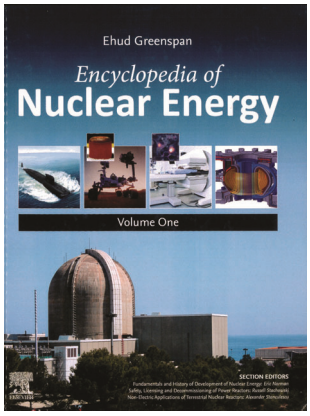


Encyclopedia of Nuclear Energy, Vols 1 to 4. Ehud Greenspan (Editor-in-Chief). Elsevier, Radarweg 29, P.O. Box 211, 1000 AE Amsterdam, The Netherlands. 2021. 3656 pages. Price: US$ 2800.

This four-volume encyclopedia is a valuable addition to available reference material on nuclear energy, particularly in the contemporary context. It comprehensively covers all aspects of nuclear energy, nuclear reactions and nuclear radiation, beginning with their role in evolution and the shaping of our universe and planet earth, covering in detail the discoveries and developments in this relatively new branch of knowledge over the last 125 years. Potential new applications and related work that may become important in future are also covered.

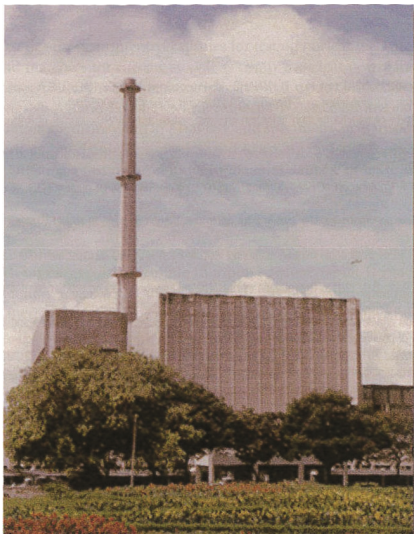
As stated by the Editor-in-Chief Ehud Greenspan in his introduction, 'the encyclopedia is intended to be an invaluable resource for students and will make an important contribution to the preservation of the vast amount of knowhow developed since the dawn of nuclear era in the nuclear energy related fields and to its transfer to the new generation.' The objective is clearly met through comprehensive coverage of the related subjects in the four volumes spanning around 1000 pages each. Besides, it is also a valuable resource for a large number of researchers in industry and academia as well as practitioners working in nuclear energy, including a large number of allied domains. The encyclopedia is of value to members of the public who may be interested in addressing their curiosity with regard to a variety of related topics. It covers the domain through 272 cross-referenced thematic articles written by experts (including some from India) arranged in 13 sections, each having its own separate editor. Each article is backed up by a comprehensive reference list, relevant websites and further reading material in some cases.

The encyclopedia extensively covers the fundamentals and history of the development of nuclear energy, different types of nuclear reactors – for research, material testing, commercial power reactors in vogue and under development, nuclear power for space and propulsion, non-electric applications of terrestrial nuclear reactors, nuclear reactor safety licensing and decommissioning, nuclear fuel and fuel cycles, nuclear waste and its disposal, radiation protection, nuclear fusion R&D, medical, industrial and agricultural applications of nuclear technology and social issues.

Deployment of nuclear power plants, beginning in the sixties of the last century made rapid progress and reached around 17% of the electricity produced worldwide. This growth was dampened following the accident at Chernobyl in 1986. The nuclear industry has been a learning organization, and has continuously improved its safety and performance record. Rising demand for energy, particularly in new emerging economies and concerns about the sustainability of energy resources did rekindle a mild positive trend in nuclear power deployment around the time the new millennium began. This however got significantly dampened again because of the Fukushima accident in 2011. The share of nuclear energy which was at 10–11% around this time has remained at the same level largely due to growth in new economies primarily led by Russia, China and India. Now, with the climate change catastrophe looming large and the inevitable thrust towards net zero, clean energy sources are in demand. Nuclear energy being a dispatchable clean source of large potential and the only significant one in several countries, has thus again started gaining importance. There is thus a renewed emphasis on exploring a variety of ways to address different challenges faced by nuclear energy and effectively facilitate the clean-energy transition. These include policy debates to soften barriers to the deployment of nuclear energy, evolving technological solutions to suit the needs of different markets and public debates in the context of nuclear energy and its role in the clean energy mix that needs to be evolved. In this context, the encyclopedia is comprehensive enough to address curiosity, information needs and potential approaches going forward covering this entire spectrum.

Scientifically, it is well established that nuclear energy is one of the safest modes of energy production. Studies following Chernobyl and Fukushima accidents have in fact underscored this and have brought out that psychosomatic effects resulting from the massive displacement of people lead to a more harm than radiation risks which such displacements aim to prevent. It is thus imperative that while the public must always remain protected from the harmful effects of radiation, the trauma as a result of large-scale displacement must also be avoided. Several new approaches are being worked out towards this end. For example, the development of accident-tolerant fuel, prevention or limiting core heat-up and elimination of adverse impact in the public domain. The encyclopedia covers most of these concepts well. While there is nothing like zero risk, it is important that the world moves towards trauma-free deployment of nuclear energy. In the short run, however, prevention of climate change-related catastrophe with assured public safety, which must be accomplished in less than three decades from now, has become a matter of greater urgency and would call for large-scale nuclear energy deployment leveraging established nuclear reactor technology. The present stage of development of nuclear technology would surely permit this and the encyclopedia contains sufficient material to at least initiate interested professionals in getting the requisite insights.

There is yet another key dimension. In a net-zero world, while there would be a sizeable increase in the demand for clean electricity for e-mobility and other needs for motive power in place of fossil energy, fossil-free hydrogen and/or chemical fuels



Dhruva reactor – an external view.

derived from such hydrogen, would also be required to replace fossil hydrocarbons in the industry and heavy cross-country transport domains. Production of hydrogen in required quantities would need high-temperature heat either from concentrated solar thermal or high-temperature nuclear reactor sources, and technology to carry out the thermochemical splitting of water. A shorter-term possibility is to carry out steam electrolysis using clean electricity. In either case, this would lead to significantly enhance the share of electricity in the overall energy demand. The share could tend to be most of it, in case electricity has to be used for production of hydrogen. A higher share of electricity would also lead to additional demand for renewable and nuclear energy resources. The encyclopedia extensively covers various technologies such as high-temperature nuclear reactors, thermochemical splitting of water, steam electrolysis and the use of hydrogen in different industry segments.

Applications of nuclear energy go well beyond established electricity production or supporting the hydrogen economy. There are several applications of nuclear reactors such as supporting research, district heating, desalination of sea water, marine transportation both on the surface and under water, space transportation and others. Besides, there are applications for electricity production using radioisotopes. Fusion energy may well be the next energy frontier for human survival in the future. Besides fission and fusion energy, radiation applications have made important contributions in sectors such as medicine, agriculture, industry and others. They have made tremendous impact not just in advanced countries, but also in developing countries of the world. All these are well covered in the encyclopedia.

Nuclear fuel and special materials used in nuclear energy-related activities, their manufacturing cycle as well as aspects of nuclear waste management are covered in the encyclopedia. These technologies as also allied subjects like radiation effects on living and non-living matter, radiation dosimetry, radiation protection are also comprehensively covered.

Search for energy and its use along with related technologies has been a prime driver of rising human capability. The increasing demand for energy and finiteness of energy resources has led to energy transitions in the past. Waste arising because of increasing use of energy and its impact on the earth's environment have also become a matter of serious concern. Global warming due to greenhouse gas emissions, primarily because of fossil energy use, has brought the world close to a catastrophe. Even so, there is a larger part of the world still suffering from energy deprivation. There is thus a dual challenge of providing the deprived world with the required amount of clean energy, while at the same time driving a new energy transition that effectively realizes the global net-zero emission by the year 2050, the date determined through studies by the Intergovernmental Panel on Climate Change. It is now becoming increasingly clear that nuclear energy is important in this context. Greenspan has devoted a significant portion of his introduction to this aspect and this seems to have significantly impacted the development of the contents of the encyclopedia. It is interesting that apart from many articles dealing with various aspects of energy transition where nuclear energy can play a significant role and the sections devoted to issues of safety and waste management, the encyclopedia has a full section on social issues of nuclear energy and even an article titled 'Environmentalist's dilemma'. After all, given the fact that the net additional energy needs would be much larger in the developing countries, most of which would have to be derived from nuclear energy, this clearly is a complex issue requiring a well-informed comprehensive debate involving the youth who are going to be the most affected. The publisher and the editors should be commended for their vision to transfer knowledge to the younger generation in the overall context of clean-energy transition in which nuclear energy would necessarily play a key role.

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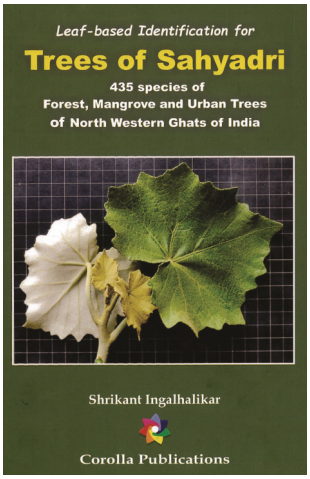

Leaf-based Identification for Trees of Sahyadri: **435 Species of Forest, Mangrove and Urban Trees of North Western Ghats of India.** Shrikant Ingalhalikar. Corolla Publications, 12, Varshanand Society, Pune 411 051. 2021. 400 pages. Price: Rs 1500.

Identifying floral elements and documenting their abundance/rarity, and distribution in the form of floras or field guides is a prerequisite for resource awareness and conservation. It is tough to identify and distinguish any live plant from others by its correct name based on a single or multiple attributes of a single organ. This happens when leaf morphology is chosen as the basis for identifying one tree species from others. The task would be more challenging if the same leaf features were applied to larger aggregations such as families or genera. As plant life fascinates one and all, amateurs often attempt such documentation with interest and commitment. The present attempt by Shrikant Ingalhalikar concerns tree recognition based on the application of leaf features and without the support of floral morphology. One conceivable reason for thinking of recognizing trees based on leaves may be that many trees present themselves in a vegetative state for a major part of the year. Hardly a few trees exhibit year-round flowering, but hide the inflorescences in distant and dense canopies. Only some deciduous trees, in contrast, flower profusely when they are leafless, and then the flowers could become the basis of recognition. Another good reason could be to bring awareness among common people who can use leaf morphology relatively easily and can circumvent more complicated conventional terminology used by taxonomists in species identification.