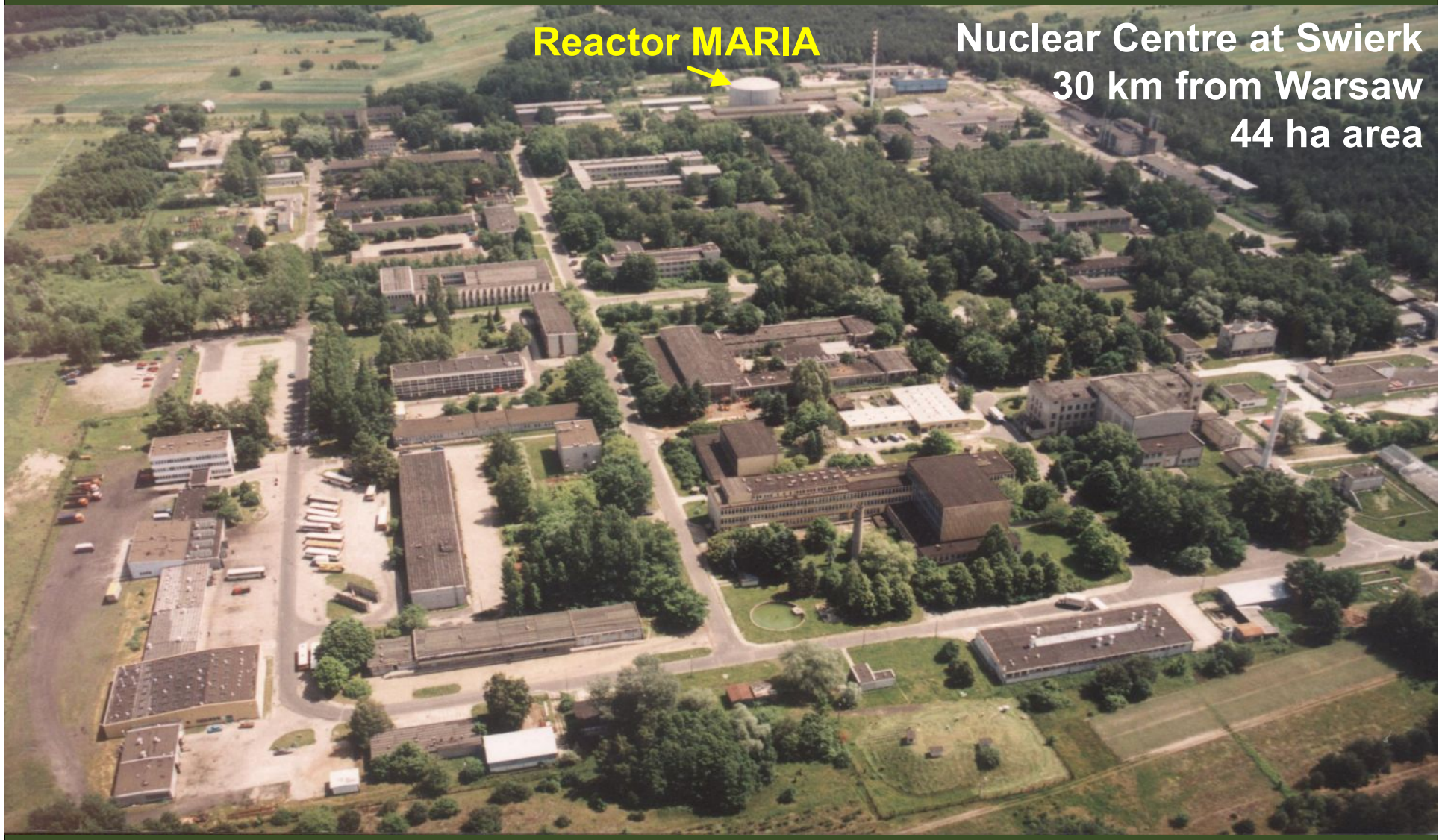
Nuclear power prospects for Poland



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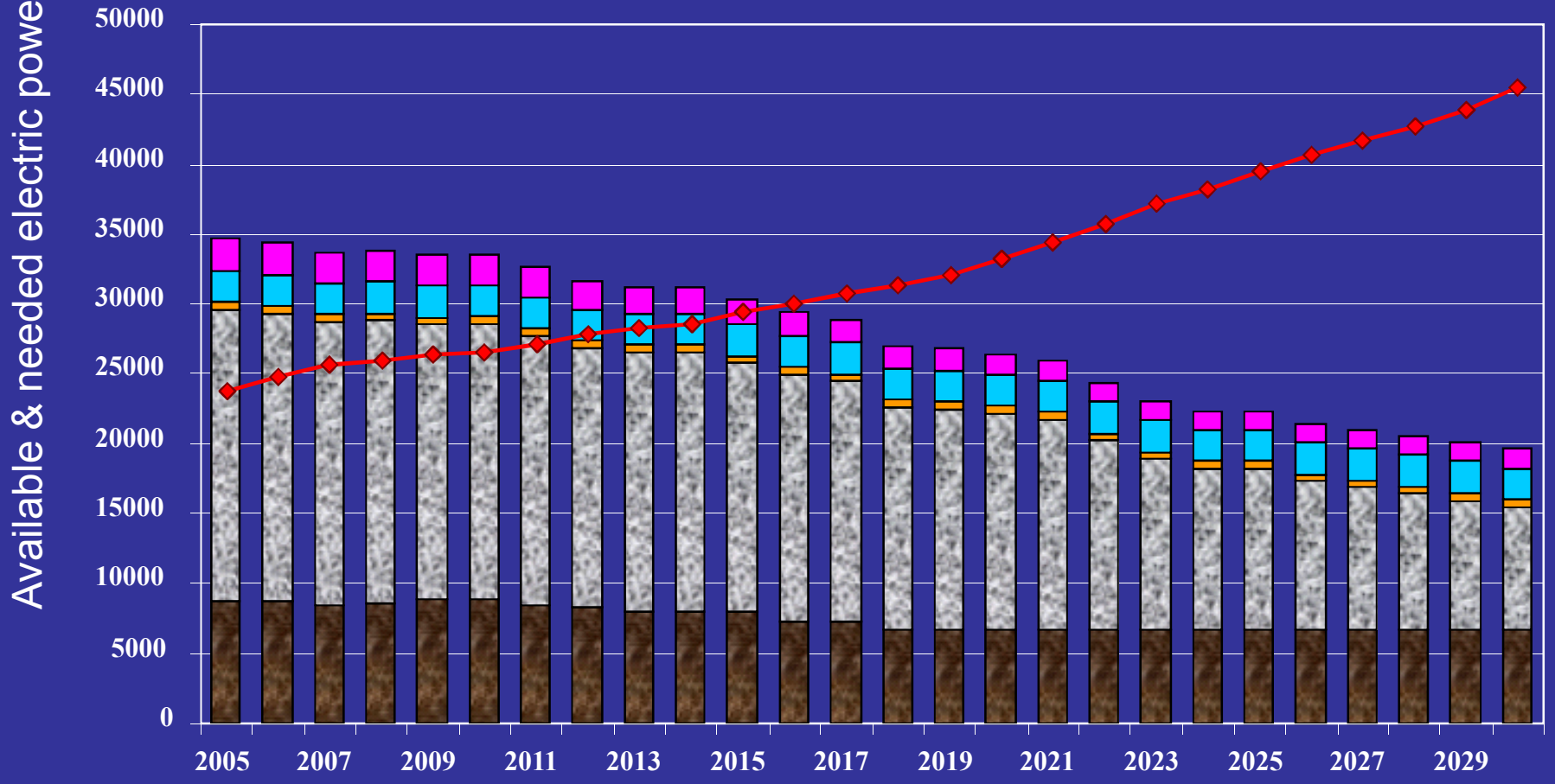
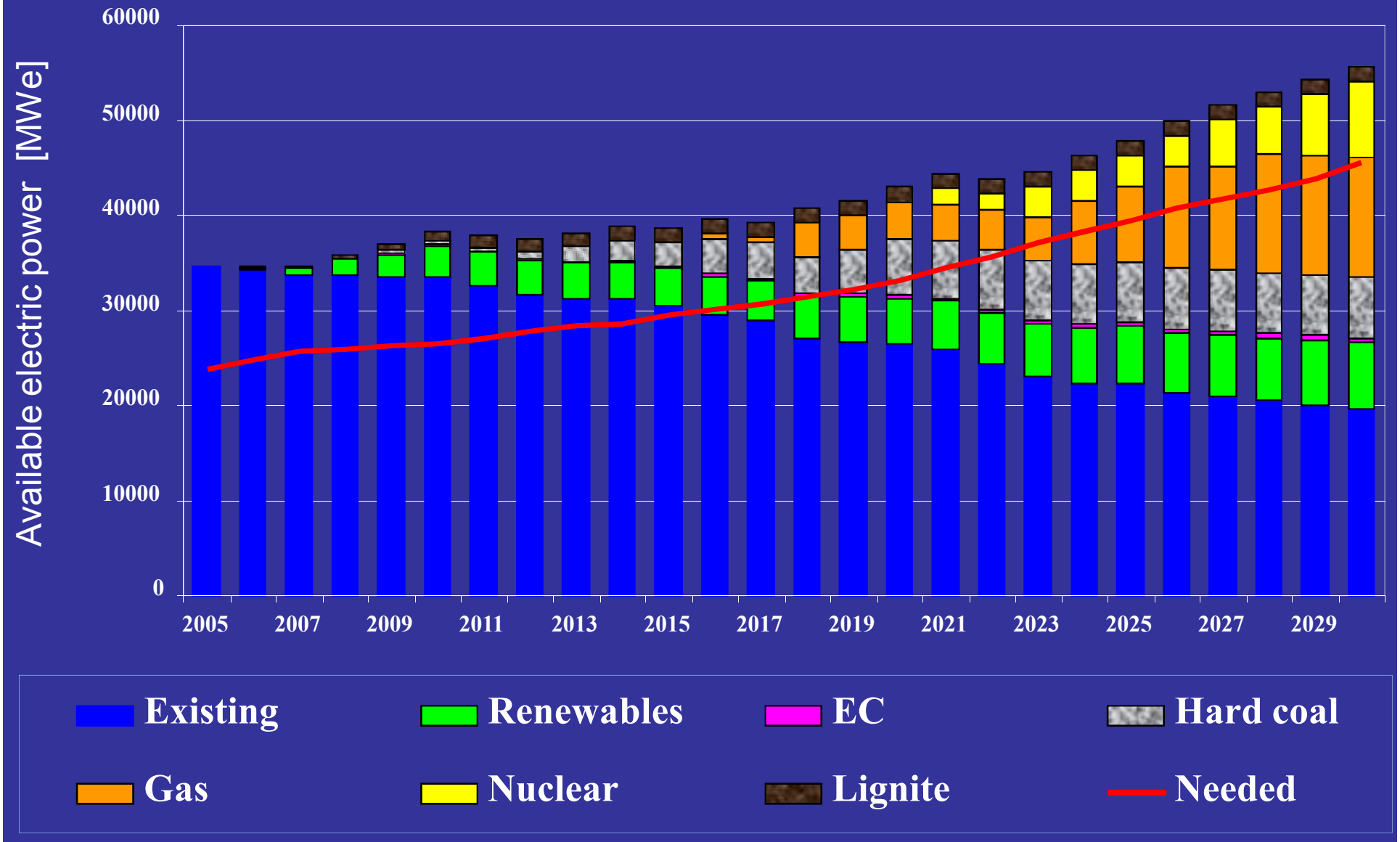
Production of electric power in Poland
with existing power plants



PGE S.A.

Plans to cover electric energy needs in Poland



PGE S.A.

Nuclear power in Poland by 2030

	2006	2030		
		min	mid	max
Final electric energy (all sources) TWh	111	172	197	209
reactors	0	6	8	10
Nuclear power MW(e)	0	4800	9600	12000
Net electric energy (nuclear) TWh	0	16	32	47
Nuclear energy fraction	0%	15%	25%	30%

min – „Polish Energy policy till 2030”
mid – more investors , larger reactors
max – higher demand

Polish Nuclear Power Program

- **13.01.2009 – governmental decision to prepare the nuclear power programme**
  - **Ministry of Economy created Department of Nuclear Energy, Governmental Commissioner appointed**
- **Today:**
  - **Drafts of legislations submitted to parliament**
  - **PGE group opened bids for „owner's engineer" and site licensing**
  - **National Center of Nuclear Research under creation**
- **2020 – first power plant in operation**
  - **second reactor soon after the first one**

Prospects for small reactors in Poland

Poland is a great potential market for SMR:

- **The grid is not well developed.**
  - **Large reactors need heavy investment in the grid.**
- **Many companies are ready to invest in their own sources of electricity and heat**
  - **fertiliser, cement & paper factories, refineries, mines, heavy industry etc.**
- **Pollution (PM10, etc) from heating of houses is a serious problem in many towns.**
  - **Many cities (inc. Warsaw) have heat networks connected to coal fired power plants**

Strategy for small reactors in Poland

- **Two markets:**
  - **Industry – own sources of electricity and heat**
  - **Towns – local sources of electricity and heat**
  - **Remote areas is not a big marked in Poland**
- **How to reduce the cost per MW?**
  - **Count on mass production**
    - **Target: 100 SMRs in Poland (1000 in Europe)**
    - 6% of 50 TWe = 3000 MWe = 100 x 30 MWe
  - **Do not advertize the simplicity**
    - People affraid that you compromise on safety
- **Cogeneration is the magic keyword**

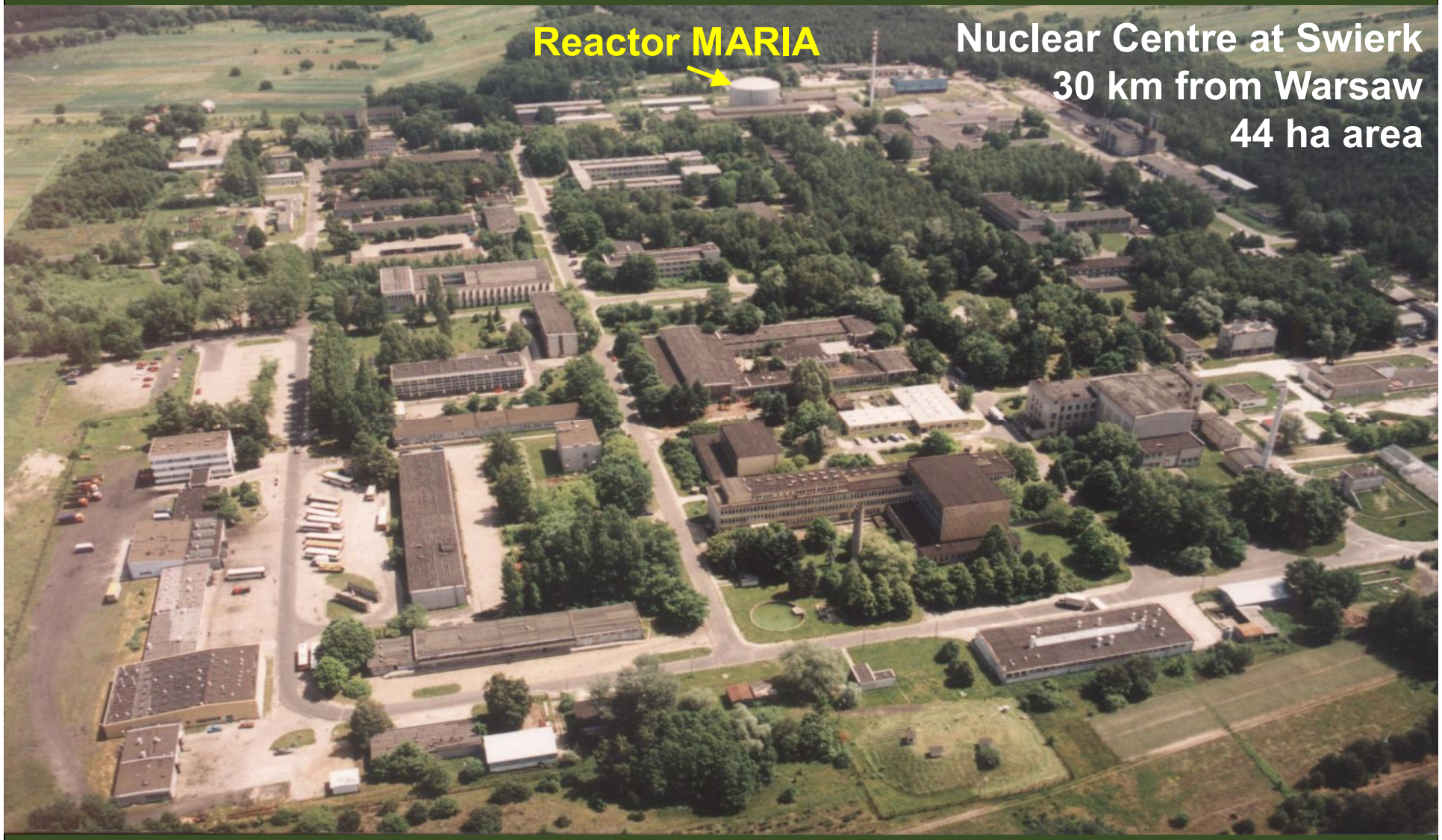
SMR as EU priority?

- **„Strategic Energy Technology Plan" (SET-Plan) of Europe will be realised by „European Industrial Initiatives" (EII)**
- **„Sustainable Nuclear Energy Technology Platform" (SNE-TP) proposes:**
  - **Eu Sustainable Nuclear II (ESNII)**
    - fast reactors to save uranium & reduce waste
  - **Nuclear Cogeneration EII**
    - mid power reactors for electricity & heat
    - so far only gas cooled high T reactors considered
- **SET-Plan conference & SNE-TP Gen. Assembly @ Polish EU presidency 28-29.11.2011**
  - **key place to discuss the Nuclear Cogeneration EII**

Strategy for small reactors

- **Chicken and egg problem of SMR:**
  - **Needs investment to build a prototype**
  - **No one willing to invest not seeing working prototype**
- **Licensing problem:**
  - **Regulatory rules for large reactors not suitible for SME**
  - **Long and expensive licensing required to build the prototype**
- **Proposed solution:**
  - **Build a pre-prototype as a research reactor**
    - <50 MWt licensing much easier
    - could use existing reserach lab site
    - could get some funds from research budget?

National Center for Nuclear Research (NCBJ)



NCBJ is being created by merging the Institute of Atomic Energy (IEA) & the Soltan Institute for Nuclear Studies (IPJ)

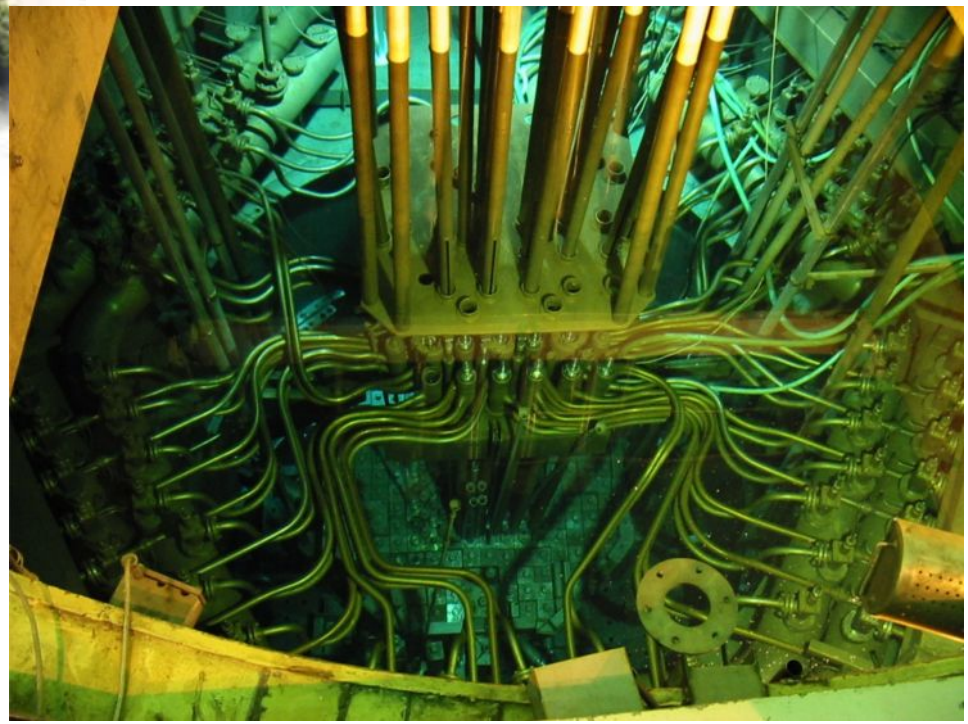
Polish nuclear R&D institutes

Institute	site	staff	prof.	phd	papers
Institute of Atomic Energy (IEA) POLATOM	Swierk	458	18	44	130
Institute for Nuclear Studies (IPJ)	Swierk, Warsaw	460	48	52	308
Inst. of Nuclear Chemistry & Technology (IChTJ)	Warsaw	241	24	44	236
Inst. of Plasma Physics & Laser Microsynth. (IFPiLM)	Warsaw	82	9	14	70
Central Lab. for Radiological Protection (CLOR)	Warsaw	52	3	7	
Institute of Nuclear Physics (IFJ) PAS	Cracow	486	71	115	~335
TOTAL		**1779**	**173**	**276**	**1080**

+ several universities & technical universities

Research reactor MARIA at Swierk

- built 1974, upgrade 1992
- neutron beam research, activation analysis, isotope production: ^{99}Mo for medical use



- pool type
- H_2O, Be moderated
- 30 MW thermal power
- neutron flux:
  - thermal $4 \cdot 10^{14}$ n/cm^{2}s
  - fast $2 \cdot 10^{14}$ n/cm^{2}s

Research programme

Nuclear power:

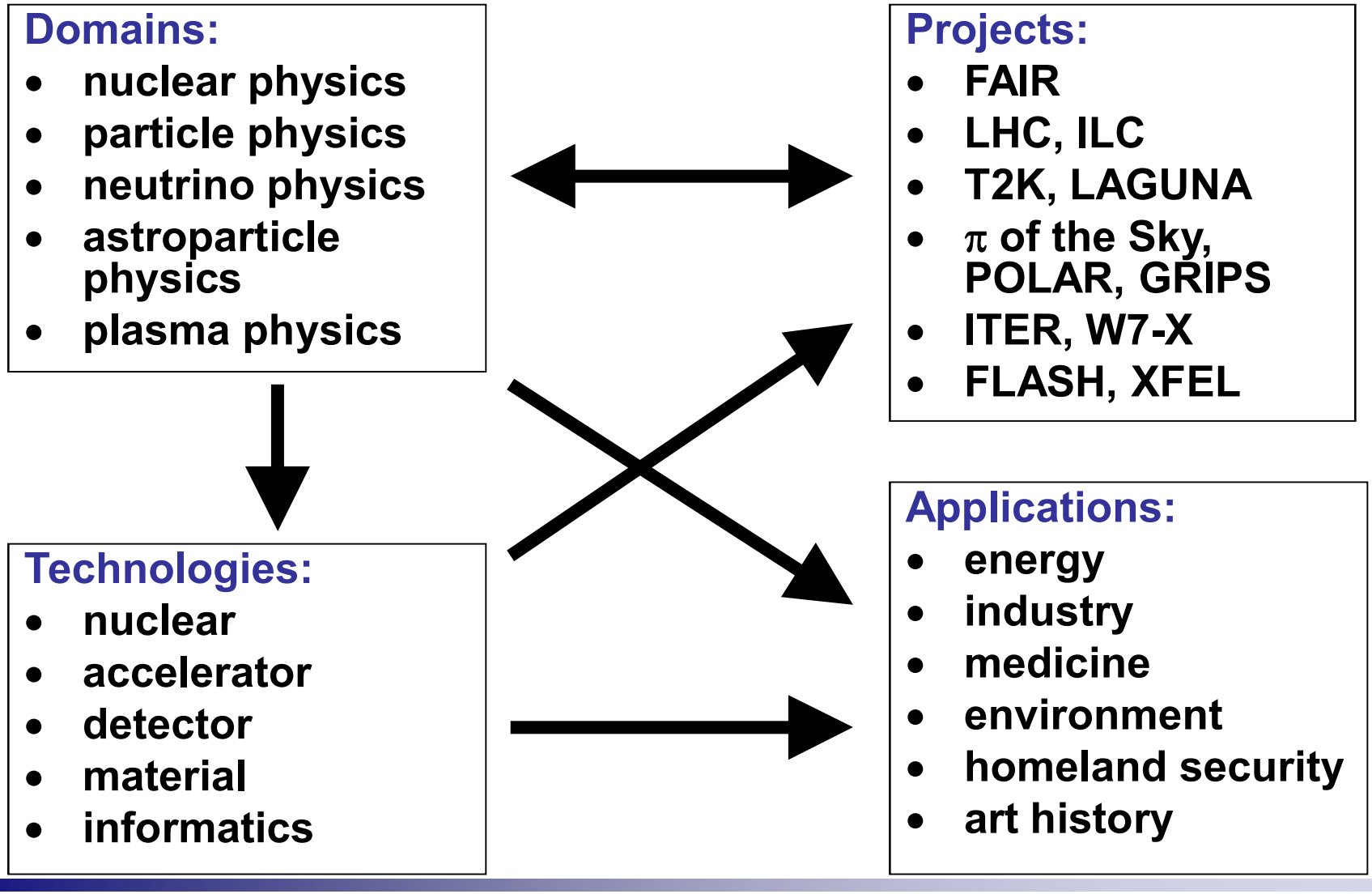
- Safety analysis
- Reactor materials
- Nuclear fuel
- Radiological monitoring
- Analysis of nuclear accidents
- Spent fuel
- Radioactive waste

Research and applications:

- Material modification
- Neutron radiography
- Neutron-boron therapy
- Production of isotopes
- Si transmutation for microelectronics

Soltan Institute for Nuclear Studies

research program



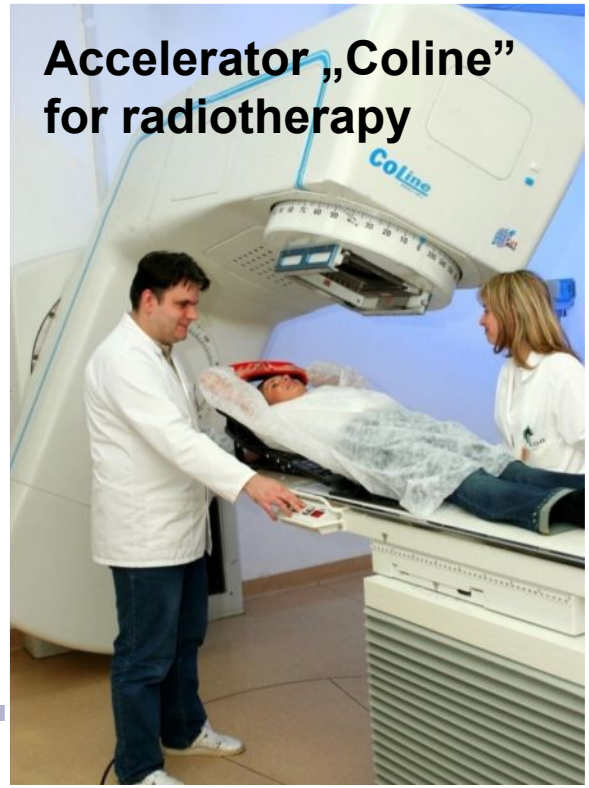
Particle accelerators and detectors


Prototype cavities
1.3 GHz for Tesla-FEL,
DESY, Hamburg


Target for experiment
Isolde, CERN, Genewa

From research instruments to commercial applications


Accelerator „Lillyput”
for industrial radiography


Accelerator „Coline”
for radiotherapy

www.HiTecPoland.eu

Conclusions

- **Lithuania and Poland share the interest in small nuclear reactors**
- **Collaboration in research is the best way to begin the common effort in this field**