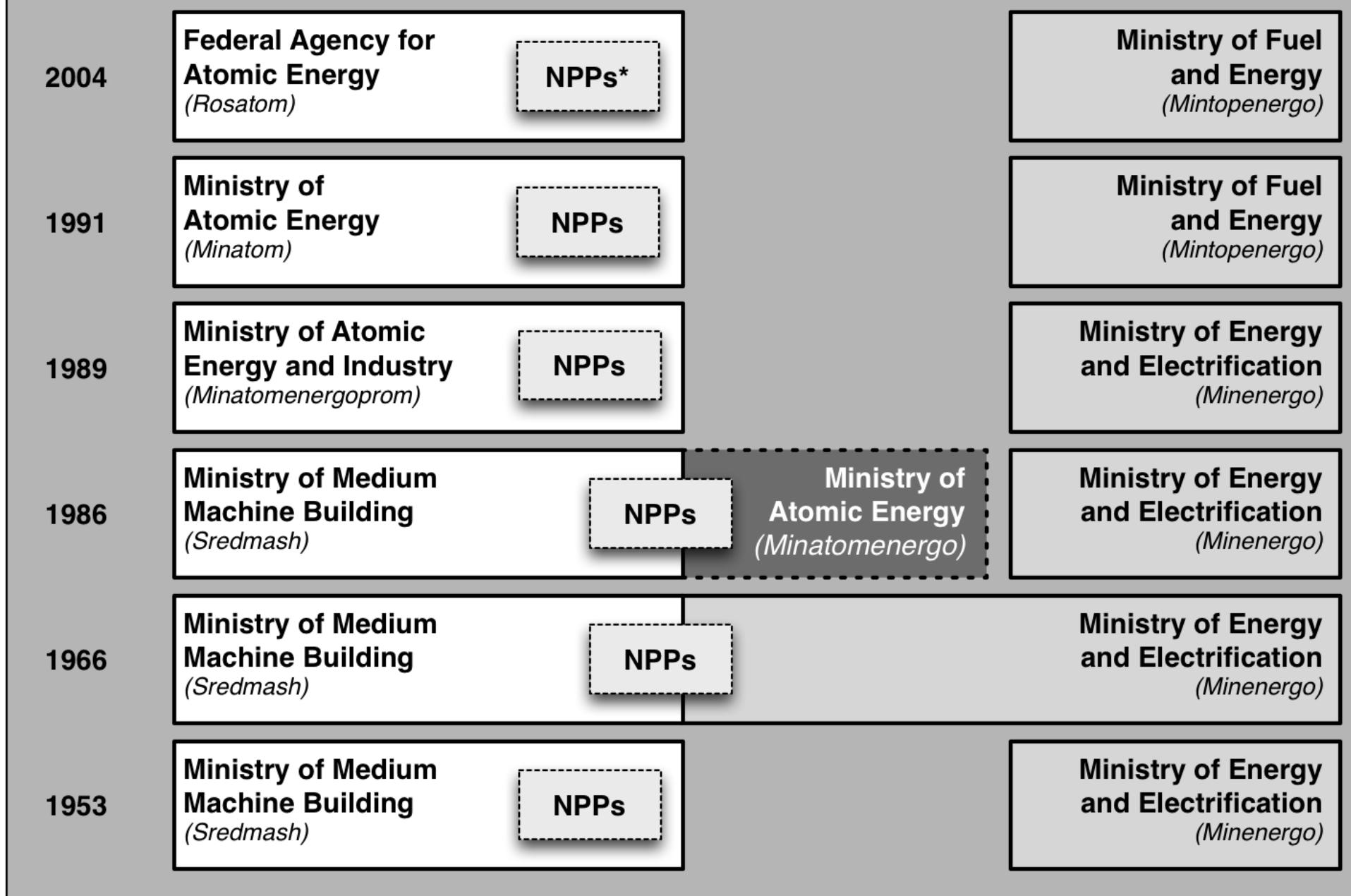
- First Chief Administration (under Beria)
- 1953: Ministry of Medium Machine Building (Sredmash)
- 1966: Transfer of NPPs from Sredmash to Minenergo

P. S. NEPOROZHNI

1910-1999

**Minister of Energy and Electrification
(1962-1985)**





Ministry of Medium Machine Building <i>(Sredmash)</i>		Ministry of Energy and Electrification <i>(Minenergo)</i>	
Scientific Director	Chief Design Engineer	Chief Project Manager	
Reactor design	Reactor construction	Nuclear fuel production, fuel element design, reprocessing, etc.	Leningrad NPP, Ignalina NPP, Shevchenko et al. Construction and maintenance of NPPs and their infrastructure

3. TRAINING

NEW CURRICULA FOR NUCLEAR

- First generation operators were “energetiki”
- No textbooks
- Secrecy
- System of “raspredelenie”

T. KH. MARGULIOVA

1912-1994

Professor, Moscow Engineering Institute (MEI)

**Founder and longtime head of MEI's Nuclear
Engineering Program, and nuclear engineering
programs all over the FSU and CEE.**



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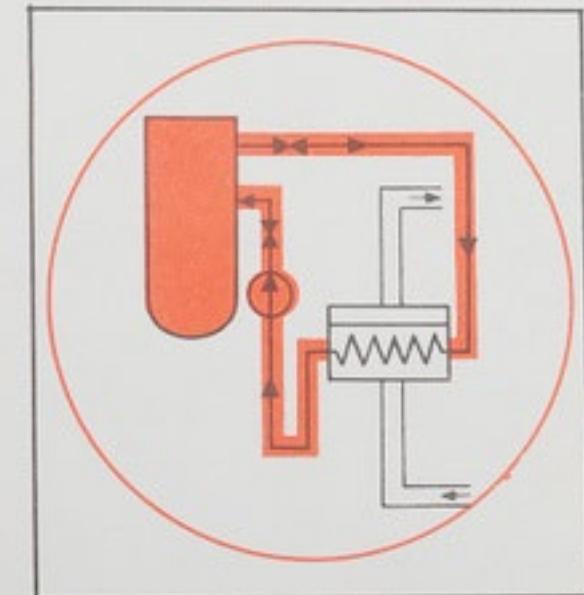
**Founder and longtime head of MEI's Nuclear
Engineering Program, and nuclear engineering
programs all over the FSU and CEE.**

Author of "Nuclear Power Plants" textbook (Soviet State Prize)

Т. Х. МАРГУЛОВА

АТОМНЫЕ ЭЛЕКТРИЧЕСКИЕ СТАНЦИИ

ИЗДАТ





Source:
[http://english
russia.com/
2009/04/29/at-
the-nuclear-
power-plant/](http://englishrussia.com/2009/04/29/at-the-nuclear-power-plant/)

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REACTOR OPERATORS

- No simulators (instead, “shadowing” experts)
- Regular re-certification tied to salary bonuses
- Strict “fit for duty” protocols
- No overlap with military services (no nuclear Navy)
- System of “nomenklatura” for leadership positions

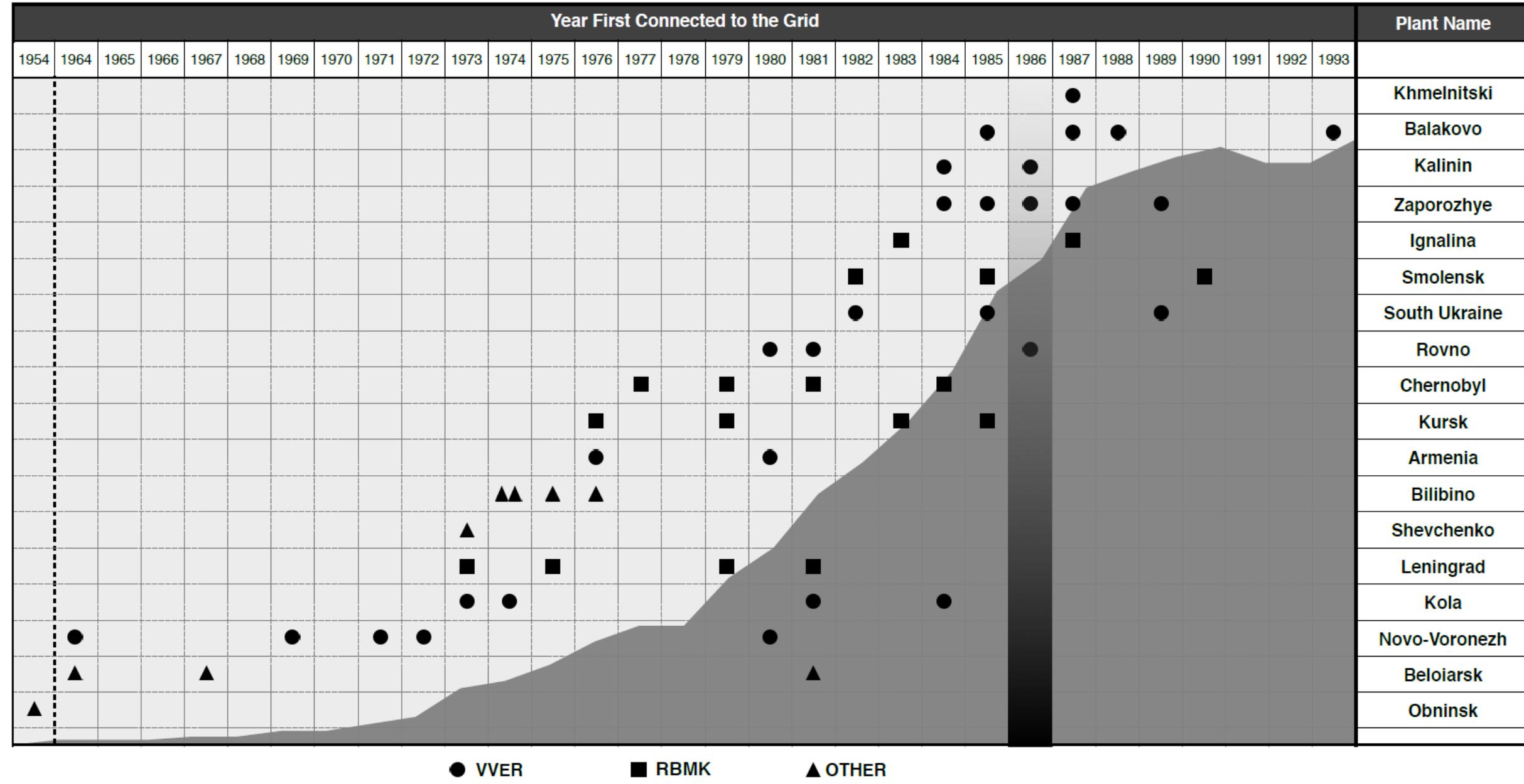
CONCLUSIONS



Smolensk NPP

**[http://english
russia.com/
2009/04/29/at-
the-nuclear-
power-plant/](http://englishrussia.com/)**


VIRGINIA TECH.

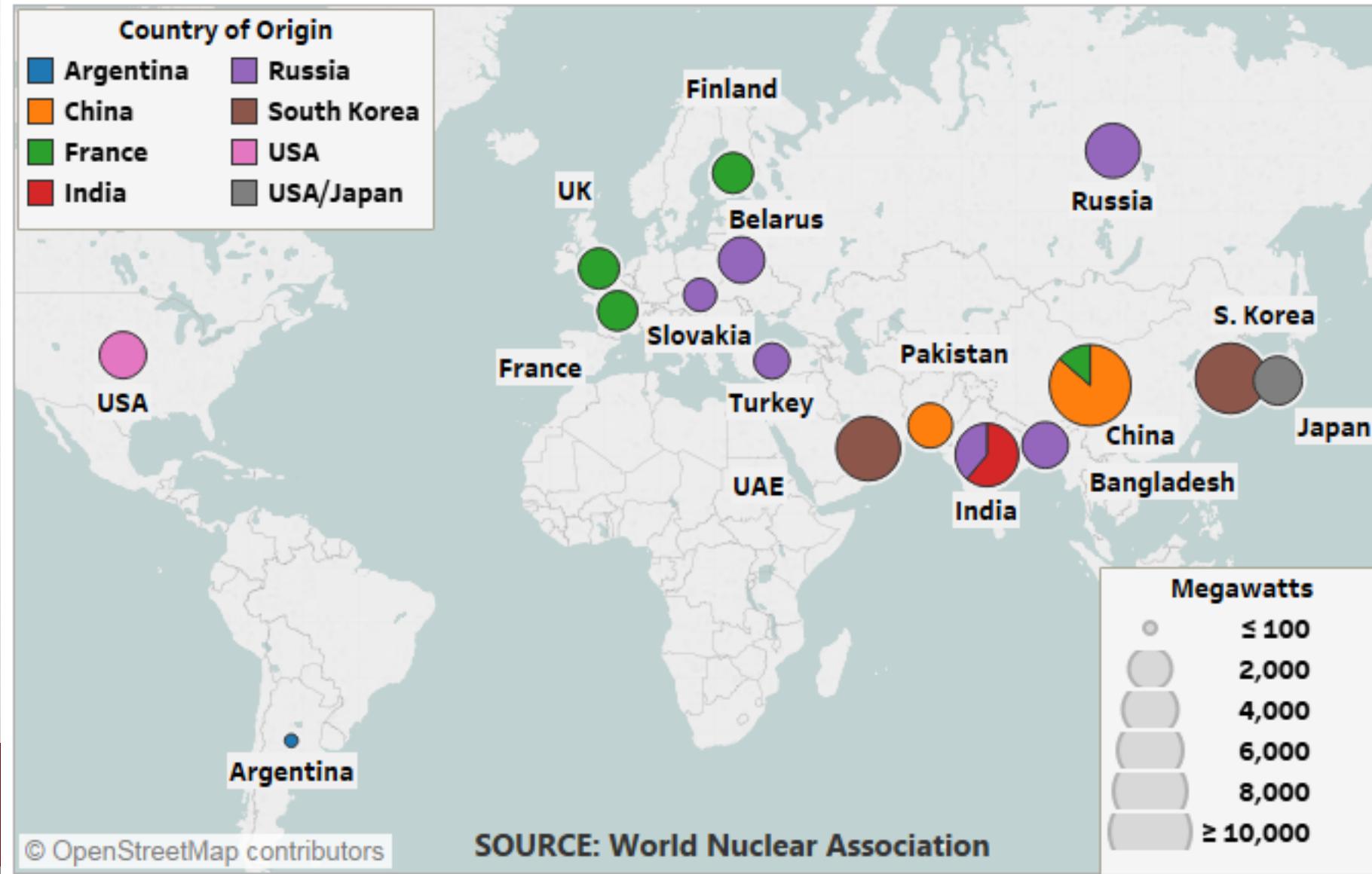




WER
RBMK
Other

Nuclear reactors under construction

CNBC





ROSATOM

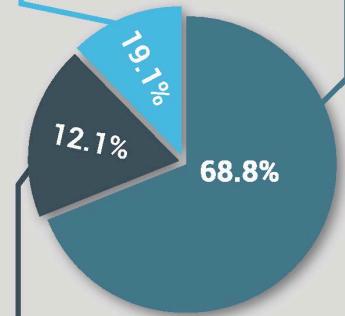
ROSATOM'S GLOBAL PRESENCE

FOUNDED IN 2007

GEOGRAPHIC
COVERAGE
40 COUNTRIES

FOREIGN ORDERS:
\$ 110. 3 BLN

FUEL ASSEMBLY & OTHERS
BUILDING NPPs ABROAD



ENRICHED URANIUM
PRODUCTS
ENRICHMENT
SERVICES

≈ 250 000
EMPLOYEES

≈ 400
COMPANIES

Construction of RR* and SMR*
Services & Modernization
Back-End Fonctions
NPP Construction

Nuclear Fuel & Its Components Deliveries
Products & Services based on Radiation
Enriched Uranium Product Deliveries
Uranium Exploitation & Mining

JOBS



*SMR: Small modular reactors
* RR: Research reactors



Thomas Thor
associates

Source:
Thomas
Thor
Associates

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VIRGINIA TECH.

THANK YOU!

sschmid@vt.edu



QUESTIONS

- 1. You're a Soviet planner, tasked with setting up a nuclear energy infrastructure from scratch, in a planned economy. How would you do it? What might be easier, what more difficult?**
- 2. You're a young Soviet engineer and among the first to graduate with a degree in nuclear engineering. You would like to design creative, new power reactors. What options would you have to pursue such a career? What obstacles might there be?**
- 3. Upon graduation from your nuclear engineering program, you're assigned to a secret city to work on nuclear weapons. What do you anticipate? Why (or why not) would you try to get reassigned to a civilian site?**