



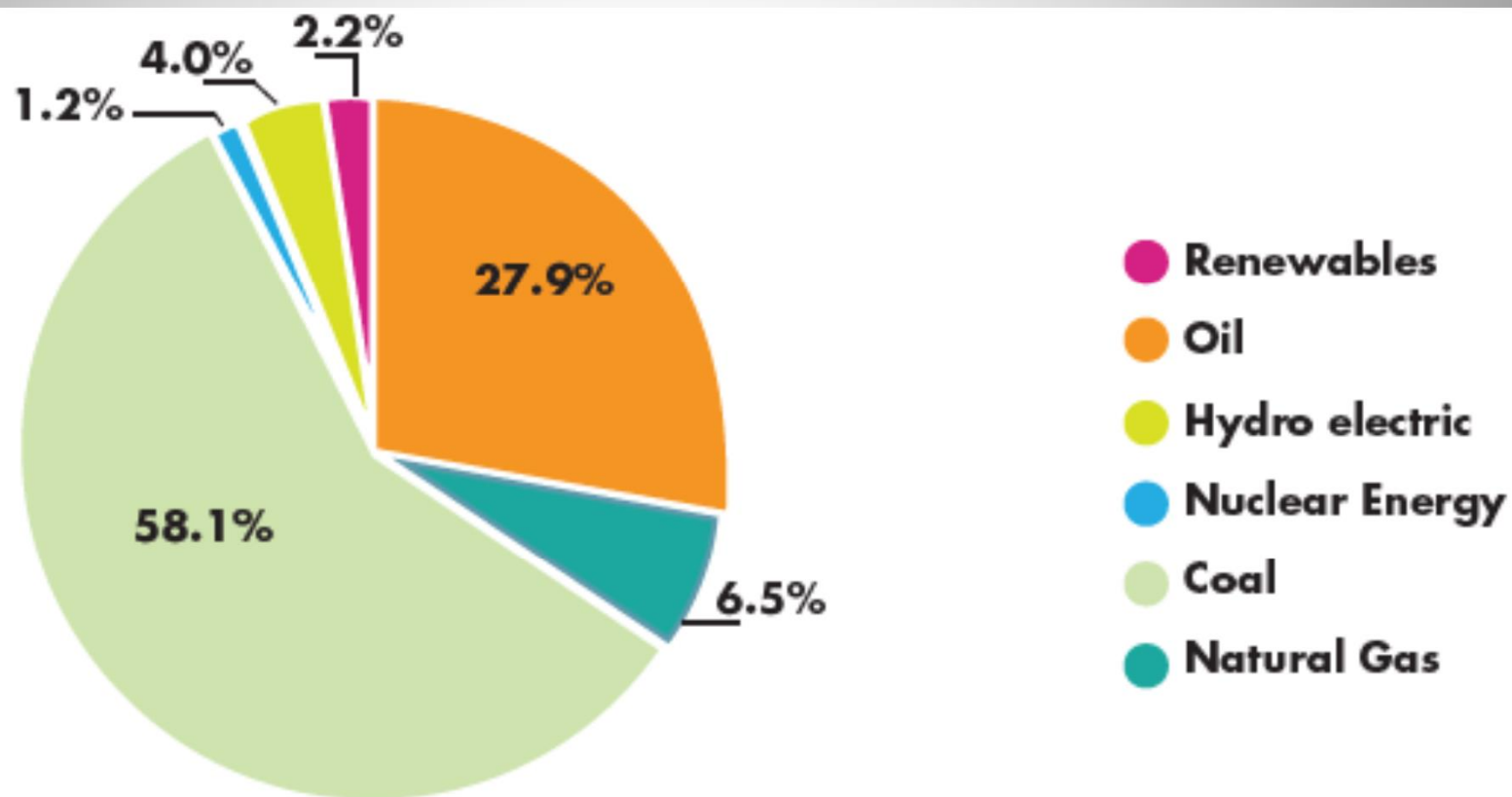
India Initiatives in Clean Energy Innovation

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Department of Biotechnology - MoS&T, GOI

Energy Mix of India





Renewable share in Total energy mix in India

Peak Electricity Demand 159 GW

Total Installed capacity 310 GW (Thermal (69.4%), Hydro (13.9%), Renewables (14.8%), Nuclear (1.9%)

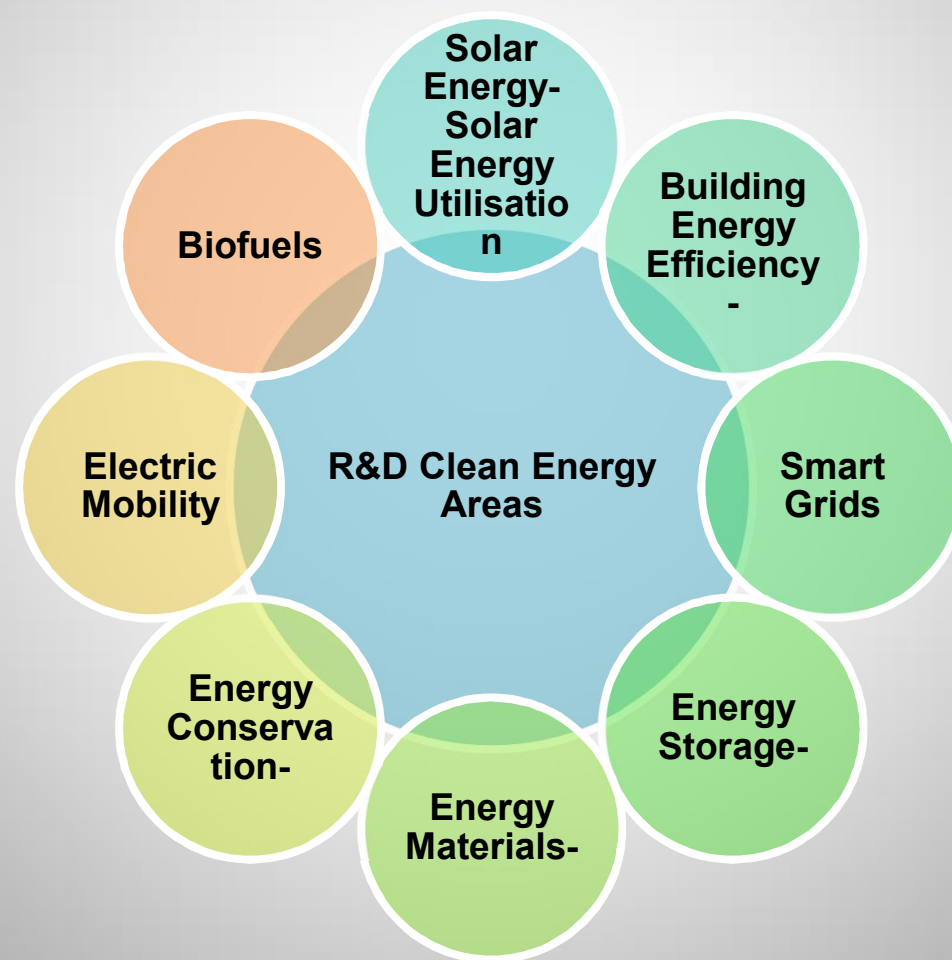
Enhanced penetration of Renewable energy **45.9 GW**

Target of 175 GW by 2022 (Solar, Wind, Biomass, Hydro)

The key Energy Objectives

- Increasing energy security
- Reducing Energy Poverty
- Improving Energy Sustainability

R&D Clean energy Areas





DBT's Bioenergy Roadmap-Vision 2020

DBT Mandate: To promote R&D and Innovation
And develop economically viable biofuel
production technologies

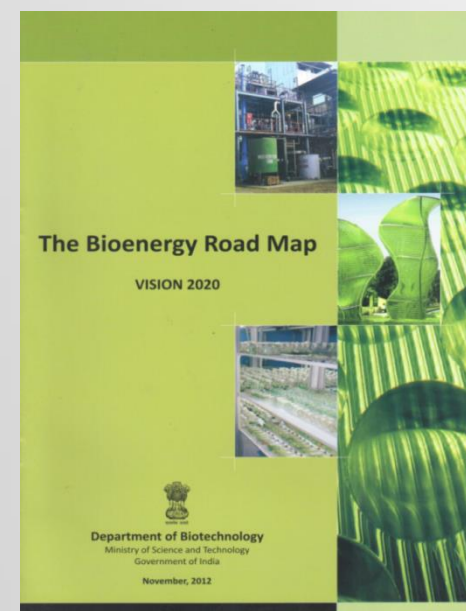
The National Biofuel Policy-2018

Vision 2020 -Bioenergy Road Map for R&D

Promote cutting edge R&D and Innovation

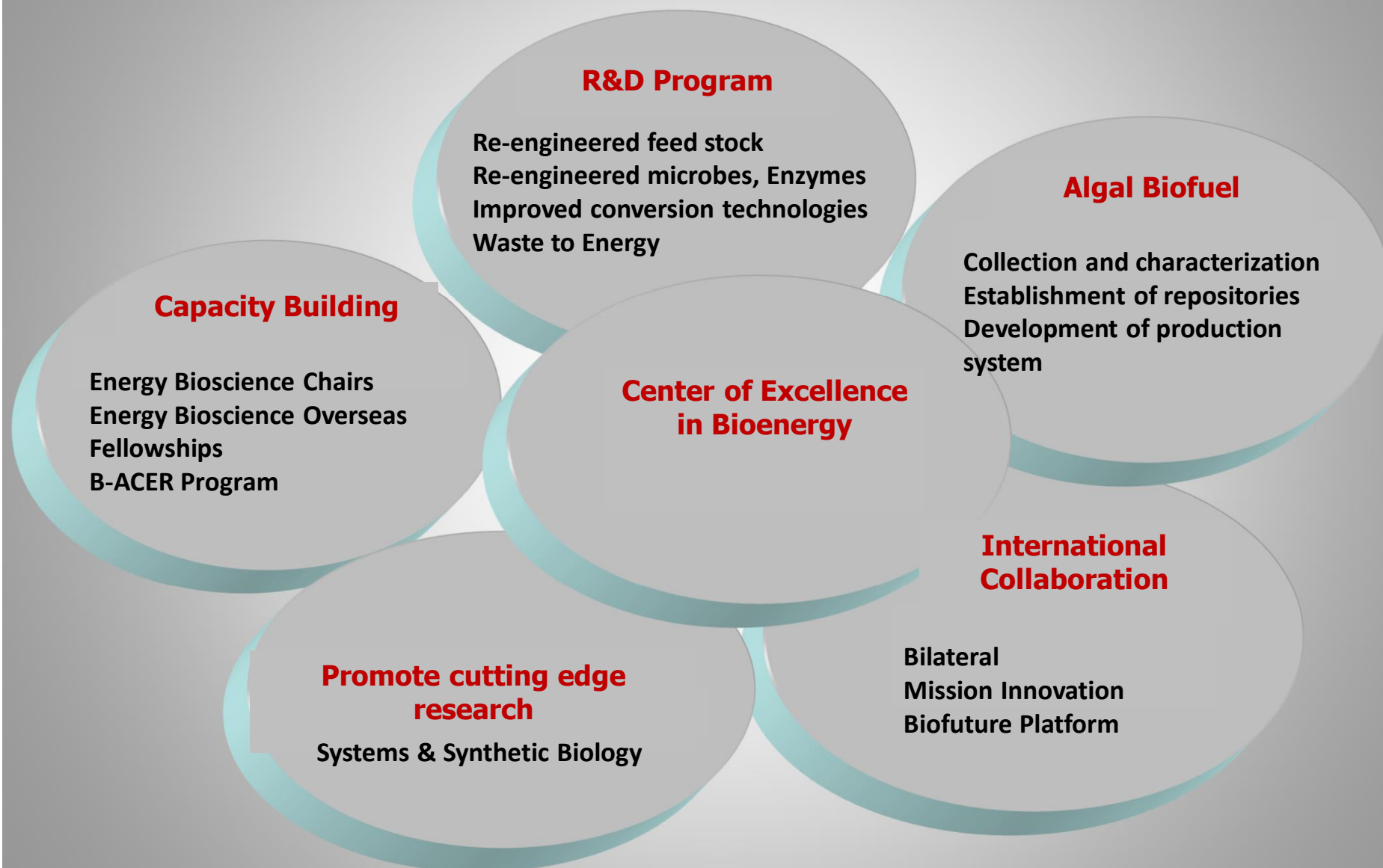
Areas of Focus

Feedstock development, Technology improvement for 2G Ethanol, Biodiesel, Biobutanol, Hydrogen, Bio-CNG, Drop-in fuels, Waste to Energy





Various Schemes for Implementation in Biofuel R&D



Department of Biotechnology- MoS&T



Center of Excellence in Bioenergy

1. DBT-ICT Center for Bioenergy, Mumbai
2. DBT-IOC Center for Advance Biofuel Research, Faridabad
3. DBT-ICGEB Center for Bioenergy, New Delhi
4. DBT-Pan IIT Center for Bioenergy (Virtual Center of 5 institutes)
5. DBT-TERI Center of Excellence for Biofuel and Bio-commodities





2G Ethanol Pilot Plant based on DBT-ICT Technology



Continuous Steam Explosion Pilot Plant (DBT-IOC Centre, Faridabad)



CO₂ to high value Lipids Pilot Plant (at DBT-IOC Centre)



100 Litre continuous fermenter

Algae used sewage water treatment





Demonstration Projects in partnership with stakeholders

Demonstration Plant to convert
1-10 TPD MSW into Energy (By DBT-ICT at BPCL Colony)

Rapid Anaerobic Digestion Technology (Mumbai)

High rate Bio-Methanation of organic fraction of MSW
(Hyderabad)

Co-Fermentation of Kitchen Waste and Fecal Sludge-
(BITs Goa with Village Panchayat)



Department of Biotechnology- MoS&T



Capacity Building in Clean Energy

Fellowship / Awards/ Training programs for PhD Students

Young Scientist –short term visits

Conferences /Seminars

Clean Energy Areas

Bioenergy Awards for Cutting Edge Research

Bhaskara Advanced Solar Energy Fellowship Program

Early Career Research Awards

Start up –Research Grant

Post Doctoral Research -Overseas Fellowship (Re-entry program)



International Cooperation in Clean Energy

US – India Joint Clean Energy Research and Development Centre

Dutch- India LOTUS Project on Cleaning Barapullah Drain

Brazil–India Biofuel projects

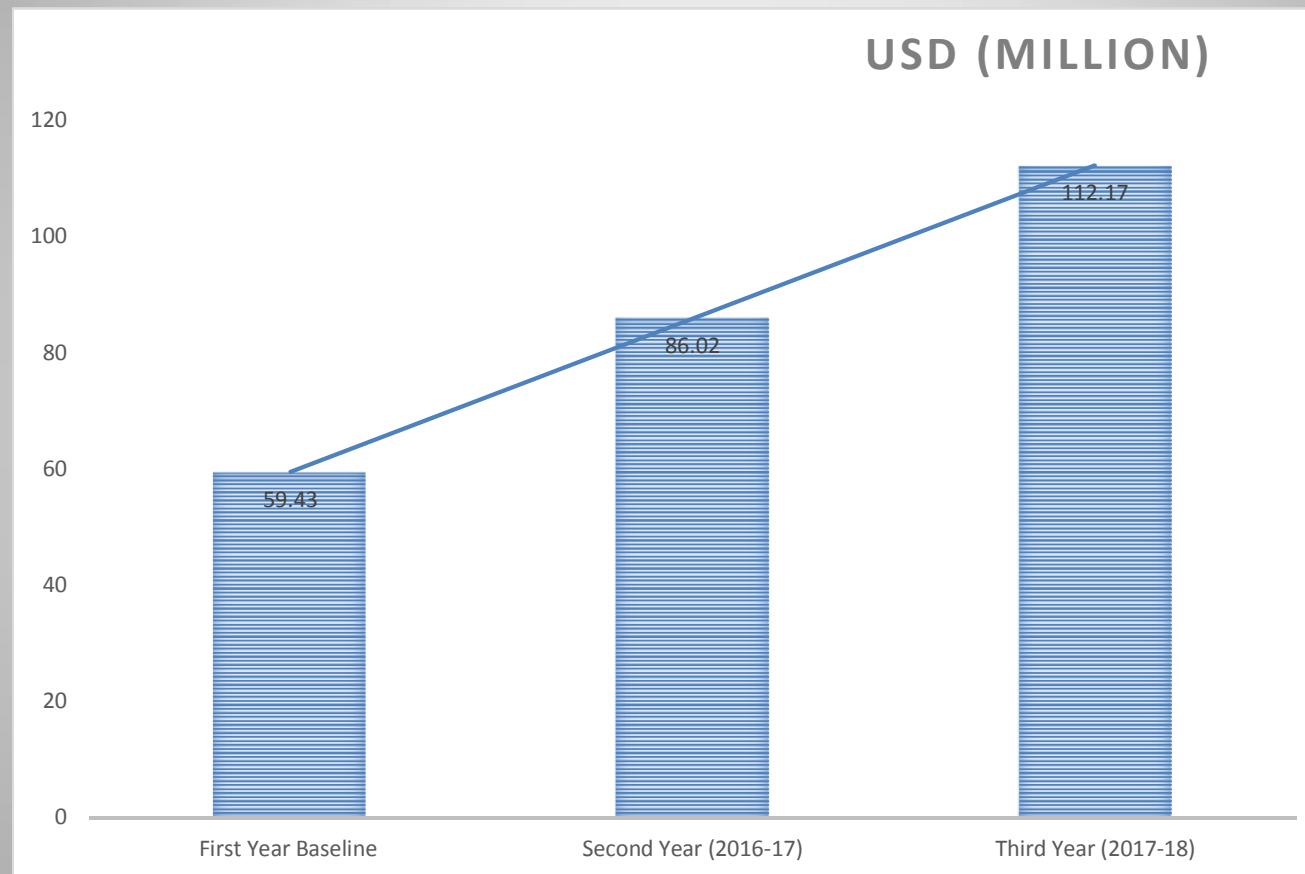
UK-India Joint Virtual Clean Energy Centre

US-India Catalytic Solar Finance Program Clean Energy Finance Initiative

UK-India Cooperation Programme on Energy demand reduction in the built environment



Clean Energy RD&D Spending



Mission Innovation: Clean Energy Innovation challenges

India is founder and active member of Mission Innovation and Co-lead of Analysis and Joint Research

Co-lead

Smart Grid, Off- Grid access to Electricity and Sustainable Biofuel

Strengthen and expand collaboration between key partners government-government, researcher-researcher, public-private etc

Mission Innovation: Analysis and Joint Research Innovation Challenges



IC1: SMART GRIDS

CO-LEADS



18 MEMBERS INVOLVED

IMPACT: Smart Grids Innovation Accelerator launched to provide a platform to share best practice and success stories. IC1 and the International Smart Grid Action Network ISGAN announced collaboration to align innovation and deployment activities.



IC2: OFF-GRID ACCESS TO ELECTRICITY

CO-LEADS



17 MEMBERS INVOLVED

IMPACT: France is investing €1.8 M in 9 projects in Africa to support various renewable technologies. Winners of the \$5 M Indian off-grid competition are collaborating with organisations from 9 MI members to improve energy access.



IC3: CARBON CAPTURE, UTILISATION AND STORAGE

CO-LEADS



18 MEMBERS INVOLVED

IMPACT: New funding including: \$30 M from the US Department of Energy; \$35 M for Accelerating CCS Technologies consortium involving 9 MI members; and \$38 M for industrial CCS in the EC indicative budget.



IC4: SUSTAINABLE BIOFUELS

CO-LEADS



12 MEMBERS INVOLVED

IMPACT: China has allocated \$62 M to international collaborative sustainable biofuels projects with 7 MI members, whilst India has funded projects with involvement of researchers from 9 MI countries.



IC5: CONVERTING SUNLIGHT

CO-LEADS



19 MEMBERS INVOLVED

IMPACT: €5 million Artificial Photosynthesis prize from the EC to develop a bench-scale artificial photosynthesis prototype and new funding from India and through the German Federal Government's 7th Energy Research Programme.



IC6: CLEAN ENERGY MATERIALS

CO-LEADS



15 MEMBERS INVOLVED

IMPACT: IC6 has held: 15 international activities in 10 countries on 3 continents, been profiled in Nature Materials Reviews and Forbes Magazine and launched the CAD\$8 M AI proof-of-concept project, Ada, in Canada.



IC7: AFFORDABLE HEATING AND COOLING OF BUILDINGS

CO-LEADS



18 MEMBERS INVOLVED

IMPACT: New projects include the "Comfort and Climate Box", to develop an integrated heating, cooling and storage solution and the Global Cooling Prize to develop air conditioning with 5x less climate impact.



IC8: RENEWABLE AND CLEAN HYDROGEN

CO-LEADS



13 MEMBERS INVOLVED

IMPACT: The "hydrogen valleys" concept, combining several hydrogen applications into an integrated system in a geographical area, has been chosen as a priority to demonstrate potential and a pathway to scale.

Innovation Challenges: India's progress

IC1 Smart Grids

- 17 Collaborative RD&D Programmes and 3 virtual centers at an investment of USD 60 million.
- Network of 27 Indian 39 institutes from MI countries along with 45 industries / utilities.

IC2 Off Grids

- 9 off Grid Research led solutions for remote communities in diverse geographic location at an investment of 5 million US \$
- Network of 30 Indian and 16 institutes from MI countries.

IC3 Carbon Capture, Utilisation and Storage

- 21 Collaborative research programmes with an investment of US 6 million.

IC4 Sustainable Biofuel

- 14 Collaborative Research Projects with an investment of US \$ 5 million.

Innovation Challenges: India's progress

..... Contd/-

IC 5 Converting Sunlight

- 13 projects at an investment of US \$ 6 million.

IC6 Clean Energy Materials

- 4 Multi institutional technology platforms and 29 Research Programs at an investment of US \$ 10 million.

IC7 Affordable Heating and Cooling of Buildings

- Partnership in Global Cooling Prize
- 3 collaborative Research Initiatives with MI Countries.

IC8 Renewable and Clean Hydrogen

- 31 Research Programmes at an investment of US \$ 10 million.

Events : 16 Reports : 11 MI Projects Supported: 73

Bilateral Collaboration : 11

Multilateral Collaboration: 18

Investments : US \$ 102 million Centre : 3



International incubator in Clean Energy Public –Private Partnership

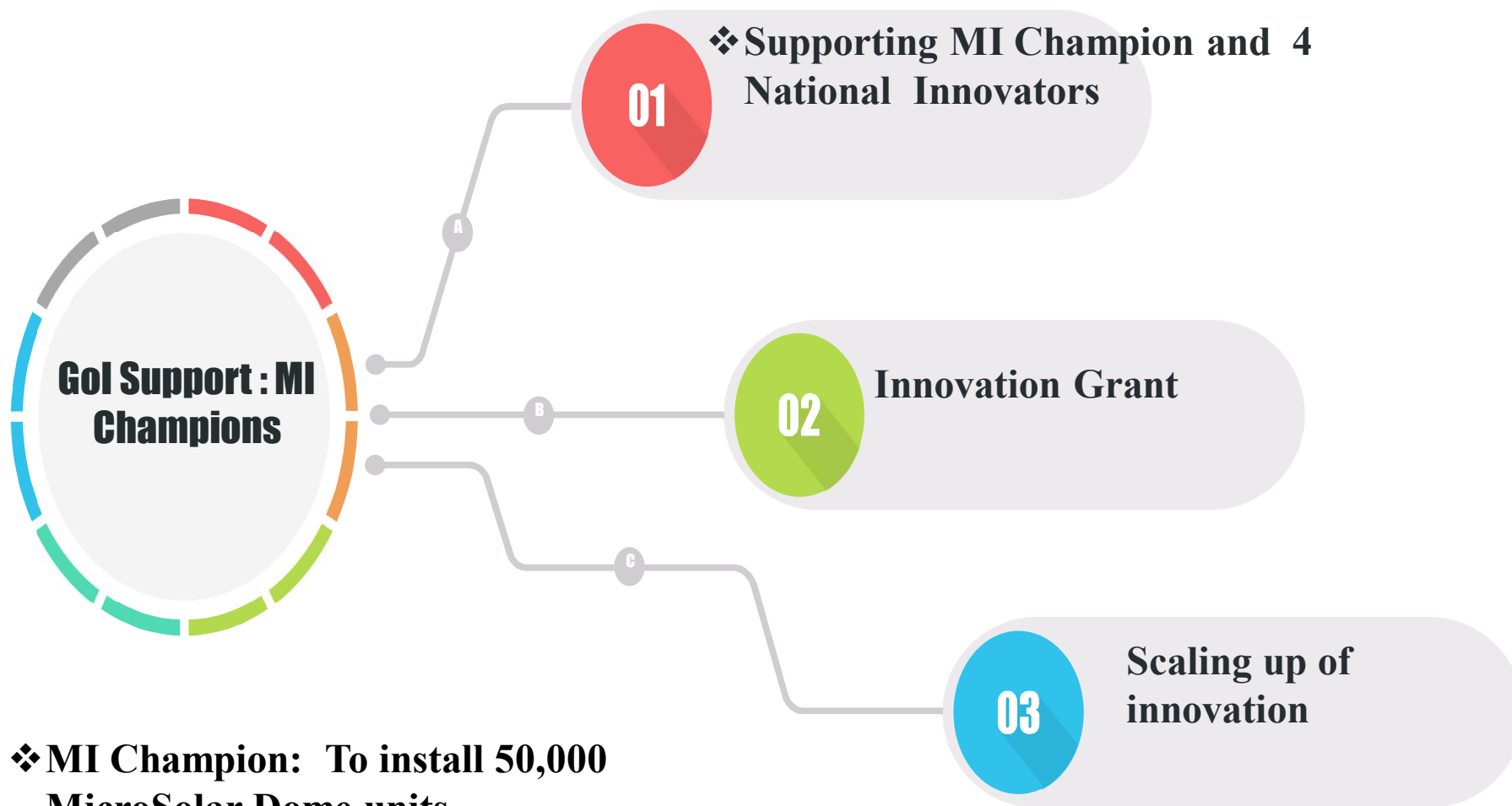
Joint initiative of Tata Trusts and Government of India

CEIIC Designed to offer complete “lab-to-market” incubation support to clean energy enterprises, both Indian and International,

Incubated 9 start ups (2 international)

Collaboration with Sweden under Avoided Emission Framework

Maximizing Impact by supporting Innovators in Clean Energy



Mapping investment data and Innovation Analysis

MoU Signed on 30 August 2018 on Enhancing Innovation for the Clean Energy Transition.

Areas of co-operation

sharing of analysis and policy recommendations related to energy RD&D;

exchanging experiences and best practices of mapping, tracking and/or estimating public funding

developing a methodology for mapping and estimating private sector investment in energy RD&D in India

Innovation analysis for policy environments that will facilitate and catalyze RD&D

jointly identifying possible priority areas for accelerating energy innovation,



सत्यमेव जयते
DEPARTMENT OF BIOTECHNOLOGY
GOVERNMENT OF INDIA





Enhancing Innovation for Clean Energy Transition

- “ Accelerating innovation by new and flexible funding instruments
- “ Encourage public –private partnership demonstration
- “ Viability Gap Funding to de-risk large investment projects
- “ Connect technology providers to concerned stakeholders
- “ Increased investments in R,D& D
- “ Enable innovators to scale innovations from lab to market



For details visit websites

DBT - <http://www.dbtindia.gov.in/>

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