



ROYAL INSTITUTE
OF TECHNOLOGY

**Royal Institute of Technology (KTH)
5th European MECOR User Group (EMUG)
May 2-3, 2013**

Welcome and Introduction

Sevostian Bechta

Nuclear Power Safety Division (NPS)

Physics Department

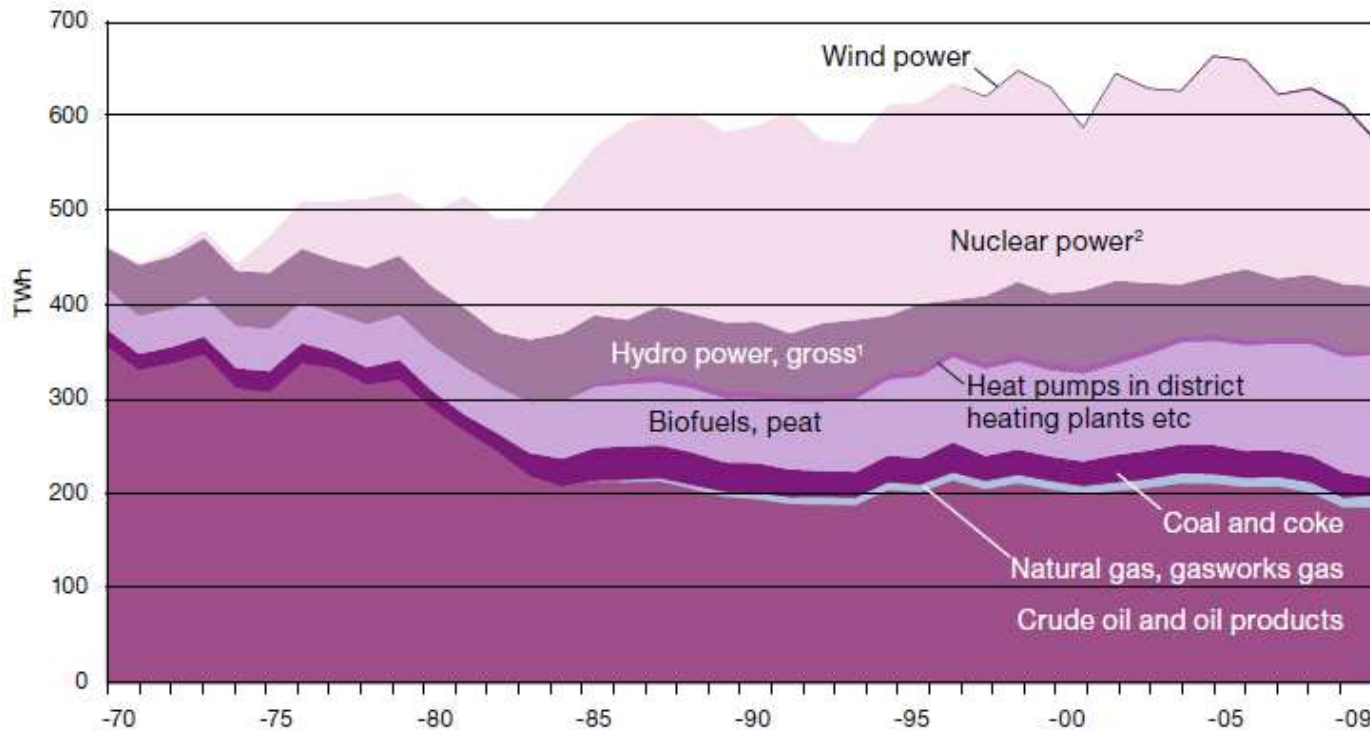
School of Engineering Sciences (SCI)

Contents

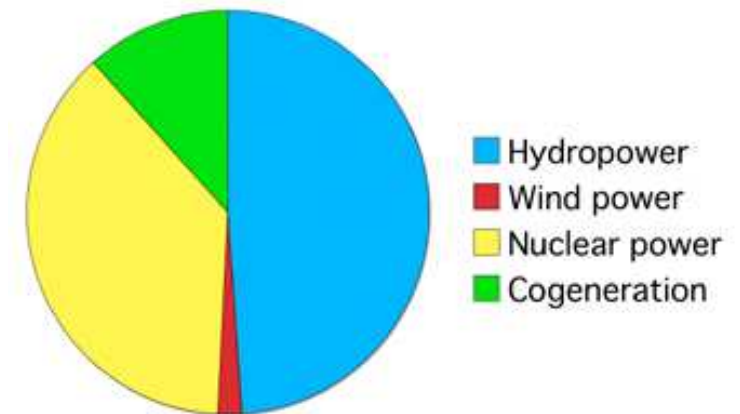
- ✓ Swedish nuclear power program in brief
- ✓ General information about KTH
- ✓ Division of Nuclear Power Safety
- ✓ 5th EMUG meeting objectives and agenda

Structure of energy generation in Sweden

Total energy supply in 1970–2009
(excluding net electricity exports)



Electricity production in 2009



Source: Statistics Sweden and the Swedish Energy Agency.

Note: 1. Includes wind power until and including 1996. 2. Nuclear power is shown as gross power, i.e. as the nuclear fuel energy input, in accordance with the UN/ECE guidelines.

- ✓ Hydro and Nuclear powers are the main contributors to electricity production
- ✓ Practically no carbon emission at electricity production

Swedish Nuclear Power Plants in Operation

| NPP | Type | Commercial Operation Start | Original power level, MW | | Current power level | Total thermal uprate, % |
|--------------|------|----------------------------|--------------------------|------------|---------------------|-------------------------|
| | | | Thermal | Electrical | Thermal | |
| FORSMARK-1 | BWR | 1980-12-10 | 2711 | 900 | 2928 | 8,0 |
| FORSMARK-2 | | 1981-07-07 | 2711 | 900 | 3253 | 20,0 |
| FORSMARK-3 | | 1985-08-18 | 3020 | 1100 | 3775 | 25,0 |
| OSKARSHAMN-1 | | 1972-02-06 | 1375 | 440 | 1375 | - |
| OSKARSHAMN-2 | | 1975-01-01 | 1700 | 565 | 1800 | 5,9 |
| OSKARSHAMN-3 | | 1985-08-15 | 3020 | 1055 | 3900 | 29,1 |
| RINGHALS-1 | | 1976-01-01 | 2270 | 750 | 2500 | 10,1 |
| RINGHALS-2 | PWR | 1975-05-01 | 2440 | 785 | 2660 | 9,0 |
| RINGHALS-3 | | 1981-09-09 | 2783 | 915 | 3000 | 7,8 |
| RINGHALS-4 | | 1983-11-21 | 2783 | 915 | 2783 | - |

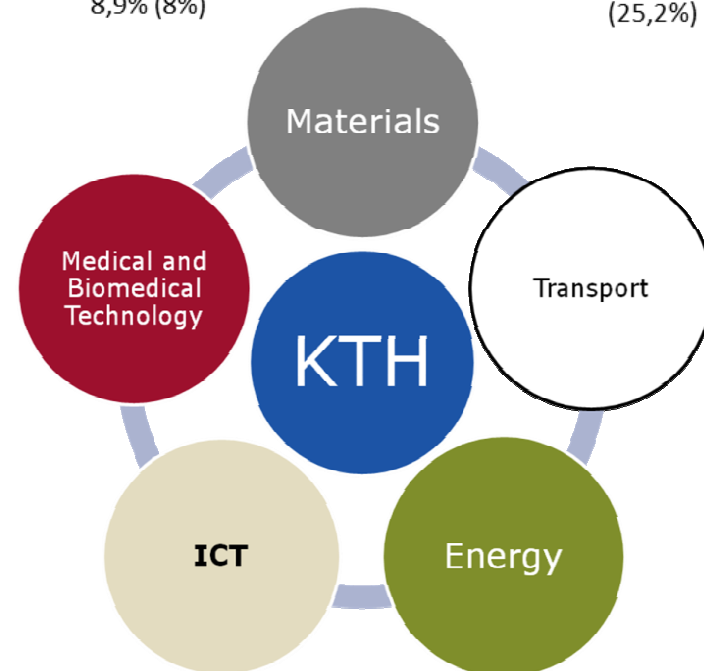
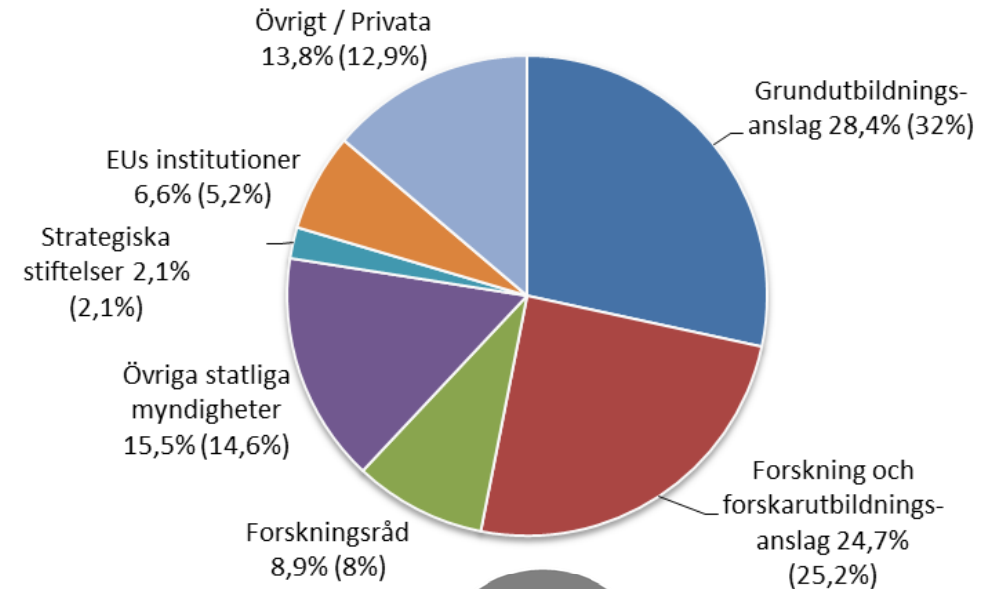
- ✓ 10 operating NPPs at 3 sites
- ✓ Majority of BWR type of Asea Atom design
- ✓ Successful power uprate program
- ✓ O1 unit operates more than 40 years, several units are coming to this time (life time extension issues)



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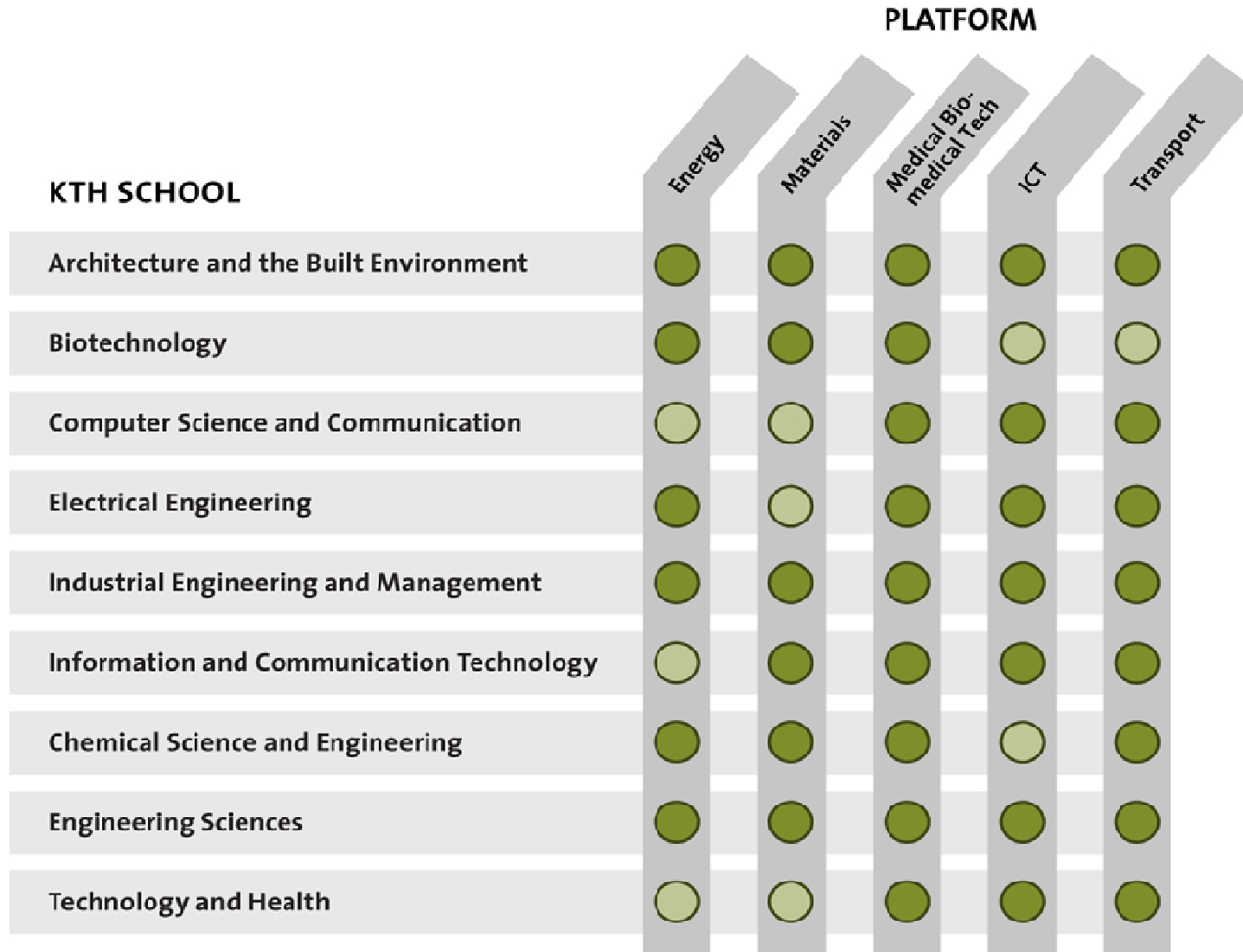
- Founded in 1827
- 17,000 undergraduate students (4000BSc, 13.000MSc)
- 1,500 PhD students
- 3,300 employees
- Approx. >200 PhD degrees issued/year
- Ranked among the top ten technical universities in Europe
- Annual turnover MEUR 360



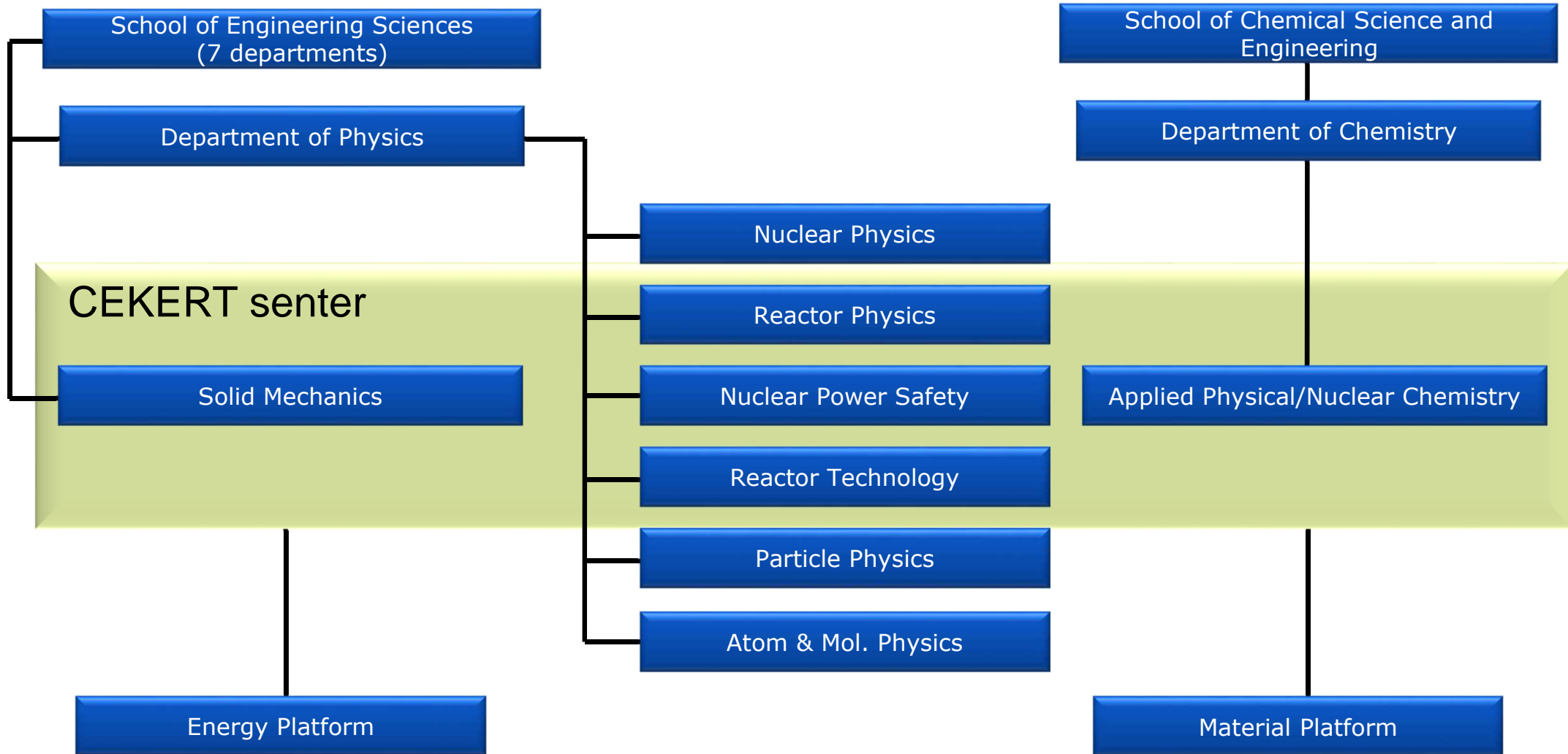


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KTH schools/platforms



Nuclear power engeneering in KTH





NPS Staff

Senior Research Staff (9)

Sevostian Bechta, *Professor, Head of the division*

Pavel Kudinov, *Docent, Associate Professor*

Aram Karbojian, *Dr., Lab Manager*

Weimin Ma, *Docent, Associate Professor*

Walter Villanueva, *Post-Doc*

Alexander Konovalenko *Post-Doc*

Dmitry Grishchenko, *Post-Doc*

Youjia Zhang, *Post-Doc*

Ivan Gajev, *Post-Doc*

Andrei Kubarev, *Research Engineer*

Sean Roshan, *Research Engineer*

3 more Post-Docs (VR ASTRID)

Supporting Staff, Technicians (2)

Lars-Erik Storm,

Per Sköld

In total ~30 People

Affiliated/Emeritus Professors (3)

Nam Dinh, *Affiliated Professor*

Bal Raj Sehgal, *Emeritus Professor*

Tomas Lefvert, *Professor*

PhD Students (9)

Hua Li, *MSc*

Viet-Anh Phung, *MSc*

Kaspar Kööp, *MSc*

Marti Jeltsov, *MSc*

Simone Basso, *MSc*

Sebastian Raub, *MSc*

Joanna Peltonen, *Lic*

Sachin Thakre, *MSc*

Louis Manickam, *MSc*

Administratör (1)

Sofia Nyström (Kajsa Bergman)

+ {
MSc Diploma Students
Visiting Students and Scientists
Short-Term Project Engineers



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NPS Research Organization

ARTS Group

*Analysis of Reactor
Transients and Stability*

MTFS Group

*Multiphase Thermofluid Science
- Basic Research*

SARAM Group

*Severe Accident Risk
Assessment & Management*

NPS Laboratory

*Basic and Applied
Experimental Research*



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NPS Current Research Areas

Severe Accident

Phenomena and Management, Risk Analysis, Issue Resolution

Reactor transients

Containment thermal-hydraulics

Advanced Modeling and Simulations

Multi-Physics (NK-TH),
Multi-Scale (system-CFD)

Generation III+, IV systems

Safety Design and Analysis.
Passive Safety Systems.

Multiphase flow and heat transfer

Physics of Boiling

Integrated Deterministic-Probabilistic Safety Analysis

**Engineering
Applications**

**Education
Nuclear Engineering
Master and PhD**

**Basic
Science
Research**

5th EMUG meeting objectives

- ✓ Information exchange and discussion of the experience in MELCOR:
 - assessment and validation including sensitivity and uncertainty studies
 - development including model improvement and MELCOR coupling with other codes
 - application to different designs including Fukushima plant and spent fuel pools
 - application by young and less experienced users

- ✓ User suggestions for:
 - Model improvements
 - Numerical stability and run time performance
 - Inputs
 - Coupling
 - Others?

- ✓ Views and opinions of the participants on:
 - Further development of EMUG collaboration
 - New priorities and next meeting agenda
 - Time and place of the 6th Meeting (2013)

- ✓ Others?



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5th EMUG meeting agenda

May 2, 2013 / Room FA32

- ✓ Section 1 – Status of MELCOR
- ✓ Section 2 – Analysis of Spent Fuel Pool
- ✓ Section 3 – Simulation of Experiments
- ✓ Section 4 – Plant Applications

May 3, 2013, Morning / Room FB42

- ✓ Section 5 – Other Activities
- ✓ Section 6 – Overview of MELCOR Activities

May 3, Afternoon / Room FA32

- ✓ Section 7 – MELCOR and SNAP
- ✓ Section 8 – Fukushima Analysis
- ✓ **Section 9 – Discussions**
- ✓ Lab Tour (Participants of interest?)

- ✓ Welcome to KTH!
- ✓ Wishing you productive work and warm environment!
- ✓ Please contact Dr. Weimin Ma for further assistance in accommodation, services (e-mail, internet,...) or other practical issues.