Education and Maintenance of Knowledge in Nuclear Technology

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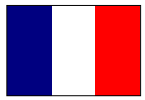
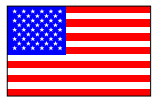
Research-Political Boundary Conditions

National Nuclear Programmes

Education Initiatives

Conclusions

Nuclear Energy Data for 2002

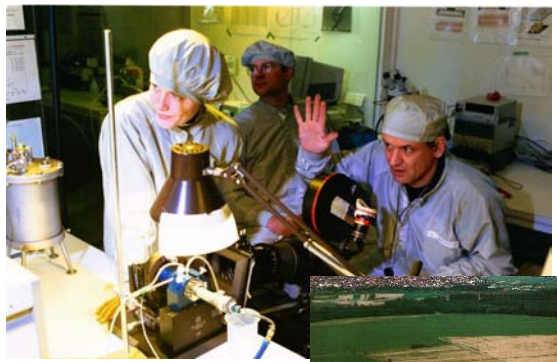
	France 	Germany 	USA 
Operating units	59	19	104
Net capacity [GWe]	63.1	21.3	98.6
Proportion of total electricity production [%]	0.78	0.3	0.20

From: IAEA PRIS

How to Motivate Young People to go Nuclear?

Motivation Perspective

?



How to Motivate Young People to go Nuclear?

From Entergy: Adhesive Sticker.

From: Advertisement in Süddeutsche Zeitung, November 15, 2003

Research Political Situation

Which signals do students get on which they base the selection of their studies and courses?

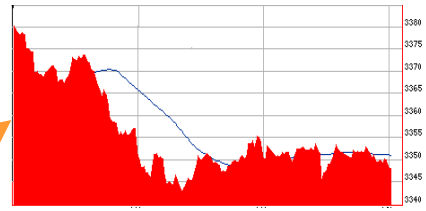
France:

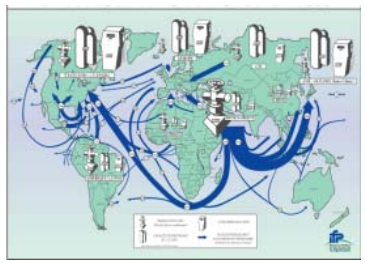
Generation IV
From: CEA

✓ Sustainability (waste, resources)

✓ safety & reliability

✓ economics





✓ resistance to proliferation and physical protection

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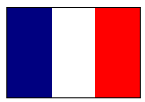
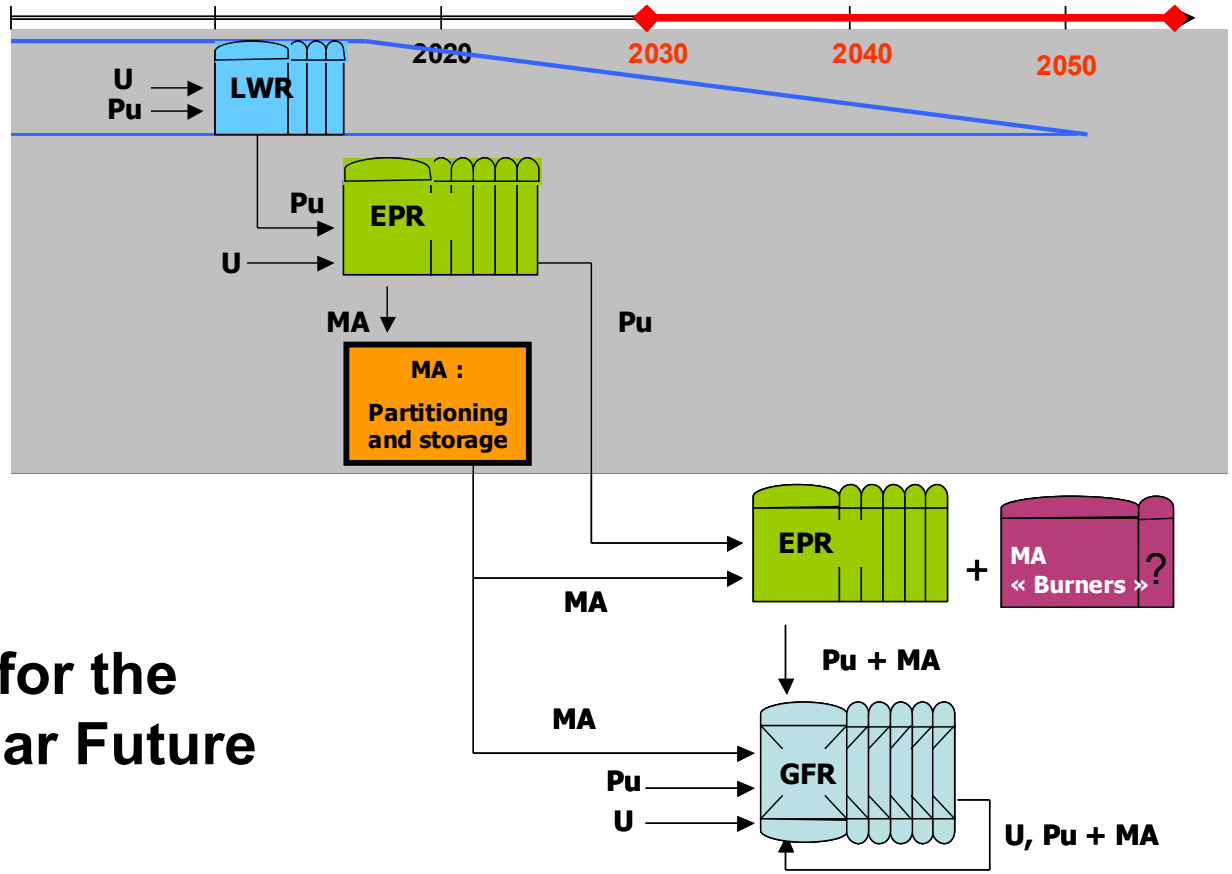
France:





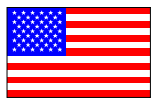
Clear Options for the National Nuclear Future

From: CEA

Research Political Situation

Which signals do students get on which they base the selection of their studies and courses?

USA: Nuclear Energy Reserch Initiative – Universities (NERI-U)



- **Generation IV (GenIV)**

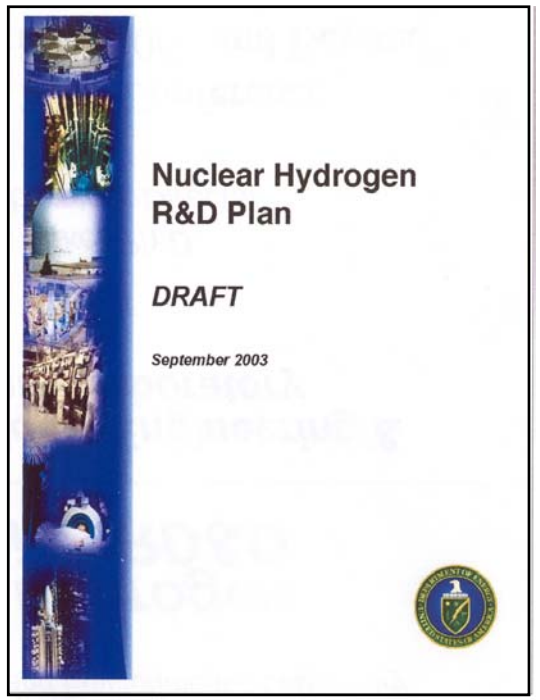
  ≈ 3 Mio $

- **Advance Fuel Cycle Initiative (AFCI)**

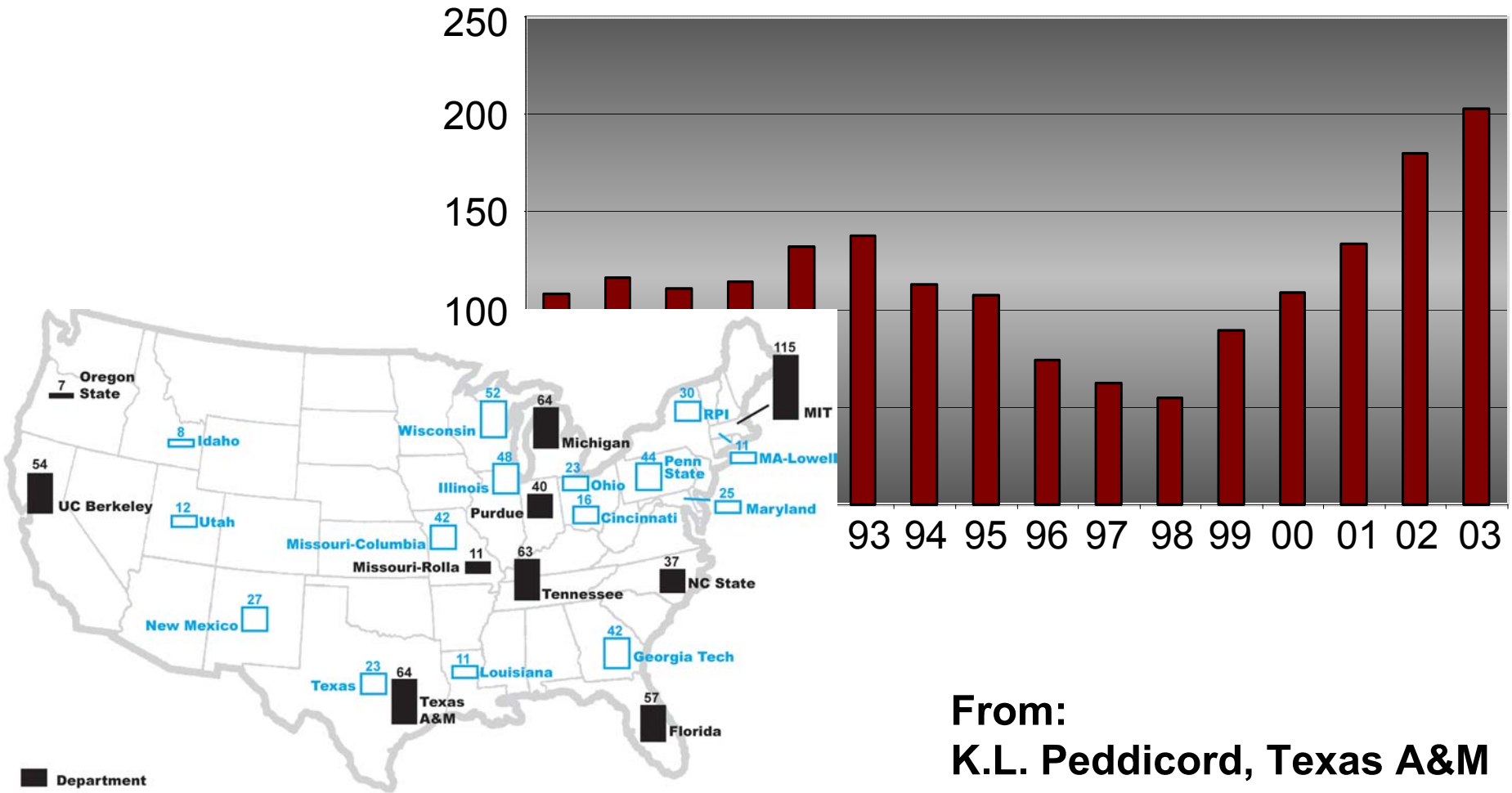
  ≈ 3 Mio $

- **Nuclear Hydrogen Initiative (NHI)**

  ≈ 0.5 Mio $

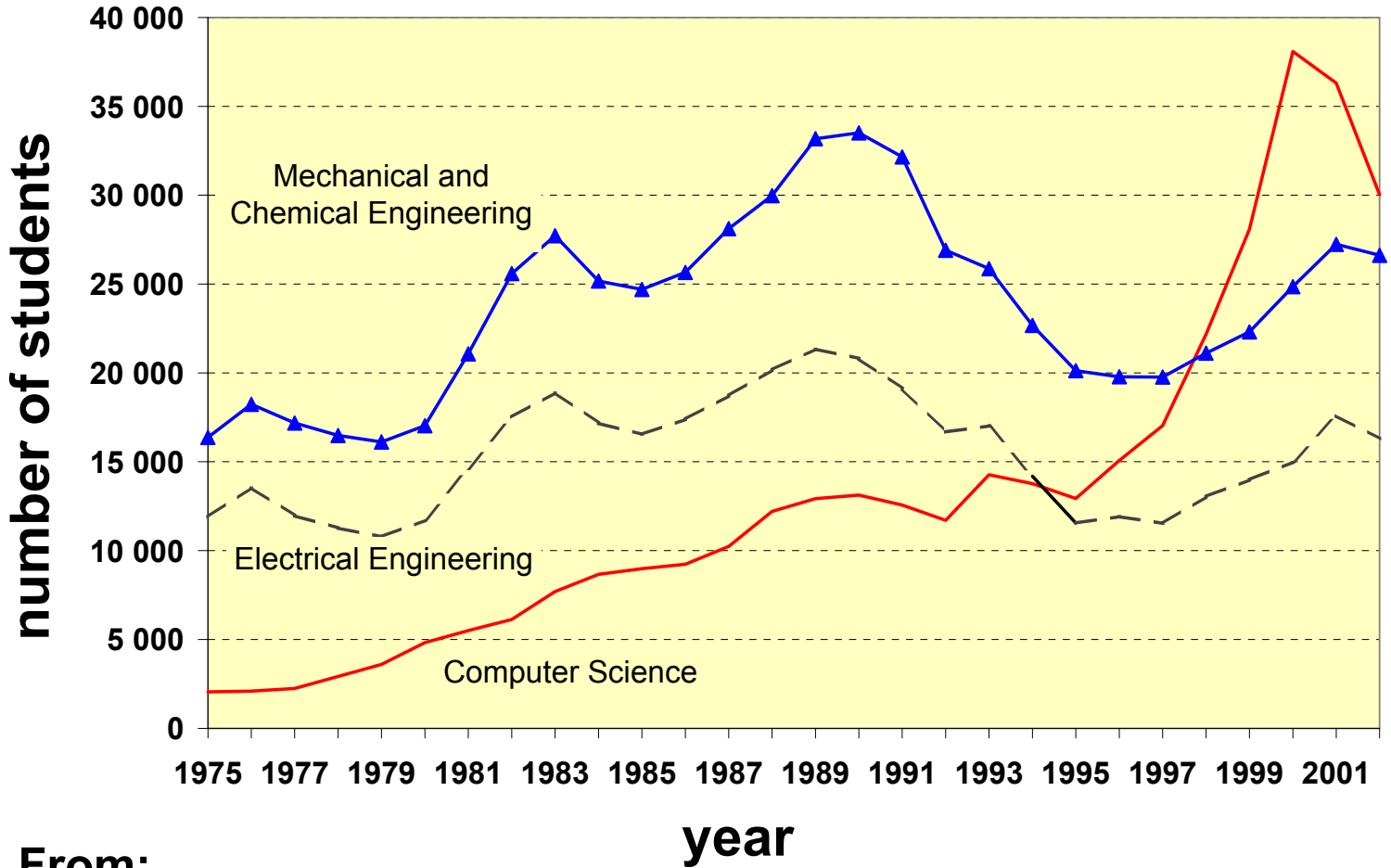


Under-/ Graduate Nuclear Enrollments in the USA



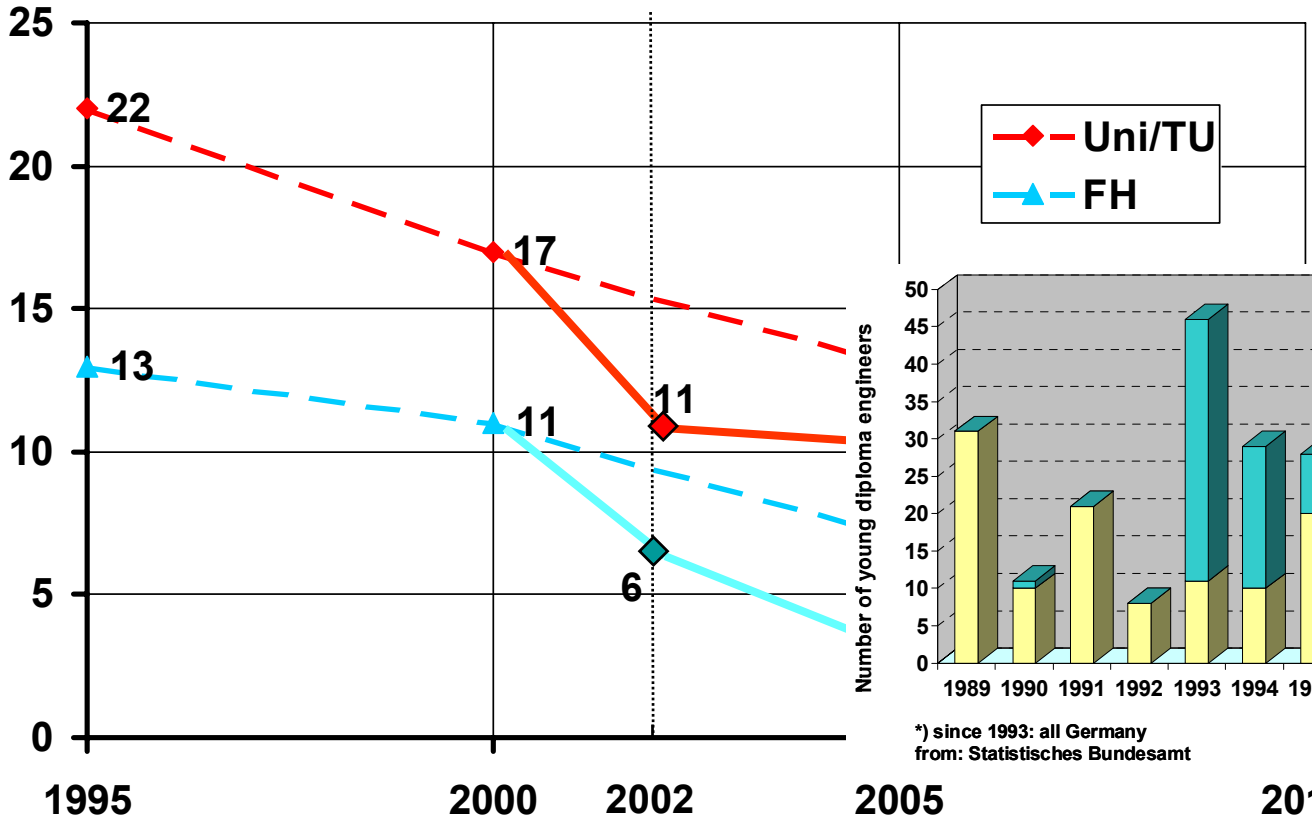
From:
K.L. Peddicord, Texas A&M

1st Semester Students in Germany



From:
Statistisches Bundesamt

Nuclear Lectures / Faculties at German Universities



(Survey of KTG (1994), FZK (2000), FZK (2002))

*) since 1993: all Germany
from: Statistisches Bundesamt

*) in reactor physics, reactor technology, reactor safety, nuclear and radio chemistry, radiation protection

Research Political Situation

Which signals do students get on which they base the selection of their studies and courses?

Germany: **Atomic Energy Act:** 04/2002

- Termination of nuclear electricity production.
- Ensure safe operation of NPP until termination.
- Ensure fulfilment of international obligations.

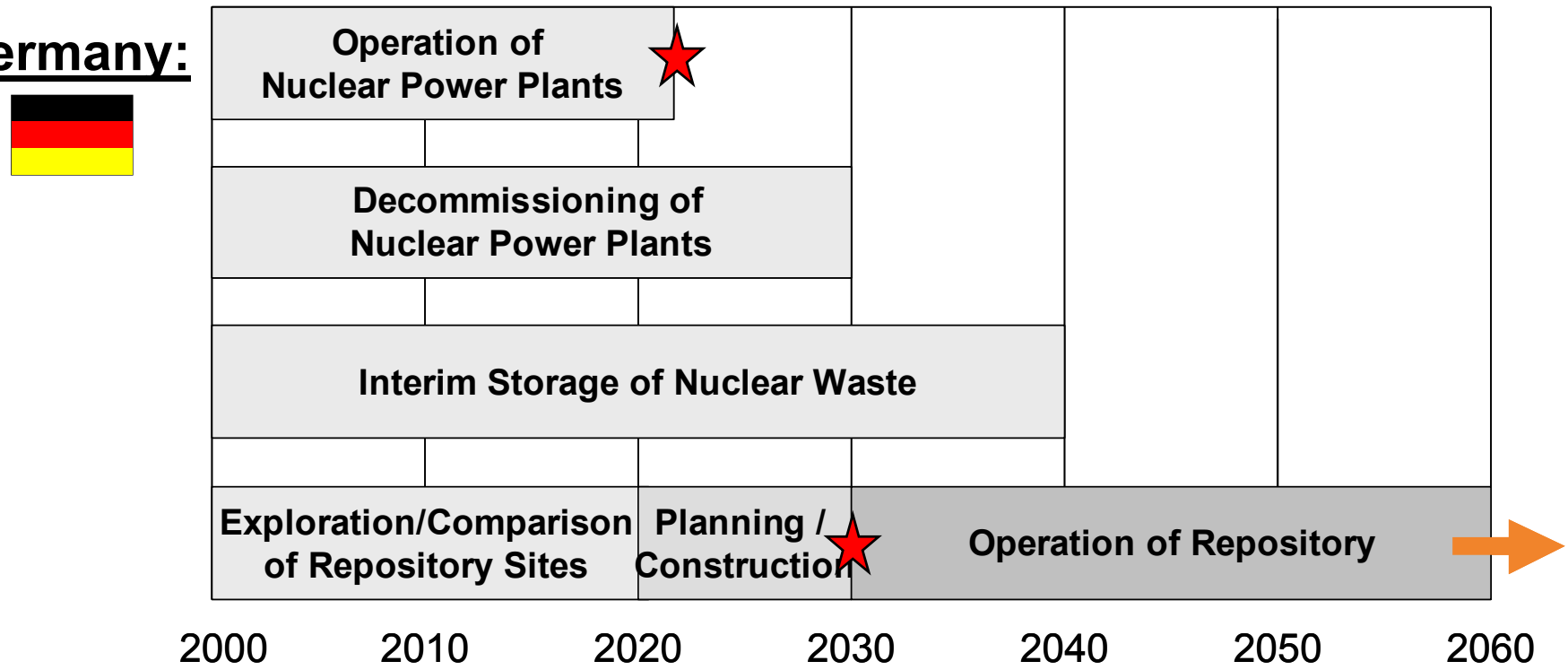
Coalition Agreement: 10/2002

- Government support of the development of nuclear technologies for electricity generation is terminated.
- Research to enhance the safety of existing reactors is supported.

Research Political Situation

Which signals do students get on which they base the selection of their studies and courses?

Germany:



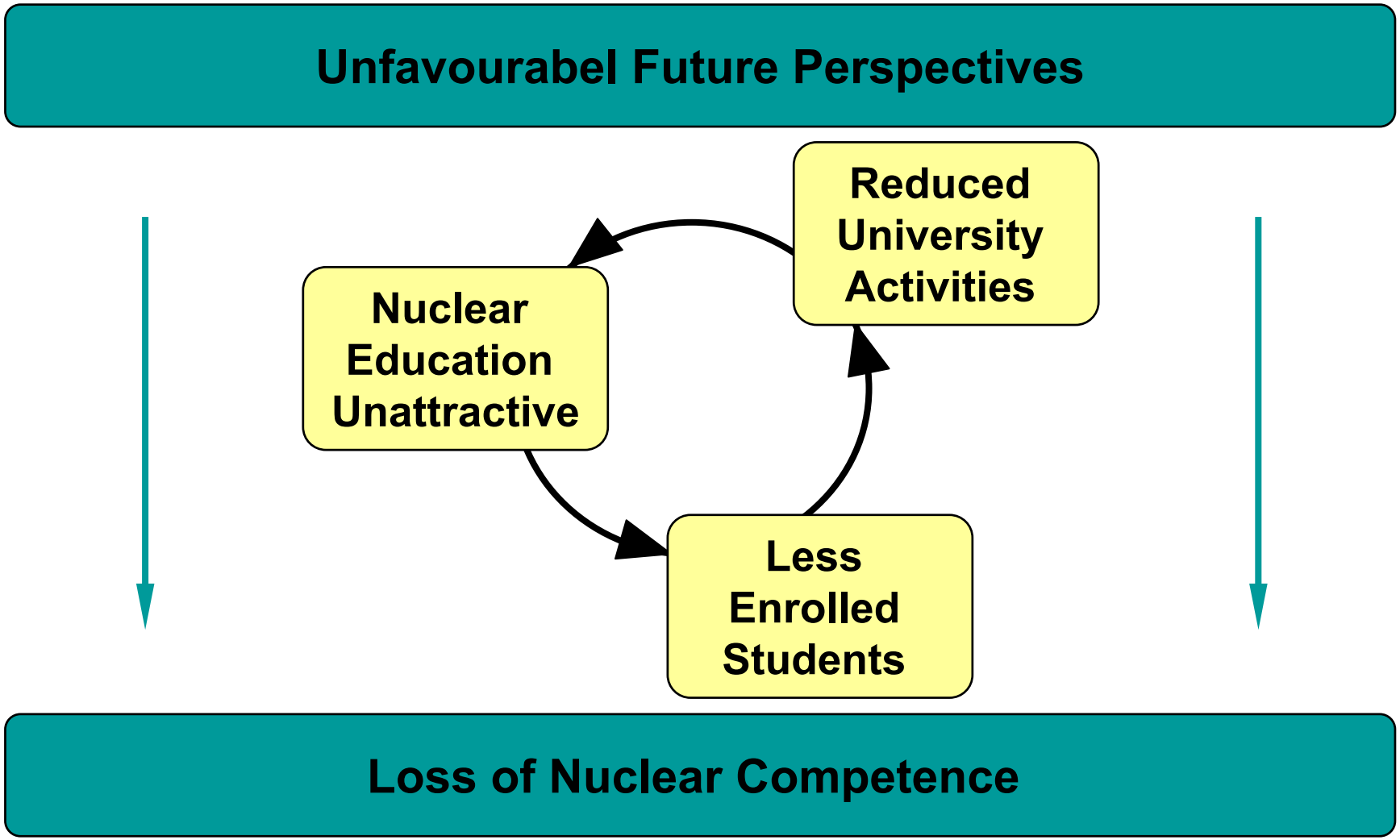
Competence in Nuclear Technology in Germany: Job Offers for University Graduates* - 2000 ⇨ 2010

Job Offering Institutions	Jobs in 2000		Jobs in 2010 (to be replaced)
NPP - utilities	1.250	- 20 %	1.000 (none**)
NPP - vendor and service industry	3.500	- 6 %	3.300 (1.000)
Authorities and licensing offices	1.350	- 19 %	1.100 (300)
R&D-institutions: a) reactor safety	370	→	370 ? (160)
b) nuclear waste disposal	350	+ 8 %	380 ? (110)
Cooperation in international bodies	100	→	100 (100)
Total	6.920	- 10 %	6.250 (1.670)

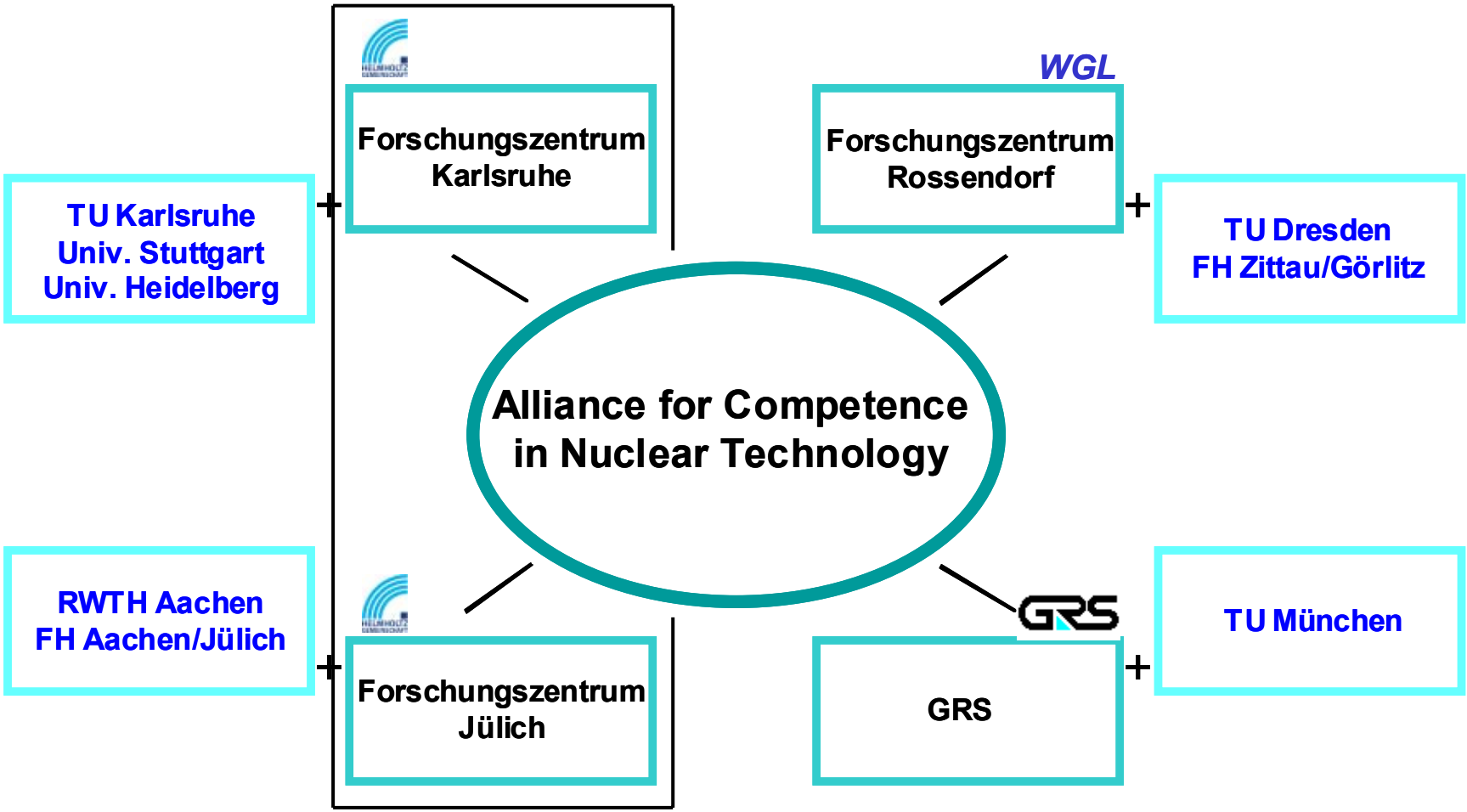
*) Uni, TU, FH
**) no major fluctuations

From:
P. Fritz, FZK

Vicious Circuit



Kompetenzverbund Kerntechnik



Info: http://www.grs.de/ptr/kv.htm

Helmholtz Evaluation of the German Programme Nuclear Safety Research

- **International Review Committee (February 2003):**

  „A clear statement of the importance of this (nuclear) profession from Government and industry is needed to attract the best students. Challenging and interesting jobs based on a stimulating research agenda and vision is the only way to attract the top quality students so urgently needed to replace the retiring scientists and engineers.“

Helmholtz Evaluation of the German Programme Nuclear Safety Research

- **Helmholtz Senate (October 2003):**

  „All partners including the financing partners must take appropriate actions to provide an attractive – political and scientific – frame to promote young scientists to realise the goal of maintenance of competence.“

Some Solution Strategies

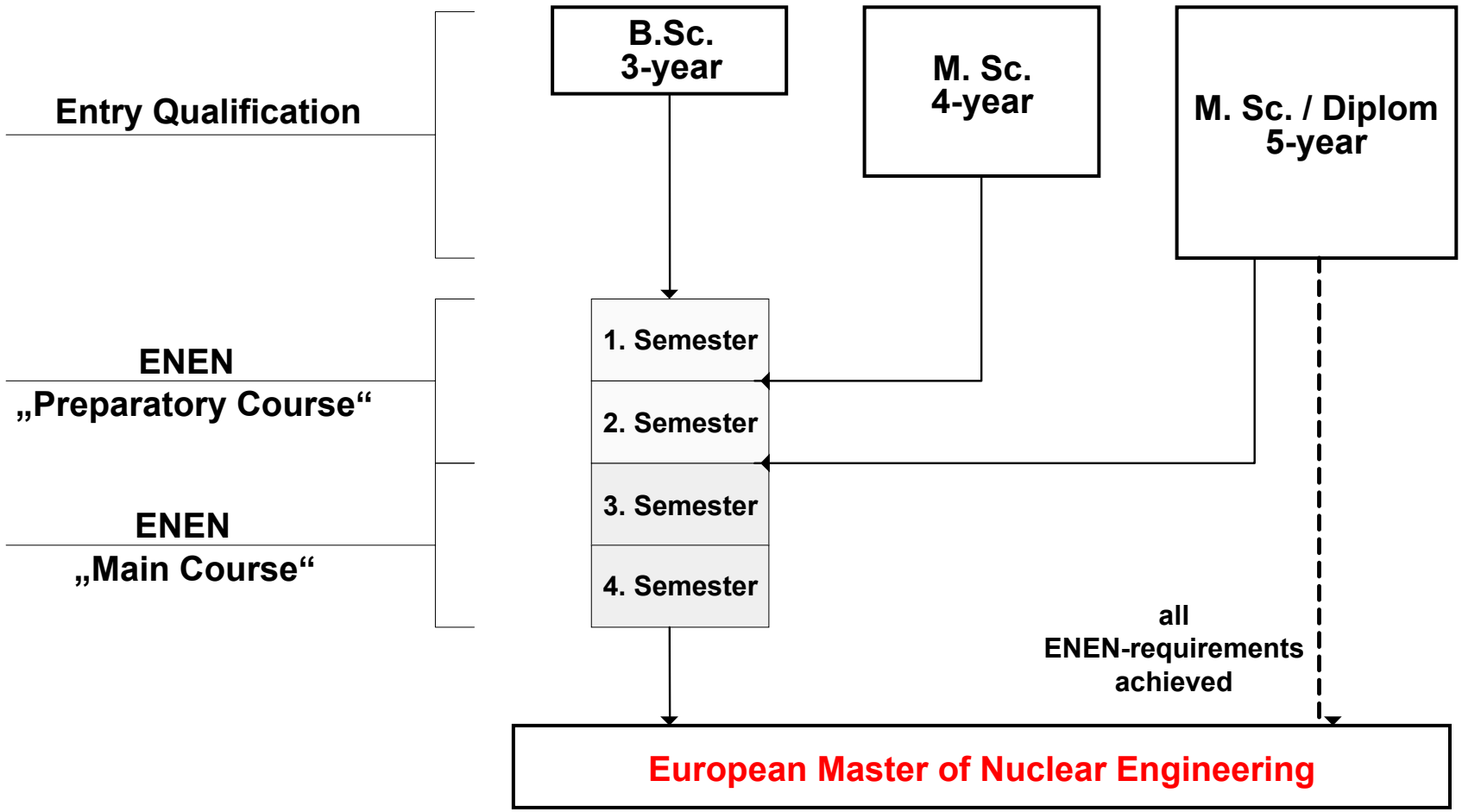
In Germany:

- **Networking of universities with national research centres: Helmholtz Virtual Institutes (VIs)**
  - **Competence in Nuclear Technology**
  - **Functional Characteristics of Aquatic Surfaces**
- **PhD Programme of German Utilities, offering attractive research topics and assured employment after PhD**

In Europe:

- **Networking of universities: European Nuclear Education Network, ENEN**
  - **25 universities from 16 European countries**
  - **Efficiency- and achievement-oriented university education in nuclear engineering in Europe**
  - **Degree: European Master of Science in Nuclear Engineering**

European Master of Nuclear Engineering



From: Schäfer, TU München

Maintenance of Knowledge

- **Data bases and documentation (e.g. Sodium LMFRs Documentary Fund of *CEA & EDF & FRAMATOME-ANP)* are fine**

but

- **Know-how and experience can only be maintained by direct person-to-person transfer to guarantee the alternation of generations - ideally in application to a scientifically & technically challenging project.**

From: Olkiluoto 3, Press release TVO Finnland, Oct. 10 2003

Conclusions for Germany (1/2)

- **According to international experience, scientific/technical junior staff can best be attracted when working on scientifically challenging, international projects.**
- **To achieve this, the German National Labs have to be allowed to participate in all relevant international bodies (e.g. INPRO, GenIV) in order to**
  - **Develop new safety technologies,**
  - **Apply these to the German nuclear power plants,**
  - **Improve the safety of nuclear power plants around Germany.**



Conclusions for Germany (2/2)

- **There has to be the distinct support from government, industries, research centres and universities, in order to attract young scientists / engineers / technicians.**

Conclusions for Germany

- There has to be the distinct support from government, industries, research centres and universities, in order to attract young scientists / engineers / technicians.
- This Federal Ministry advertisement is for sure not the correct message in order to attract nuclear junior staff!

<u>Süddeutsche Zeitung, Nov. 15, 2003:</u>
„NPP Stade was shut down yesterday. Germany changes to renewable energies.“
(Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)