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Uranium extraction from phosphates: Background, opportunities, process overview and way forward for commercialisation

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Socio-economic up-gradation for major part of global population, particularly in developing countries will call for large growth of electricity demand. The fact that 2 billion of world's 7 billion population do not have access to electricity justifies this growth projection. Environmental concern along with increasing demand for other essential ingredients for improved standard of living like affordable food, water, healthcare etc. will encourage large growth in nuclear technology utilisation.

While conventional uranium resources will continue to be the major source for meeting the resultant surge in uranium demand, there is a need to look forward beyond this. Inherent advantage of uranium extraction from phosphate (UxP) is that it is the by-product of phosphate fertilizer industry. There is no need for separate mine development, ore processing or tailing disposal. Feed phosphoric acid is available from phosphate industry in ready to use condition. UxP thus enables recovery of energy resource otherwise lost for ever besides making the fertiliser cleaner. UxP has also potential to make phosphate industry economically more viable and socially more acceptable. Phosphate industry also benefits from cleaner return acid making operation of downstream plant simpler and cleaner besides possible value addition of the product basket

Due to low uranium concentration in source material, normally in the range of 80 –150 ppm, and several process and engineering issues inherent to this relatively difficult separation process, large scale commercial deployment will depend on development of commercially viable technology. Though the process has been utilised for production of uranium in the past, before setting up a new commercial facility, it is imperative that its techno-economic feasibility be established considering all related aspects of the proposed facility. This will address the difficulties encountered in earlier plants, problems related to wide variation in physical and chemical characteristics of phosphate ore / phosphoric acid and ensure cost effectiveness by fine tuning the process integration, equipment selection and optimisation of process parameters. To improve success rate of programme implementation, this is best done by using a proven tool for managing life-cycle of 'technology development to commercialisation'and by following a systematic approach towards feasibility study.

Proven approach is to develop competencies in all related field of chemistry, process, technology and commercialisation by successively engaging in research, development, demonstration and deployment. Engaging concerned professionals in these activities and systematic transition from one activity to the next enables all stakeholders to get familiarised with related challenges and ways to overcome them. The generated institutional knowledgebase helps in timely project completion as well as achieving desired performance from the installed facility. During plant operational phase, this institutional knowledgebase helps in improvement of several performance parameters like energy efficiency, resource consumption, capacity utilisation and thus overall economy of operation.

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