Document Control Sheet

1	**Document No and Year**	:	NIAS/NSE/EECP/R/RR/14/2024 dt. 07 November 2024
2	**Title**	:	Technology Assessment of Select Small and Modular Reactors (SMRs) to Achieve Net Zero with Energy Security in India
3	**Type of Document**	:	Research Report
4	**No. of Pages and Figures**	:	92 + vi pages, 6 tables and 7 figures
5	**No. of References**	:	82 key references (for the main text part)
6	**Editor**	:	Rudrodip Majumdar, Raja Ram Singh Yadav, A.V. Krishnan, R. Srikanth
7	**Originating School**	:	Natural Sciences and Engineering
8	**Programme**	:	Energy, Environment, and Climate Change
9	**Collaboration**	:	NA
10	**Sponsoring Agency**	:	International Sustainable Energy Foundation (ISEF)

11 **Abstract:**

India's cumulative emissions from fossil fuels and industry between the start of the Industrial Revolution in 1750 and the end of 2021 amount to only 3.3% of the World's total. As per the World Energy Outlook, India's per capita emissions in 2023 are only 42.6% of the World average and much less than those of the developed countries.

Since India's energy needs are also growing rapidly to overcome its development deficit, the country's share in global CO2 emissions will increase along with its share in the global electricity generation till fossil-fuel-free energy sources are scaled up to meet the electricity baseload demand.

India's Nationally Determined Contributions (NDCs) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in November 2022 include raising the 2030 targets for all non-fossil fuel sources of energy to 500 GW, and the implementation of a 'Long-term Low Carbon Development Strategy (LT-LEDS)'. Nuclear power is included in these NDCs and the LT-LEDS.

The rapid expansion of NPPs is a reliable and efficient way to mitigate climate change and achieve multiple SDGs since nuclear power can generate firm, zero-carbon electricity at affordable tariffs while providing important co-benefits such as high-skill jobs in technology, manufacturing, and operations, besides enhancing community development. Small Modular Reactors (SMRs) are designed with a smaller core damage frequency and source term compared to conventional NPPs and include enhanced seismic isolation as well as several passive safety features, resulting in a lower potential for unsafe radioactive releases into the environment. Therefore, SMRs can be located much closer to population centres compared to conventional NPPs.

As part of an ISEF-sponsored project, NIAS has formulated a technology evaluation methodology for SMRs as a critical input to select suitable SMR technologies for serial manufacture and deployment in India.

12	**Keywords**	:	Climate Change; Small Modular Reactor; Technology Evaluation; Technology Selection; Energy Transition; Nuclear Regulatory Considerations
13	**Security Classification**	:	Restricted