Initiatives from Indian Funding Agency- DBT

Dr. Sangita Kasture
Principal Scientific Officer
Department of Biotechnology, Ministry of Science & Technology
Government of India

National Biofuel Policy

- Goal
  - To ensure that a minimum level of biofuels become available to meet the demand.

- Target
  - 20% blending of biofuels by 2017

R&D Efforts – Agencies involved

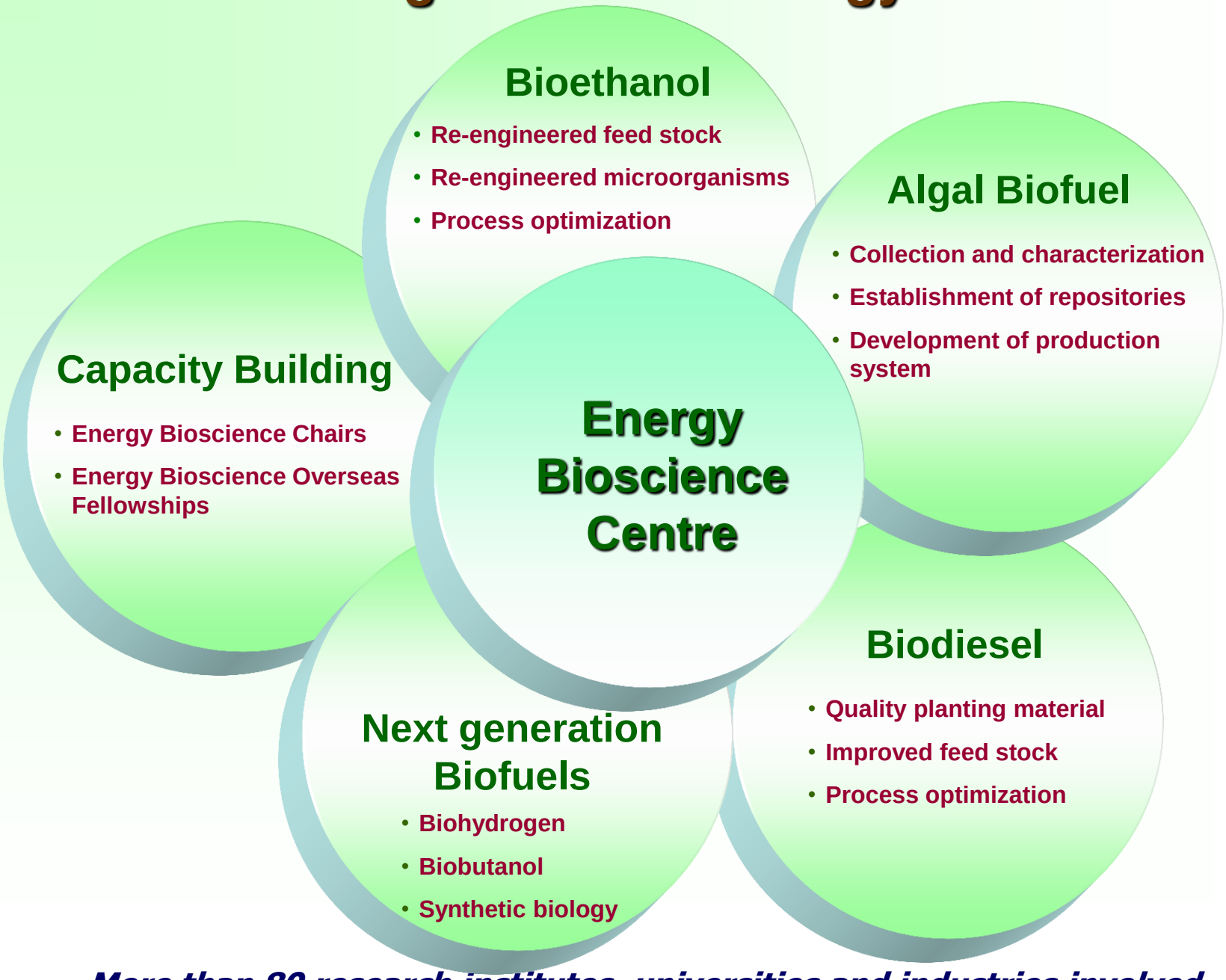
- Ministry of Agriculture – Indian Council of Agricultural Research
- Ministry of Defence– Defence Research Development Organization
- Ministry of New & Renewable Energy (MNRE)
- Ministry of Petroleum and Natural Gas – Indian Oil Corporation
- Ministry of Science & Technology
  - Council of Scientific & Industrial Research
  - Department of Biotechnology
  - Department of Science & Technology

Inter Agency Committee chaired by Secretary, DBT to coordinate R&D effort.

Policy for R&D

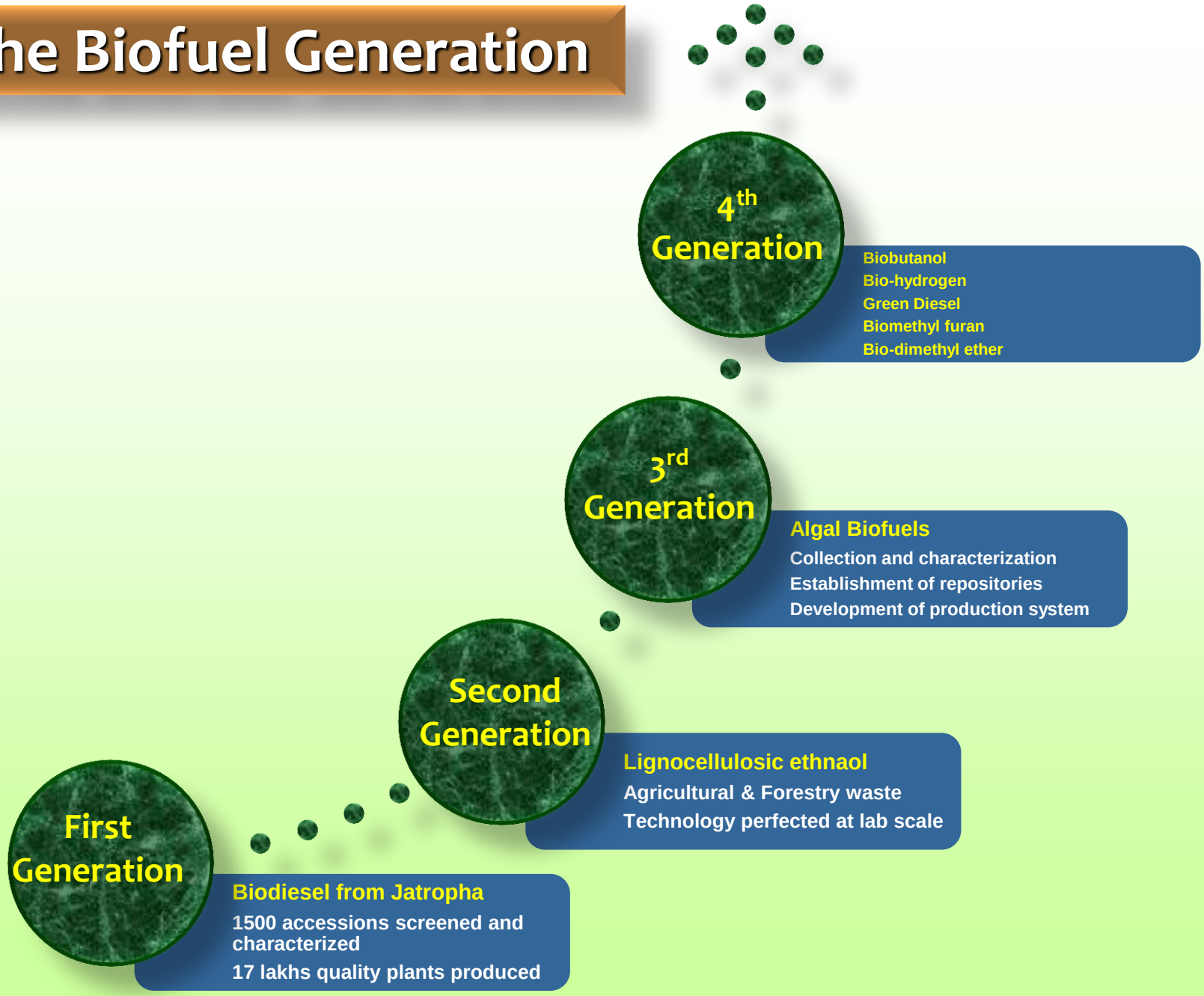
- A major thrust to be given through this Policy on Innovation, Research & Development and Demonstration in the field of biofuels.
  - Feed stock Development and Improvement
  - Improved Production Technologies
  - Bio refinery based fuels and bio chemicals
  - Algal Biofuel
  - Synthetic Biofuel

National Programme on Energy Biosciences



More than 80 research institutes, universities and industries involved

The Biofuel Generation



National Programme on Energy Biosciences

Bioethanol	Algal Biofuel	Biodiesel	Next Generation Fuels
• Re-engineered enzymes • Re-engineered microorganisms • Process optimization (40 Centers involved)	• Collection and characterization • Establishment of repositories • Development of production system (25 Centers involved)	• Quality planting material • Improved feed stock • Process optimization (10 centers' involved)	• 3rd and 4th generation Biofuels • Biohydrogen • Biobutanol • Biohydrocarbons • (5 Centers)

More than 80 research institutes, universities and industries involved

Bioenergy Centers

1. DBT-ICT Centre for Energy Biosciences, ICT, Mumbai

2. DBT-IOC Centre for Advanced Bioenergy Research, R&D IOCL Faridabad

3. DBT-ICGEB Centre for Advanced Bioenergy Research, ICGEB New Delhi

DBT- ICT Centre for Energy Biosciences

Bioenergy Research Centre

Fermentation Technology
Extractive fermentation, Metabolomics and Metabolic Engineering for Optimized production of amino acids, Vitamins and Enzymes

Enzyme Technology
Design and Use of Stable, Reusable, Inexpensive Enzymes for organic and other Biotransformations

Second and Next Generation Biofuels
BioAlcohols, BioDiesel, BioHydrogen, BioMethane

DBT-ICT Centre for Energy Biosciences
Work Areas
In Industrial Biotechnology

Synthetic Biology
Engineering Metabolic pathways for overproduction of primary metabolites, synthesis of designer proteins and Strain improvement

Separation Technology
Design and Applications of selective adsorptive and chromatographic separations for small and macromolecules

Algal Biotechnology
Design of algal systems for production of primary and secondary metabolites, as also starch, oil for biofuels, amino acids and other natural products

DBT-IOC Centre for Advanced Bioenergy Research

- **Mission**: " Research, Development and Deployment of sustainable, environmental friendly and economically viable bio-assisted energy technologies"
  - Lignocellulosic based bio-fuels
  - Algal research
  - Gas Fermentation
  - LCA & Economic models
  - Synthetic biology
  - Novel biotechnological method for CO2 mitigation
  - Life cycle analysis

Pilot Plant of Lignocellulosic ethanol at DBT- IOC Centre , Faridabad

Multi feed Lignocellulosic Biomass to ethanol pilot plant in collaboration with NREL USA(5-8 Kg/hr multi feed capability)

DBT-ICGEB Centre for Advance Bioenergy Research

- Focus -Basic Research in Biofuel development
- Genomics, Metagenomics, Systems and Synthetic biology
- Research Themes-

  Biomass Deconstruction (Enzymatic)

  Fermentation (C5 & C6, CBP)

  Advanced Biofuels

  Algal improvement-lipid/hydrocarbon

Major Biofuels being researched upon

Biofuel	FeedStock	Technology
Biodiesel	Jatropha, TBO	Transesterification batch / continuous process
Bioethanol	Cellulosic – Agricultural & forestry waste	Pre-treatment enzyme modification
Bio-butanol Bio-hyrogen	Algae – Micro & Macro	Simultaneous saccharification and fermentation
Bio-hydrocarbon	Biomass	Synthetic biology

Algal Biofuels

A National Network involving 12 Laboratories

8 Collection and characterization Centres

R&D for Strain improvement

- Increased Lipid
- Increased Biomass

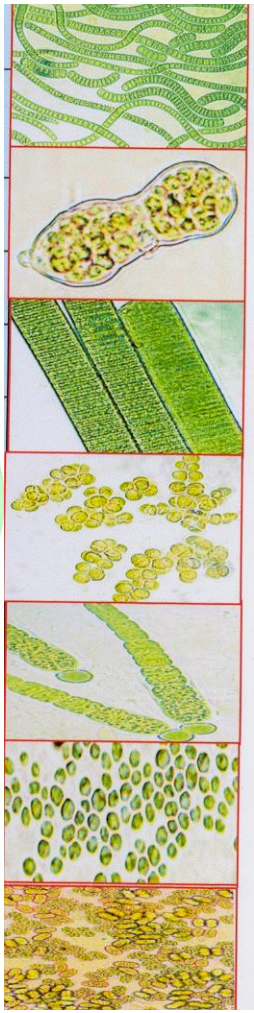
Analytical Centre

3 Centres for developing Production Systems

- Photo bioreactor
- Race way pond
- Open Sea

3 Repositories

- Cyanobacteria
- Marine Algae
- Fresh water Algae



Collections at Repositories

1. IBSD Repository

Collection from Fresh water from NorthEast India- 1086

cyanobacteria - 1086 nos.

No. of microalgal isolates - 464 Nos

2. NFMC Repository –Marine

Marine cyanobacteria - 470 nos.

(www.nfmc.res.in)

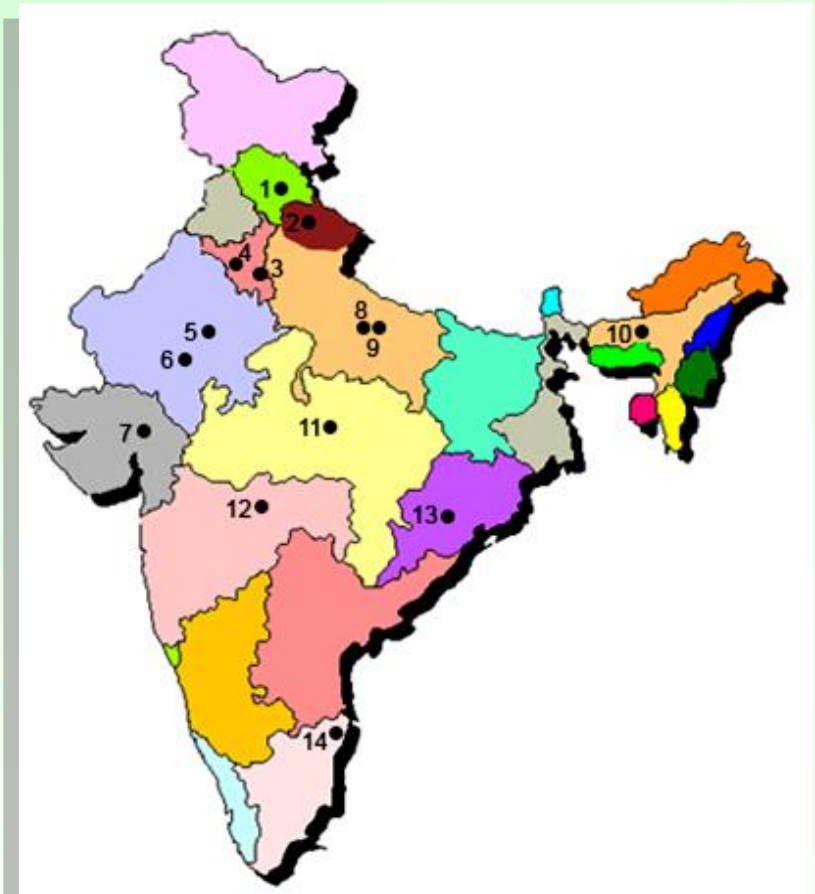
No. of microalgae (Green) - 10 Nos

Cryophilic microalgae- - - 8 No

3. IIMT Bhubaneswar -Brakish water

Microalgae - 44 n

Multi-location trials of Jatropha across the country



- First systematic study for morphological, chemical and molecular characterization of germplasm
- 400 accessions bulked to raise 17 lakh quality plants

Collections made by institutes	Collections accessioned	Accessions used for trials	Institutions involved	Area under plantation	Number of plants in trials
1261	890	349	13	317 ha	693696

Indo - U.S.

Joint Clean Energy Research & Development Centre

(Indo-U.S. JCERDC)

सत्यमेव जयते
Government of India

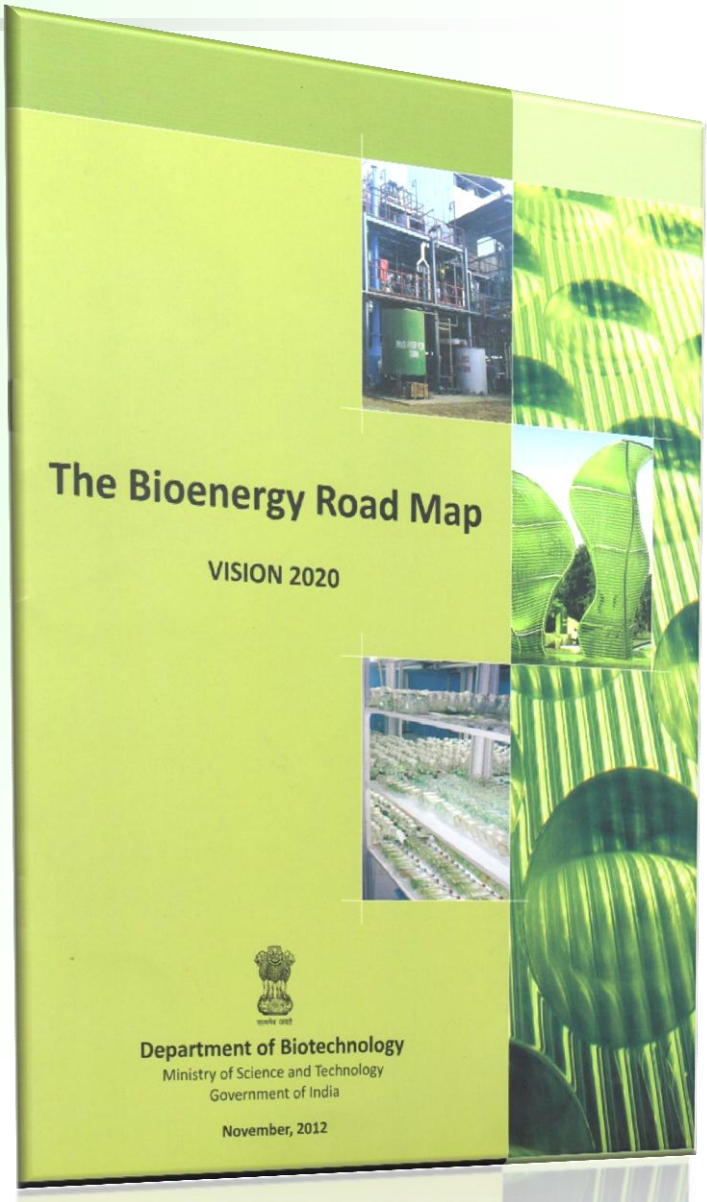
U.S. DEPARTMENT OF ENERGY

Indo-US JCERDC

- Joint Initiative by Planning Commission GOI and DOE US
- Priority areas
  - Solar Energy
  - Second Generation Biofuels
  - Energy Efficiency of Buildings
- The thrust is on cutting edge R&D for technology / process development
- All components -Research & development to commercialization

Energy Bioscience

- **Thrust**
  - To meet alternate energy requirement
- **Goal**
  - To make available biofuel for 20% blending by 2017
- **Focus**
  - Feedstock development
  - Development of Biofuel Production Technologies



The Bioenergy Road Map – Strategy and Action Plan

- Launch a Strategic Research Programme towards achieving the Goal of 20% blending by 2020
- Set up at least 5 Joint Centres
- Support Basic R&D programmes in cutting edge areas
- Work towards establishing a bio-based economy – Value added bio industrial products using bio refinery concept
- Create a 'Team India' of atleast 100 scientists in inter-disciplinary research areas.
- Train atleast 100 Post Doctoral Overseas in specialized areas -Synthetic Biology, Enzyme and Protein Engineering, Metabolic Engineering, Systems Biology etc.
- Attract atleast 25 overseas scientists -Energy Bioscience Fellowship and Institute atleast 5 chairs.

Thank You