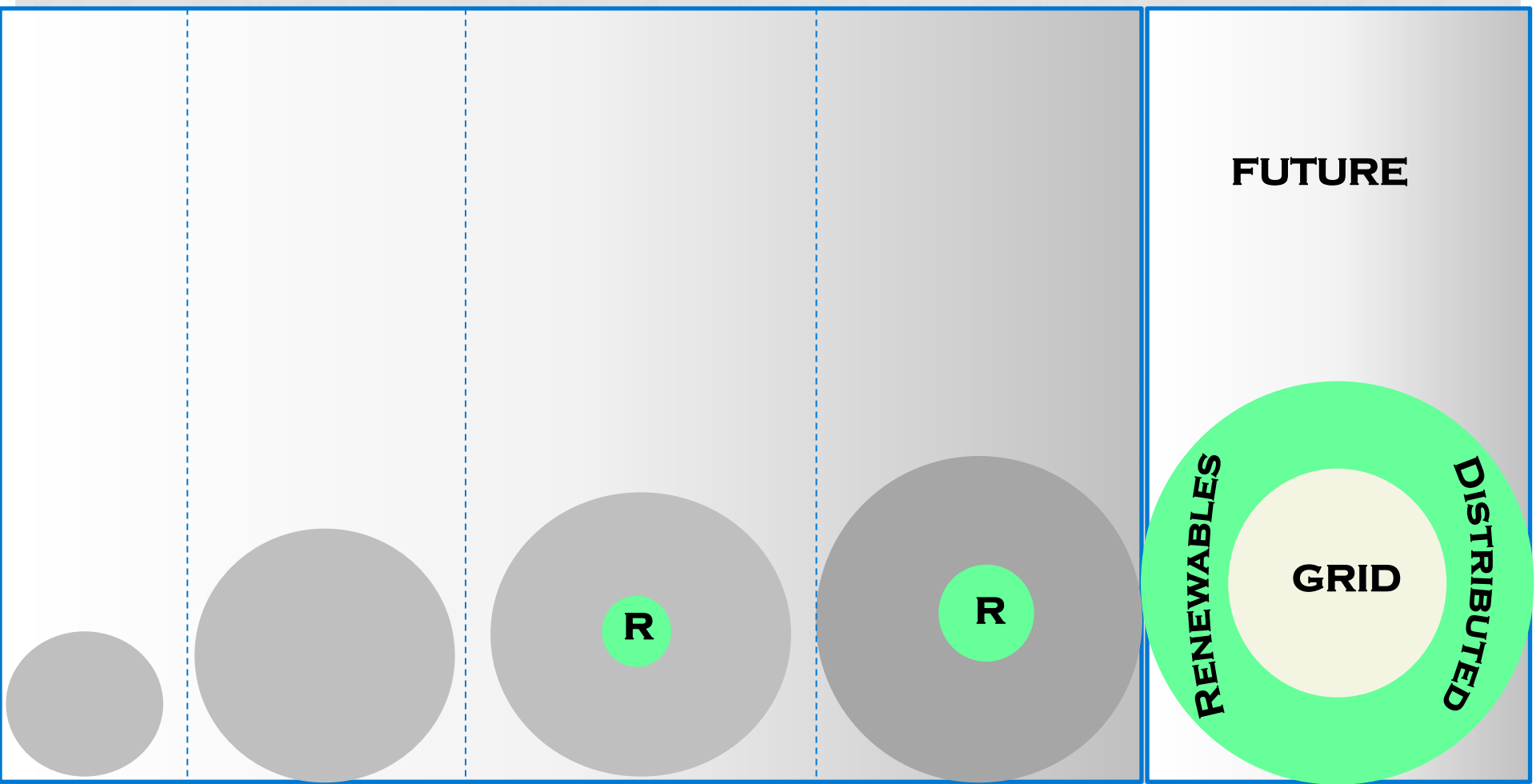


IHFC CONFERENCE 2017

WARM GREETINGS FROM THERMAX LIMITED



Power generation across generations



IN-SITU

CITY

GRID

**CONTINENTAL
GRID**

FUTURE

R- RENEWABLES

Energy Market Movement

Zero Emission

**Solar
Wind
Geothermal
Tidal
Fuel Cells**

Zero Emission + Firm

Fuel Cells

THERMAX PORTFOLIO

- 400-500 USD/ kW with an onboard MeOH Reformer
- Low-Med Temp FCs – DRDO, CSIR, IITs
- Hybridization, Integration & Heat Recovery - Space Cooling/ Heating
- Gasification Technologies
- Coal to Gas to Methanol
- In sync with Gov/ NITI Aayog – Electrification, eV, Mobility beyond roads
- Fuel SCM

MAKE IN INDIA

Indigenous production

Importantly, NMRL's development of indigenous PAFC stacks has been done in close cooperation with Indian industry. In fact, NMRL developed PAFCs are the first examples of successful industrialization of any FC type in India. NMRL has transferred PAFC technology to Thermax Ltd, Pune which began production with the supply of twenty-four 3 kW PAFC units for captive use at NMRL via a buy back arrangement. According to CSIR, Thermax's facility 'is provided with all sub-manufacturing modules to manufacture electrodes from basic raw materials, assemble them in the form of fuel cell stacks and conduct elaborate testing of each stack for meeting the strict quality control requirements of NMRL necessary for defence establishments'. It seems that large scale skilled manpower for the manufacture of fuel cells has also been developed in the course of industrializing NMRL's PAFC technology.

NMRL and Thermax have now graduated to the production of the N11, 11.5 kW marine grade PAFC stack shown below that has a rugged cocoon structure and has passed shock and vibration tests that one may experience during intense underwater operations. Such parallel / series connected PAFC stacks can be used for power generation levels of up to 500 kW, thereby underlining the modularity of NMRL's AIP solution which can be used in submarines other than the Scorpene as well.

THERMAX'S FUEL CELL FACILITY



Only company in India with a manufacturing + testing capability

THANK YOU

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