

# CHALLENGES IN EDUCATION AND QUALIFICATION OF HUMAN RESOURCES FOR NEXT NUCLEAR GENERATION

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## ABSTRACT

The general goal of this paper is to present an overview of Higher Education and personnel qualification for Nuclear Field by the perspective of the International Atomic Energy Agency (IAEA), also by the Organization for Economic Co-operation and Development (OECD and by the United Nations Educational Scientific and Cultural Organization (UNESCO). On the other hand to present the challenge of the Brazilian Government in redesigning, since 2003, the role of the state in order to make it active for younger generations, while promoting growth and social justice, has guided in all actions carried out under the Policy of Human Resources Management of public personnel. The government should be able to formulate and implement public policies and decide among various options, what is the most appropriate for its Human Resources. For this, they require the strengthening of strategic intelligence and government adoption of new ways of interaction and participation. The role played by the Brazilian Nuclear Energy Commission (CNEN) in looking forward to replace and qualify its nuclear staff, as soon as up, since that the qualification of a human resource in this field demands more than one decade. Last but not least the proactive work of IPEN-CNEN/SP to encourage young generation to enter nuclear area, and the efforts of the Brazilian government to implement an integrated Nuclear Programme to form human resources, to attract and retain students in nuclear engineering and related specialized fields, and how this problem should attract the attention of the entire nuclear community, government and industry.

## 1. INTRODUCTION

In terms of education and qualification of human resources for nuclear area, there are some major problems involved, such as: the ageing of highly specialized workforce; the replacement and qualification of next generation staff; how to provide attractive nuclear educational; the role of high education in meeting global changes; how to improve access, equity and quality for a large number of persons all over the world. As reported by OECD, "...failure to take appropriate steps now will seriously jeopardize the provision of adequate expertise tomorrow - we must act now". [1]

The International Atomic Energy Agency (IAEA) has been working to respond to future workforce demands and to ensure adequate quantity and quality of nuclear education. Over the years the IAEA's has been focusing its activities to provide and to support the development of policies and strategies in nuclear education, and also to foster strong regional or inter-regional nuclear education networks [6].

The network between IAEA and universities were been profitable. The agreement between the IAEA and the European Nuclear Education Network (ENEN) will provide specialized

education in nuclear technology and reliability of the online training materials, for students in over four dozen cities in 18 European countries. The Deputy Director General and Head of the Department of Nuclear Energy, Mr. Yury Sokolov, said “We have confidence that our combined efforts and expertise will benefit all Member States who wish to have more opportunities and resources and new strategies for nuclear human resource development through internet-based education and training”[5].

The Organization for Economic Co-operation and Development (OECD) identified that the ageing of this highly specialized workforce as one of the major challenges to knowledge retention in the nuclear industry, since the average nuclear scientist is well over 50 years old [2].

“OECD proposes four fundamental features of lifelong learning:

- **A systemic view.** This is the most distinguishing feature of lifelong learning. The lifelong learning framework views the demand for, and the supply of, learning opportunities as part of a connected system covering the whole lifecycle and comprising all forms of formal and informal learning.
- **The centrality of the learner.** This requires a shift in attention from a supply-side focus, for example on formal institutions and arrangements, to the demand side of meeting learner needs.
- **Motivation to learn.** This is an essential foundation for learning that continues throughout life. It requires attention to developing the capacity for “learning to learn” through self-paced and self-directed learning.
- **Multiple objectives of education.** The life-cycle view recognizes the multiple goals of education – such as personal development, knowledge development, economic and social and cultural objectives – and that the priorities among these objectives may change over the life cycle.” [3]

By the point of view of the OECD a report argues that “Brazil has tremendous strengths and the ability to take immense strides forward in the medium term, there are formidable challenges which need to be faced. The country continues to be plagued by a number of weaknesses, hampering its potential for economic, technological and social development. Brazil also needs to put in place a more comprehensive policy framework for the broad diffusion of knowledge. The Brazilian innovation system and the productivity of research need to be strengthened, while the policy frameworks which are keys for disseminating the outcomes of research throughout society as a whole need reinforcing. These reforms should be carried out in such a way that they help build effective links to industrial activity and lead to the creation of marketable products”. [4]

The United Nations Educational, Scientific and Cultural Organization (UNESCO) published a **Global Education Digest** informing that an additional 51.7 million of new tertiary students were enrolled around the world and that 2.8 million students currently study outside their home country. Ten years after the first World Conference on Higher Education in 1998, participants at the 2009 Conference, that will take place from 5 to 8 July, will reaffirm **the role of higher education in meeting global challenges** - from poverty eradication to sustainable development - while examining strategies to improve access, equity and quality. UNESCO will seek for an internationally-agreement with a set of actions to ensure that

Higher Education and research play a strategic role in knowledge creation and sharing for a more sustainable, inclusive and development-oriented future. [7]

## **2. SCENARIOS OF HUMAN RESOURCES FOR NUCLEAR NEXT GENERATION**

### **2.1. The role of the Brazilian Government**

There are some scenarios for the Brazilian Government, the Brazilian Nuclear Energy Commission (CNEN), reporting to the Ministry of Science and Technology (MCT) and its Institutes, such as IPEN, in terms of Human Resources for the next nuclear generation.

For the purpose of this paper it is described below two points that will interfere directly with education, qualification and training of Human Resources for the next nuclear generation.

- In terms of nuclear next generation, the 2030 National Energy Plan (PNE 2030), drawn up by the Brazilian Ministry of Mines and Energy (MME) outlines a scenario for Brazil's energy demand and supply over next 20 years. It emerges from this planning exercise that Brazil would continue moving toward greater use of its domestic sources while modifications occur in the relative shares of the cane sugar and gas in the future, and a reduction in the share of the external inputs in total energy supply future.<sup>1</sup>
- In terms of training and development of personnel for public administration, the edition of the Decree no. 5707, from 23 February 2006, established Policies and Guidelines for the Development of Personnel incorporating the concept of management by competences and skills in the Federal Public Administration. This approach has among its objectives the adequacy of competences and skills required of the public servers to the goals of institutions and the development of permanent civil servants, the rationalization and effectiveness of spending on training. This Decree introduced the notion of competence and development of all the knowledge, skills and attitudes needed to develop the functions of servers, in order to reach the goals of the institution.<sup>2</sup>

### **2.2 The role of CNEN**

The Brazilian Nuclear Program (PNB) outlined at the PNE, CNEN is developing four priority actions: (1) the construction of the Multipurpose Brazilian Reactor (RMB) to conduct research and production of radiopharmaceuticals, (2) the development of the project to hold tailings from medium and low activity, the development of design and prototype for fuel tank used; (3) and the project the Brazilian Nuclear Regulatory Agency.<sup>3</sup>

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<sup>1</sup> Text from: [www.iadb.org/intal/.../i\\_INTAL\\_ICM\\_145\\_panoramaregional\\_2.pdf](http://www.iadb.org/intal/.../i_INTAL_ICM_145_panoramaregional_2.pdf) (2009)

<sup>2</sup> Text base for the National Congress of Human Resources for Federal Public Administration (2009)

<sup>3</sup> COMISSÃO NACIONAL DE ENERGIA NUCLEAR-CNEN. Projects of CNEN Available on: <http://intranet.sede/presidencia/lst-mensagens-pres.asp>, (2009)

Nowadays, CNEN has the HR necessary to their duties. It has a total of 2,756 persons, of whom 85% are technical staff, working in CNEN and its Institutes and of these, 48% have university degree, 17% have Master's and 7% Doctorate degrees. Enough but insufficient for the implementation of the PNB, specially considering those points outlined in this paper: the ageing of this highly specialized workforce; the reduction of staff, without alternative replacement; the lack of attractive nuclear educational programmes in Brazil; since a few Colleges or Universities and Research Institute offers Nuclear Education. So, the challenge of CNEN and its Institutes in terms of education and qualification of HR for the next nuclear generation is severely immense.

### **2.3 The challenge of IPEN in terms of HR of the nuclear next generation**

Some scenarios were constructed by IPEN when the update of its strategic planning were identified, among other critical factors, the need for urgent replacement of the table of servers, such as a variable that affects all the possible scenarios for the future of the institution.

To enable the institution to align their decisions and monitor the demands of the National Energy Plan (PNE-2030) which includes targets for expansion of supply in the nuclear area with the resumption of Angra 3 (prediction of initiation in September 2008) and four other nuclear power plants, requires the maximization of the use and development of human potential.

The Human Resource Manager had drawn up some Institution actions necessary for the integrated management of people, such as:

1. **Attracting skills** - skills add to the organization, the medium and long term, through procurement and expansion opportunities for the entry of students with scholarships and the provision of new fronts of activities in education.
2. **Manage and retain skills** - for effective management of people is essential to the succession planning for career; mobilize, evaluate performance; reward and recognition plans among other actions.
3. **Train skills** - match performance with organizational objectives require the server powers that go beyond the execution of tasks, so that the institution seeks to strengthen the capacity to learn of your body working with the systematization of a Plan of Development (training,) from the real needs and demands of not random. [9]

In accordance with Decree No. 5707/2006 and Decree 208/2006, of 25/07/06, the adoption of a management model for competences and skills it is compulsory for the entire Federal Government. In this sense, the CNEN and its Institutes has been, since 2006, adopted their guidelines to government requirements.

The IPEN, based on the lines of R & D activities and defined in its Master Plan, which in turn are guided by national priorities guiding the strategy of S & T and Innovation of the MCT and the directives of CNEN, IPEN initiated in April 2008, construction of its Master Plan for People Management, from the development of the mapping work of the technical skills and needs of staff.

The methodology adopted in this work, in order to identify the needs of Human Recourses by the year 2010, was comprised of three phases, described below: <sup>4</sup>

**Stage I:** description of technical competences and skills, current and required, from the lines of R & D as defined in the Master Plan IPEN for the period 2007-2010;

**Stage II:** mapping the needs of staff from the calculation of the functions available in current units, and those required for compliance with the lines of R & D and activities outlined in the Master Plan for the period 2007-2010.

**Phase III:** Consolidated mapping plan, effective and necessary, according to the sub-programs and programs outlined in the Master Plan of IPEN.

In light of the alternatives presented **three scenarios were produced**, namely:

### **I. SCENARIO reduction of activities**

Data as of July 2008, the population of IPEN was 1,023 personnel. If maintained a continuous reduction of staff, without alternative replacement of the staff we have approximately 750 persons by 2010, which would mean an accelerated reduction of the activities of the institution.

Indicators signal a narrow focus, if not change the current conditions, namely: the average age of staff is 48 years and estimates that ~ 363 people come to retire by 2010; this scenario will be the IPEN loss of more than 30% in its capacity to act.

### **II. SCENARIO expansion of activities**

In this scenario the IPEN expands partnerships with institutions and public and private companies and, consequently, the financial resources arising from these partnerships. The use of alternative models of obtaining financing through funds sector, with promotion agencies and the Law of Innovation opens new opportunities to even be the replacement of staff.

The results obtained with the mapping of skills and needs of staff in accordance with the positions of the Plan of Careers in Science and Technology, to careers in Research, Technological Development and Management, Planning and Infrastructure in C & T .

### **III. SCENARIO gradual acceleration**

At the Brazilian Nuclear Program is outlined the installation of 5,345 MW in nuclear power plants in the Southeast and Northeast (Angra 3 and four more plants of 1,000 MW each).

To make a gradual growth of its activities and monitor the pace of expansion, considering the prediction of the PNB to build 7 nuclear reactors will **require replacement average of at least 250 people every 5 years**, for the rebuilding of framework in 1500 personnel until 2030.

The proactive work of IPEN to implement its Master Plan for the Management of People it will be necessary the development of some efforts, such as:

- Alignment of the entire chain of HR, on the basis of competences and skills;

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<sup>4</sup> The methodology adopted in this work was developed by the Human Resources Manager, Pupak, M. O., IPEN-CNEN/SP

- Knowledge Management focused on business, considering the "gaps" of competences and skills identified;
- Training of managers to effectively promote the development of people;
- Integrated Information System for all key processes of the Institution;
- Preparing the personnel staff for future functions, from the elaboration of planning of actions for development;
- Development of competences and skills that add value to professional Institution. [10]

### 3. CONCLUSIONS

In Brazil, as in other member countries of IAEA, the value of training is highly regarded. There are not many companies in Brazil that offers training for both new graduates and experienced staff with the aim of increasing the competence of the trainees in their specific function within the organization. For the purpose of this paper let's consider two examples. The first one shows how industries may provide highly qualified employees to meet its specific needs on nuclear area and the second example is based on the recommendation on how the Government should provide support to develop "educational networks or bridges" (as reported by OECD) between universities, industry and research institutes [8]

Taking into consideration all the points and scenarios of education and qualification of HR for nuclear area is a fact that the replacement of nuclear staff with high qualification of scientists, engineers and technicians of many disciplines, happens to be on those days, a hard work. Also, that the replacement of nuclear personnel is shrinking and this problem requires immediate attention of the entire nuclear community (academic communities, government and industry).

Considering the jobless problem, the vast area of the country and the population demands for education, the Brazilian government should implement an integrated nuclear program to form human resources, attract and retain students in nuclear engineering and related specialized fields. It is needed a co-ordinate work between research institutes and universities to encourage and reduce the negative perception of the younger generation to nuclear area. Those initiatives are still incipient, since weak government support for scholarship, fellowship and traineeships are not enough to signalize for this young generation the future needs in this area. With insufficient budget from government the impact and deterioration of nuclear education in Brazil will be still widespread. The work to be done is to bring the attention of Brazilian Politicians to the importance of the government orientation to long-term future nuclear issues. Last but not least should be the establishment of a cooperation management between IAEA and CNEN in order to support scholarship for young scientists with a potential to further develop nuclear sciences in Brazil. [8]

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