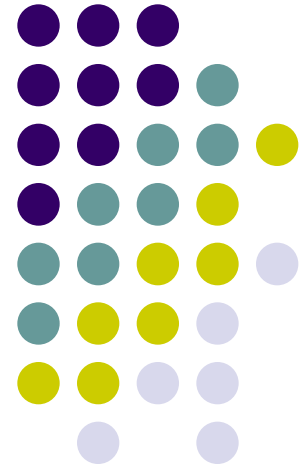




UNIVERSITY OF PITEȘTI
<http://www.upit.ro>
INSTITUTE FOR NUCLEAR RESEARCH
<http://www.nuclear.ro>

Expanding Nuclear Knowledge's -
Romanian experience:
“Nuclear Materials and Technologies “- Master
Educational Plan



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Assoc.prof.dr. Monica Valeca,phd
Dr. Preda Marin-SCN

International Conference-NUCLEAR 2011 SCN Pitesti May 2011

MAIN OBJECTIVES



- *To deliver higher education and training in the following specific domains:*
 - *Powders Technology and Ceramic Materials*
 - *Techniques of Structural Analysis*
 - *Composite Materials*
 - *Semiconductor Materials and Components*
 - *Metals and Metallic Alloys*
 - *Optoelectronic Materials and Devices*
 - *Nuclear Materials*
 - *The Engineering of Special Nuclear Materials*
- *To train managers of the Nuclear Waste Products and Nuclear Safety*
- *To qualify in ICT Systems for Nuclear Processes Guidance*
- *To qualify in Environmental Protection Systems at the Level of Nuclear Power Stations*
- *To train managers for The Quality Assurance of Nuclear-Energetic Processes*
- *To deliver higher education and training regarding the International Treatises, Conventions and Settlements in force in the field of nuclear related activities.*

PRINCIPLES...



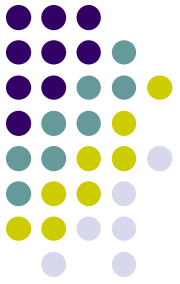
There are several principles that should be observed such as:

- the continuity and synergy with the Bachelor in Physics Engineering;
- the possibility to enter into the educational process at any moment, on the basis of an Accreditation of Prior (Experiential) Learning made by a specific, individual initial evaluation
- the possibility to exit from the educational process at any moment with a Certificate of Competencies or a Diploma, ECTS based;
- the full use of ODL & ICT methods where possible;
- a rational staff and students mobility in order to efficiently use the human and logistic resources of both universities.

BASIC TRAINING IN REACTOR PHYSICS ENGINEERING- UPIT

4 th year	Quality Assurance in Nuclear Energetic	Nuclear Techniques	Non-Destructive Defectoscopy	Practice and Diploma		
	Semiconductor Materials & Devices	Solid State Physics	Structural Analysis Techniques	Condensed State Spectroscopy	Composite Materials	Powders' Technology & Ceramic Materials
3rd Year	Electrochemistry & Corrosion	Physics Metallurgy	Quality Management	Marketing	Technology of Materials	Polymers Physics
	Electro-techniques	Atomic & Molecular Physics	Nuclear Physics	Statistics & Quantum Physics	Electromagnetic Fields	Systems Theory
2nd Year	Maintenance	Microprocessors Programming	Electro-Mechanical Technologies	Machinery & Mechanisms	Electronic Devices & Circuits	Digital Systems
	Technical Chemistry	Special Mathematics	Numerical Analysis	Descriptive Geometry & Technical Drawing	Electricity & Magnetism	Optics
1st Year		Analytic Mechanics	EU Language	Physical Education		
	Mechanics and Resistance of the Materials	Linear Algebra, Analytic & Differential Geometry	Mathematical Analysis	Computer Programming & Programming Languages	Physical Mechanics and Acoustics	Molecular Physics & Thermodynamics

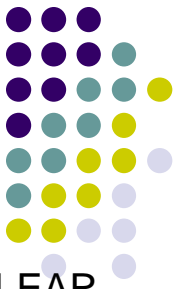
MASTER: NUCLEAR MATERIALS AND TECHNOLOGIES



**Optional
Modules**

Core Master	Metals and Metallic Alloys	Opto-electronic Materials & Devices	Nuclear Materials		The Modern Technologies in Generating the Nuclear Power	The Re-Engineering of Nuclear-Energetic Reactors	The Risk Management in Nuclear Energetic Systems
	Techniques of Structural Analysis	Composite Materials	Semiconduct or Materials & Components		Reactors: Triga and Candu type	Marketing in Nuclear Energetic	The Management of Nuclear Systems from the Holistic Point of View
	The Management of Nuclear Waste Products	The Management of Nuclear Security	Financing the nuclear power programmes	ICT Systems for Nuclear Processes Guidance	Environmental Protection Systems at the Level of Nuclear Stations	The Quality Assurance of Nuclear-Energetic Processes	International Treatises, Conventions and Settlements

SPECIFICITIES OF THE MASTER STUDY PROGRAMME



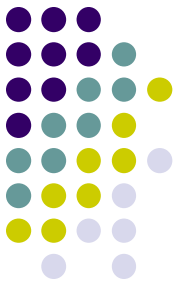
- The master study programme in NUCLEAR MATERIALS AND NUCLEAR TECHNOLOGIES has a series of specificities
- MAIN OBJECTIVES
- The NMNT Master Study programme offer solutions to the actual demand of highly qualified personnel in the field of nuclear activities.
- Thus, the qualification delivered lead to the fulfilment of the following training objectives:
- *To deliver higher education and training in the following specific domains:*
 - *Powders Technology and Ceramic Materials*
 - *Techniques of Structural Analysis*
 - *Composite Materials*
 - *Semiconductor Materials and Components*
 - *Metals and Metallic Alloys*
 - *Optoelectronic Materials and Devices*
 - *Nuclear Materials*
 - *Nuclear reactors: Candu and Triga type*
 - *Financing nuclear programmes*
- *To train managers of the Nuclear Waste Products and Nuclear Safety*
- *To qualify in ICT Systems for Nuclear Processes Guidance*
- *To qualify in Environmental Protection Systems at the Level of Nuclear Stations*
- *To train managers for The Quality Assurance of Nuclear-Energetic Processes*
- *To deliver higher education and training regarding the International Treatises, Conventions and Settlements in force in the field of nuclear related **activities**.*

DELIVERY METHODS



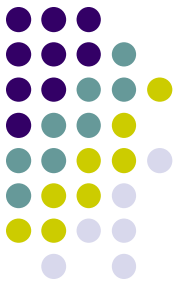
- The **NMNT Master Study** programme will be delivered in a very flexible way. The educational plan, initially structured in a traditional manner, meaning “course modules, over classic semesters” can be easily re-structured in order to be delivered in a modular, accumulative procedure, without a compulsory succession of the modules. This procedure will allow:
 - The possibility to join the programme at every moment
 - An Open and Distance Learning System for the study modules that allows this
 - Bilateral exchanges of students and / or teaching staff in order to deliver certain modules in foreign’s universities or in the University of Pitesti
 - The possibility to leave the study programme after the completion of a part of the modules, with an **appropriate Certificate of Competencies**, ECTS based.
 - The possibility to take optional modules in order to achieve extra competencies leading to supplementary qualifications and / or diplomas.
 - The possibility for the individuals to enter into a process of accreditation of prior learning (formal or experiential) in order to design for them personal educational pathways.
 - In connection with the basic, Bachelor Study Programme in “Physics Engineering – Nuclear Materials and Technologies”, another set of possibilities arises. Based on the Erasmus mobility scheme and on bilateral agreements, students in engineering study programmes from both universities can go for exchanges and mobility’s abroad, in order to supplement their basic qualification with extra skills and competencies. This will give them the opportunity to go directly for the **Master Diploma** even if they are in the possession of a bachelor diploma in a different area.

PRELIMINARY CONSIDERATIONS



- There are several principles that should be observed such as:
- the continuity and synergy with the Bachelor in Physics Engineering
- the possibility to enter into the educational process at any moment, on the basis of an Accreditation of Prior (Experiential) Learning made by a specific, individual initial evaluation
- the possibility to exit from the educational process at any moment with a Certificate of Competencies or a Diploma, ECTS based
- the full use of ODL & ICT methods where possible
- a rational staff and students mobility in order to efficiently use the human and logistic resources

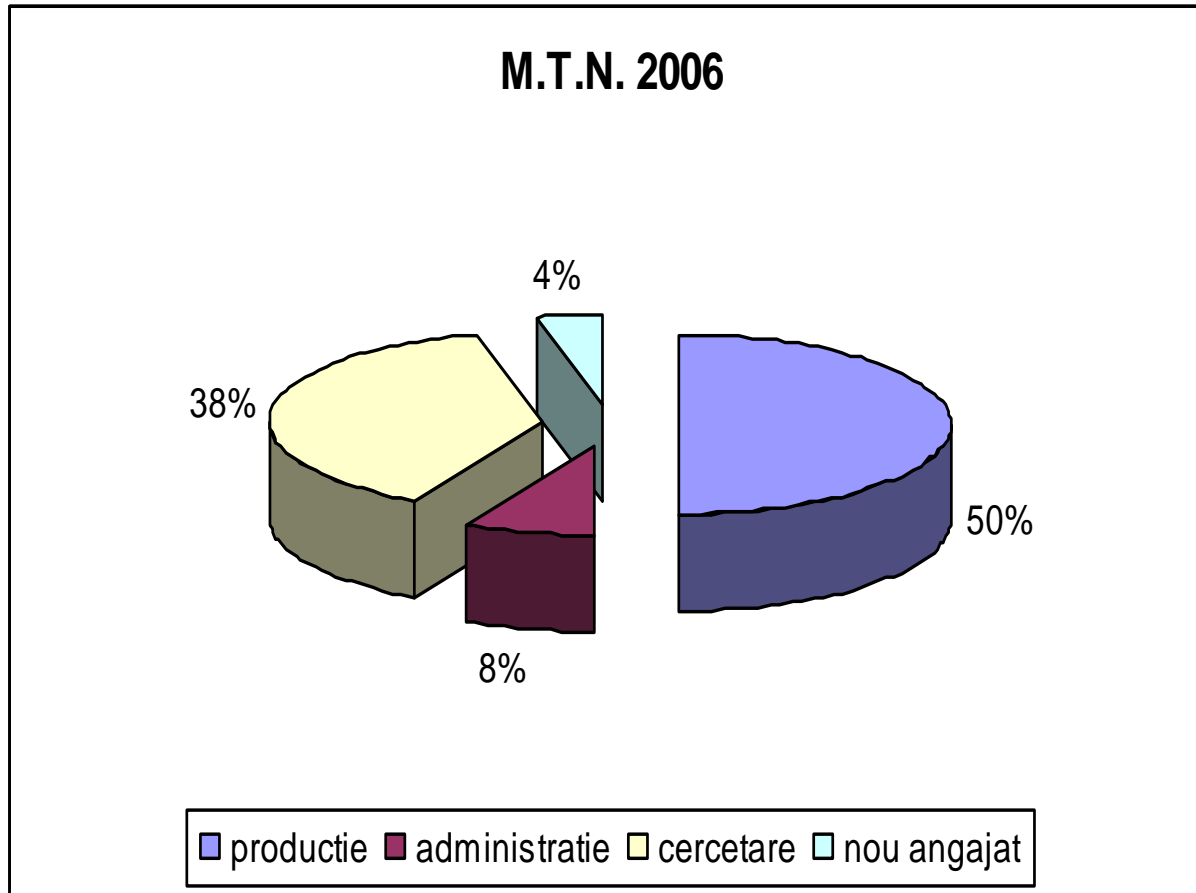
RESULTS



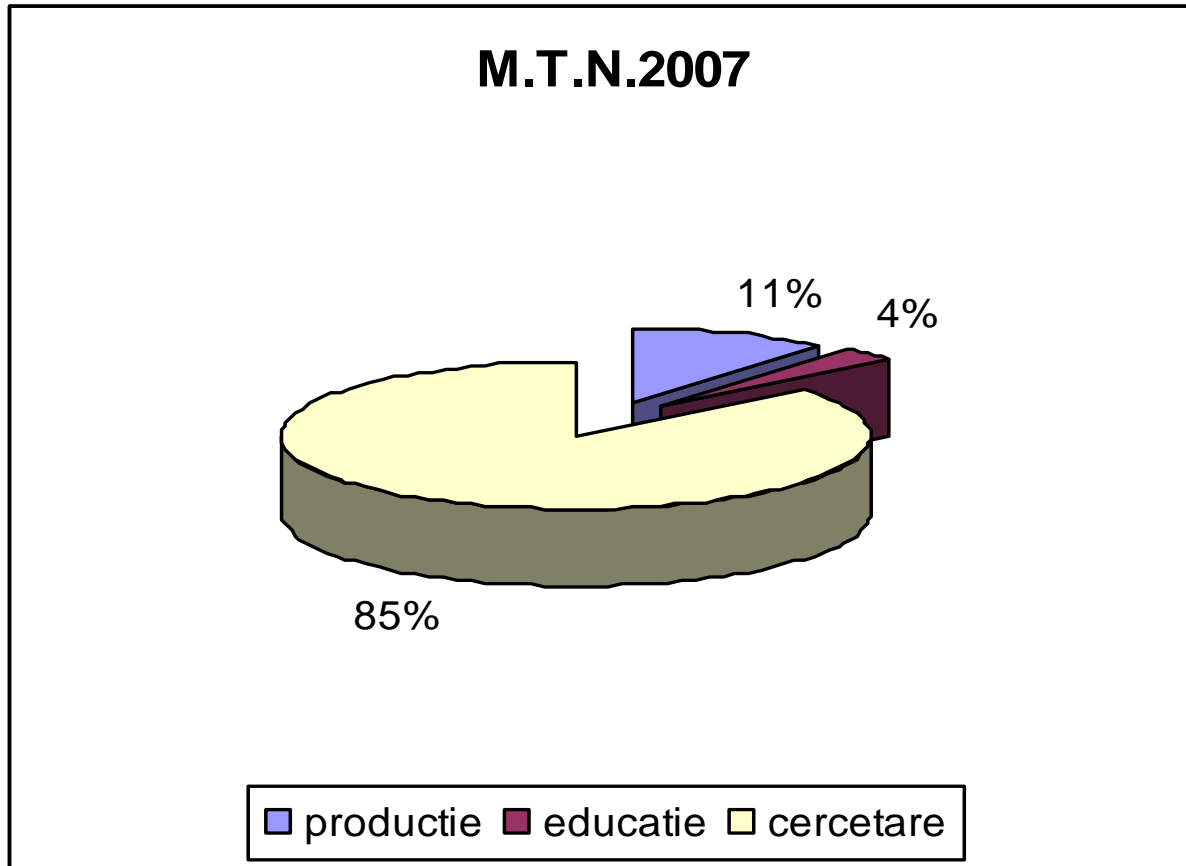
- Starting with mentioned criteria we can present as an example from the Pitesti University, where from 2004 starts a series of study programs of master type with specialization in Nuclear Materials and Technologies, with 2 years duration. The practice courses have been made at Nuclear Research Institute Pitesti lab's;
- Pursuant to master courses we can say that 70% of students are specialists in nuclear field (staff from research institutes, from factories of nuclear equipments, heavy water and nuclear fuel) and 30% are young graduates of a technical faculty;
- Take in to consideration the nuclear power prospects with 4 nuclear units in operation, the human resources needed to be prepared as estimated:



MASTER ADDRESSABILITY (1)

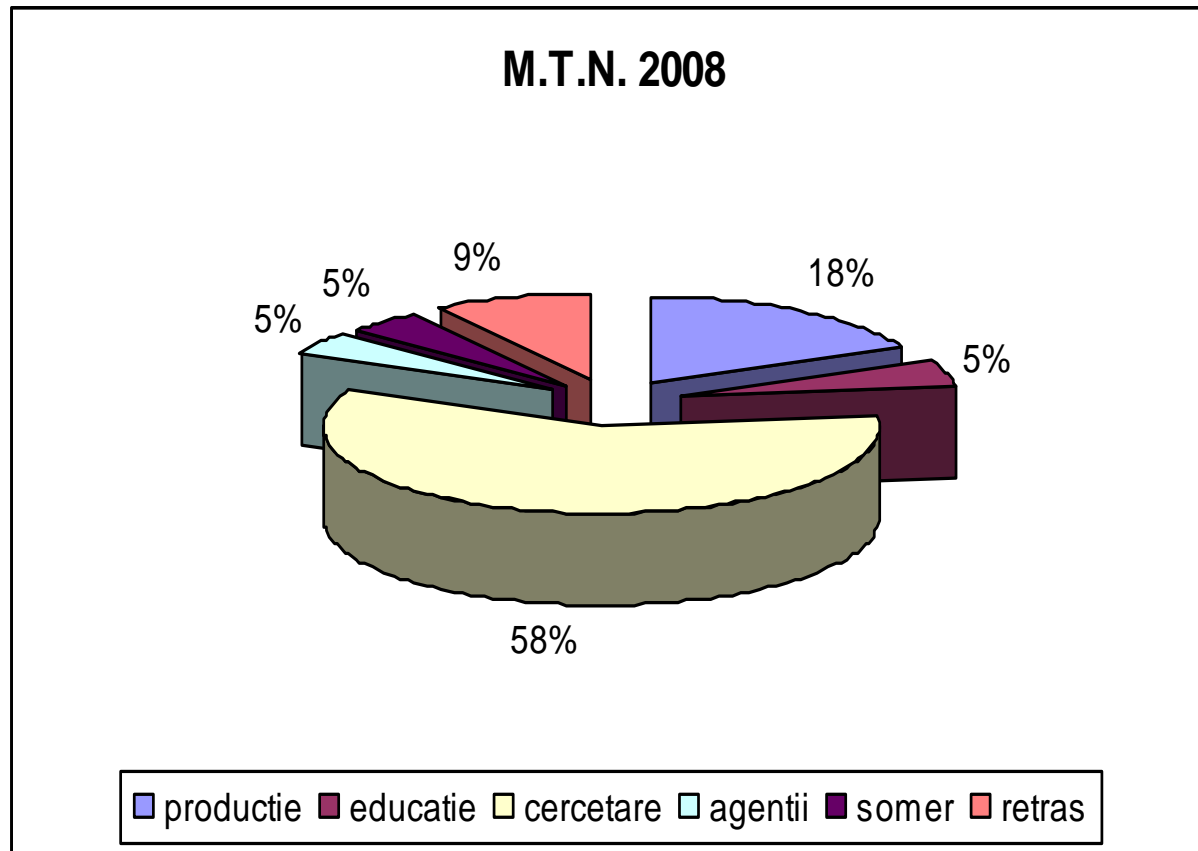


MASTER ADDRESSABILITY (2)

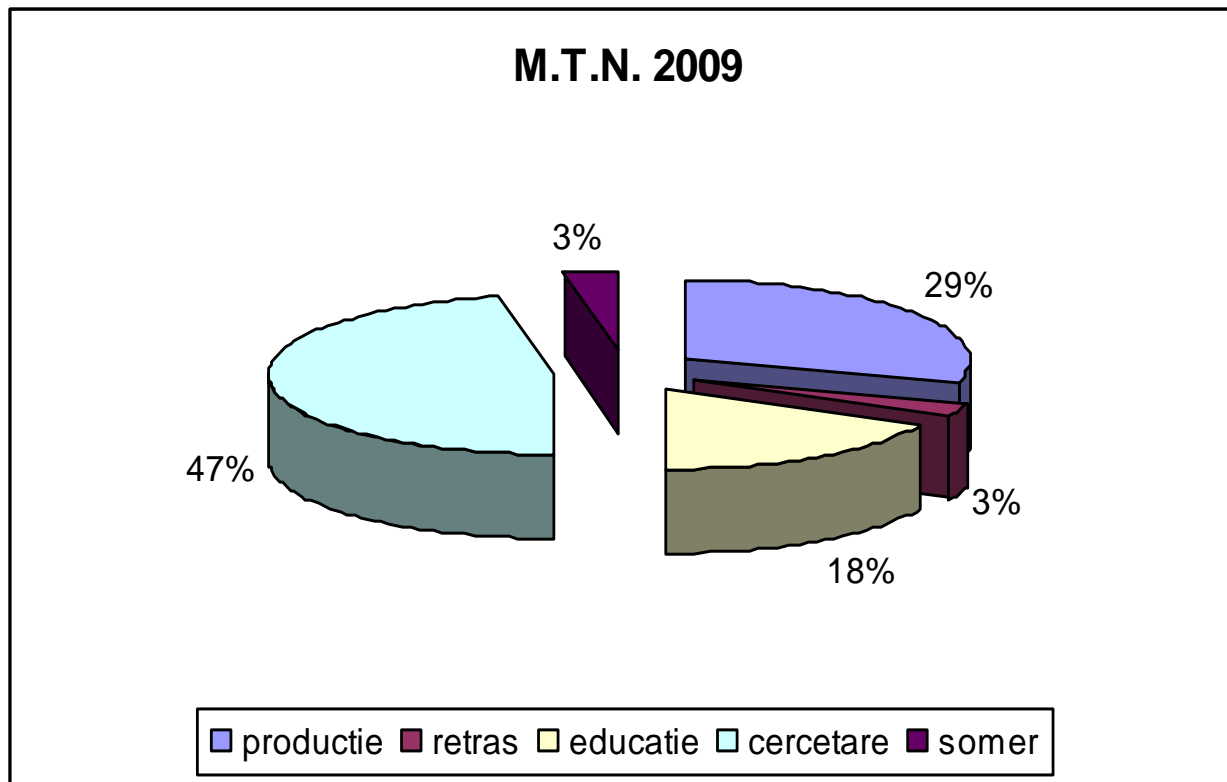
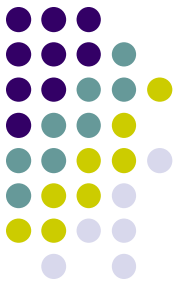




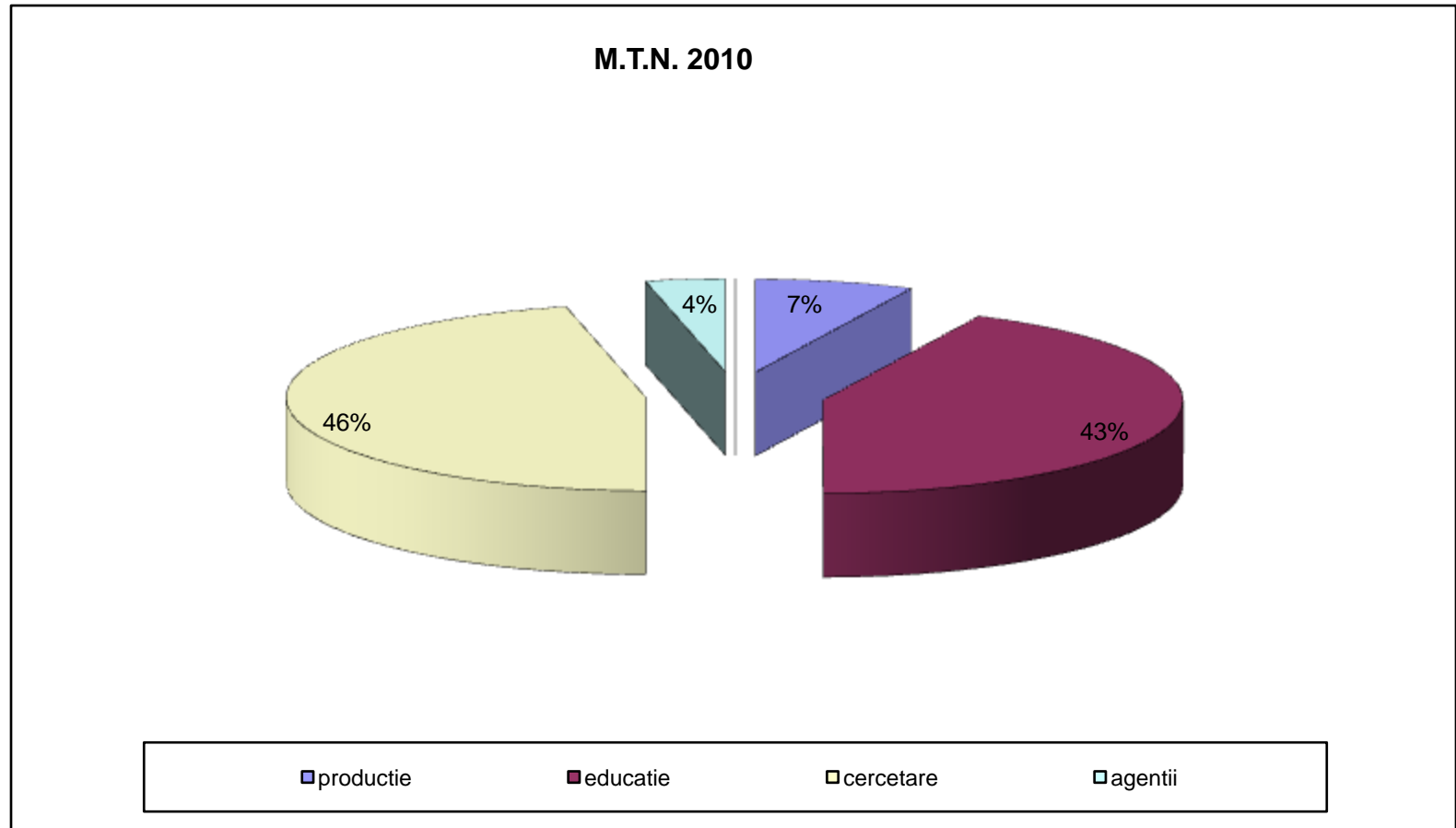
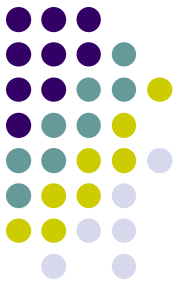
MASTER ADDRESSABILITY (3)



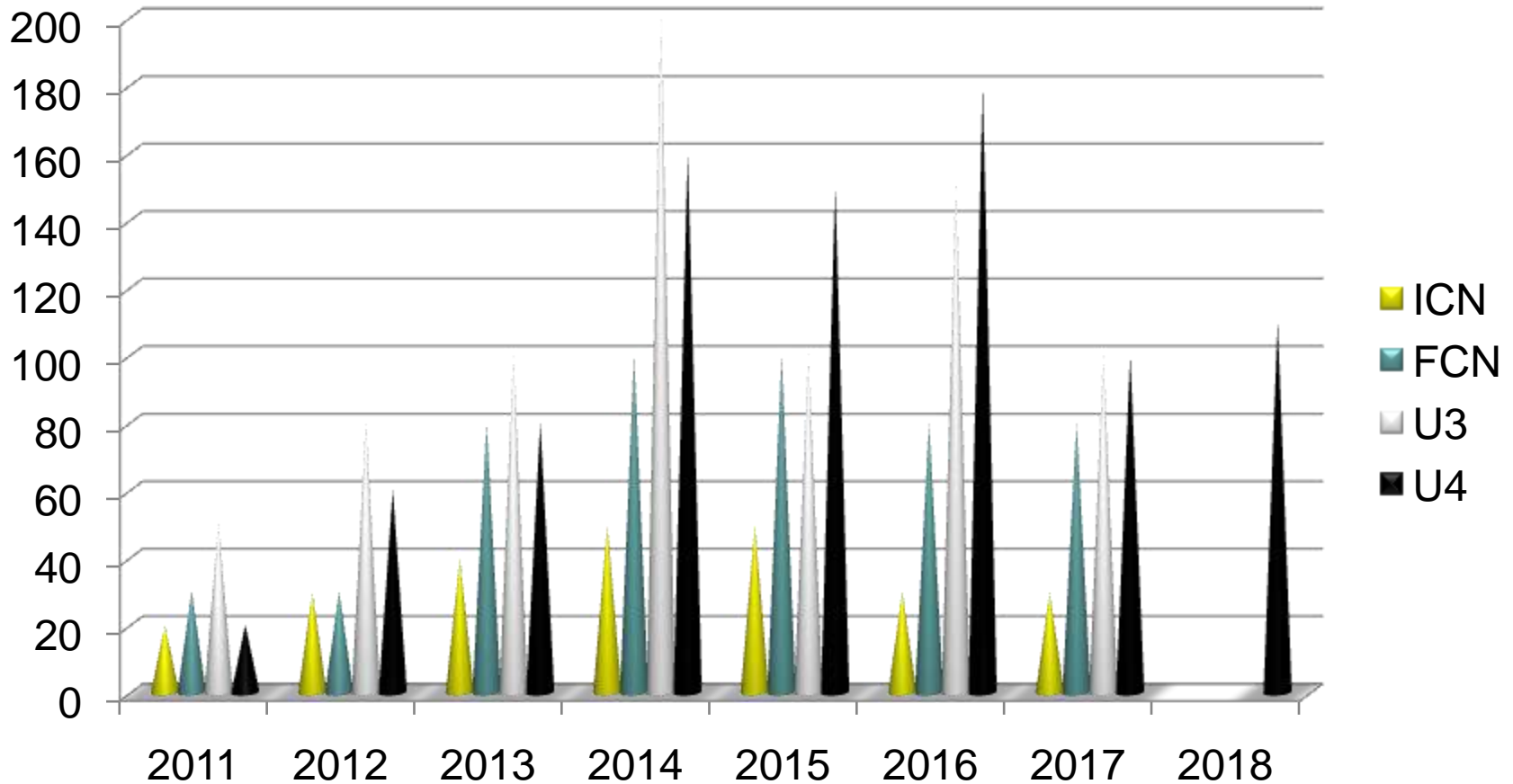
MASTER ADDRESSABILITY (4)



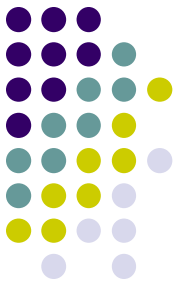
MASTER ADDRESSABILITY (5)



SUPPLEMENTARY HIGHER EDUCATION PERSONNEL ESTIMATED FOR TECHNICAL SUPPORT OF UNIT 3&4



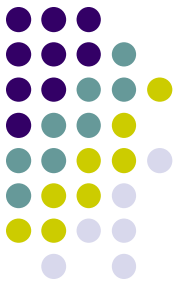
ELEMENTS PROPOSAL FOR A INTERNATIONAL REFERENCE CURRICULUM (1)



General inputs:

- Implementation of a “national nuclear programme” (nnp) based on nuclear fuel cycle in each country;
- Based on nnp is necessary to evaluate the number of necessary staff and the level of knowledge for each part of the programme for medium and long term period;
- To develop and to implement 2 level of cooperation mandatory for each country:
 - 1.The national level (between educational system, the patronages and the governmental agency's);
 - 2.International level (bilateral or under AIEA, EU, etc coordination programmes)
- To ensure the continuity of the knowledge in both sense: for the generations and for the trainers, for operators, high level management and agency's.

ELEMENTS PROPOSAL FOR A INTERNATIONAL REFERENCE CURRICULUM (2)



Some important activities based on Romanian experience:

- General knowledge: reactor physics, reactor components, radioactivity & radiation; management of nuclear safety, management of nuclear waste & decommissioning, measurements & control;
- Phenomenology (Two-phase flow regimes pressure drop, critical flow, condensation & evaporation);
- BOP of nuclear plants;
- National regulations and specific standards;
- International conventions and treaties.

Were we apply?(1)



**The Pitesti TRIGA
Nuclear
Research Reactor**

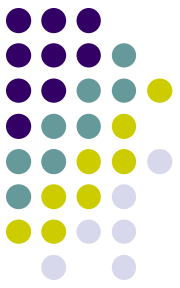


**The Post – Irradiation
Examination Laboratory
(LEPI hot cells)**

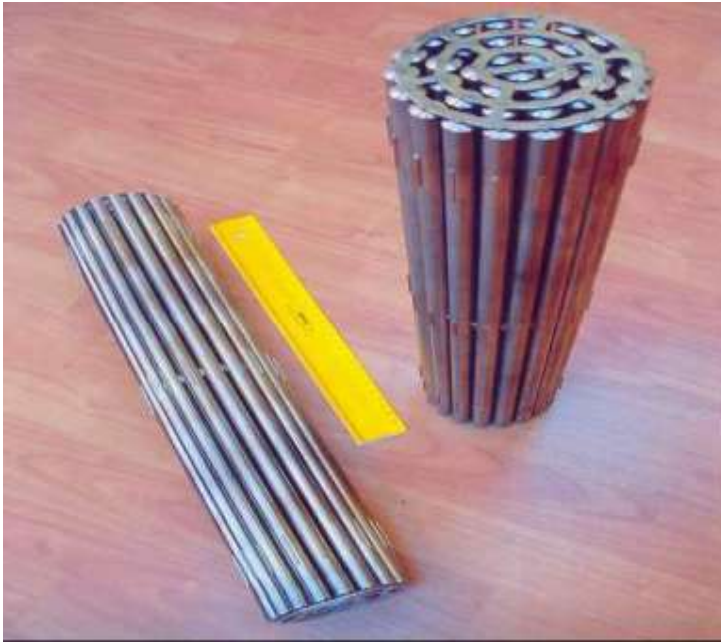


**Stand for Testing
the Fuelling Machine**

Were we apply?(2)

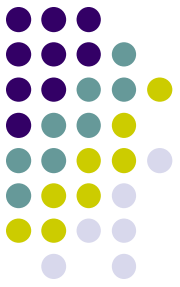


- Fuel factory
- Technical support for National Nuclear Programme
- Medicine and research applications

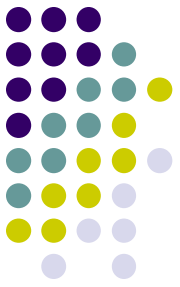


Were we apply?(3)-Romanian installations

- Operation - 2 power reactors-CANDU
- Planning – 2 power reactors



Were we apply?(4)



The Heavy Water Plant



The Feldioara
Uranium Ore
Processing Plant



National
Uranium Company (CNU)

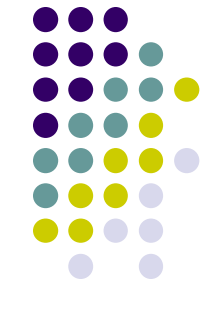
When the lights go on in Europe...

...half of them are
nuclear-powered

Secure and clean air energy
you can rely on.

www.foratom.org

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Thank You