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MARMARA RESEARCH CENTRE

ENERGY INSTITUTE

Role of Energy R&D to Support Energy Policy Preparation & Monitoring

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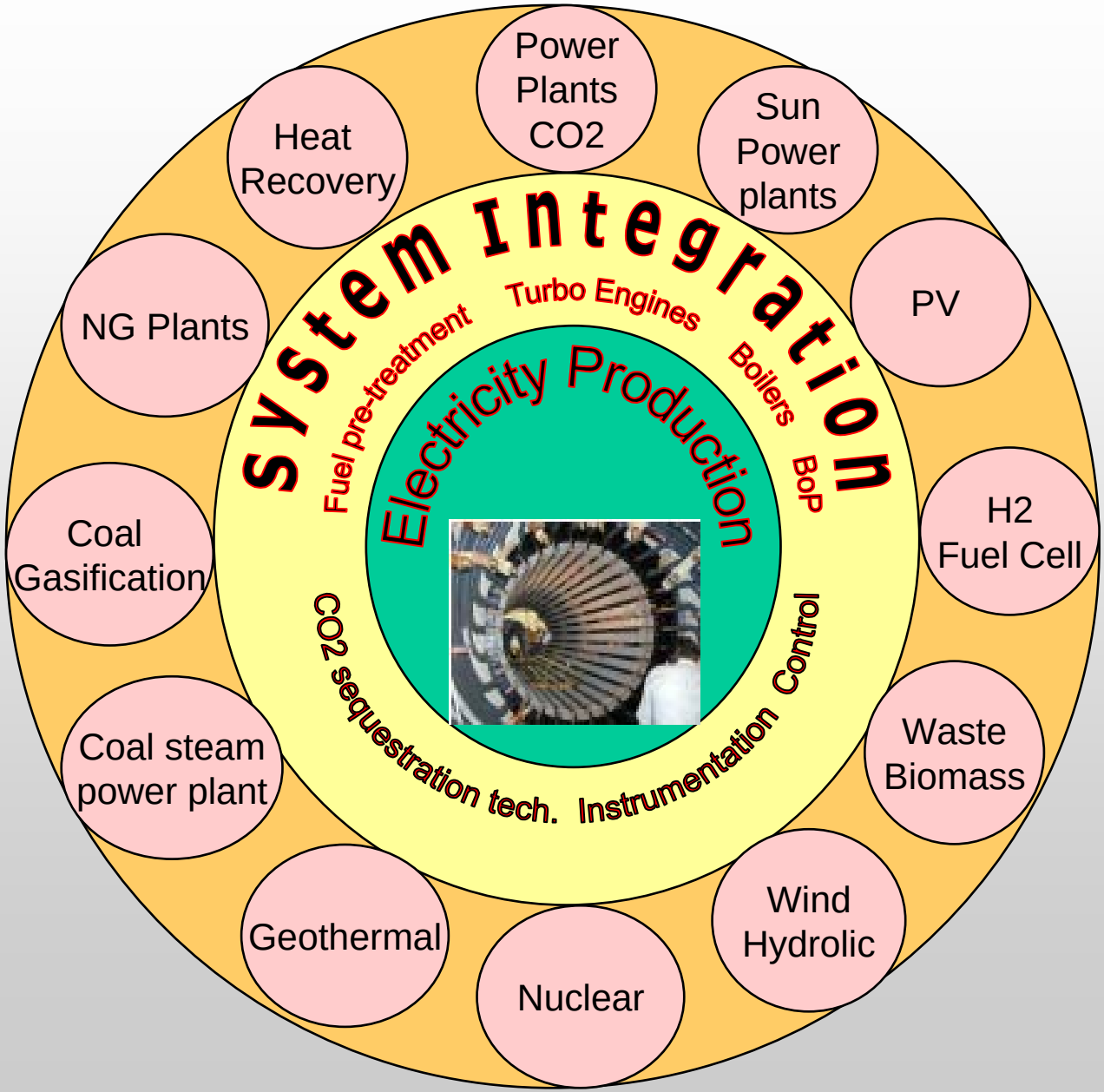
Sustainable Development and Energy

- Three basic components of energy technologies for sustainable development:
  - Energy source,
  - Technical and economical feasibility,
  - Environmental friendliness.
- In the coming 25 years (IEA);
  - Needed investment budget will be app. 16 Trillion US$
  - World global energy consumption will increase 60%,
- Climate Change is going to be the most serious problem of the planet. In this frame following items should be emphasized:
  - Developing and applying new and environnental friendly technologies.
  - Energy saving and efficient use of energy.
  - Financing of investment needed in the transtion period.

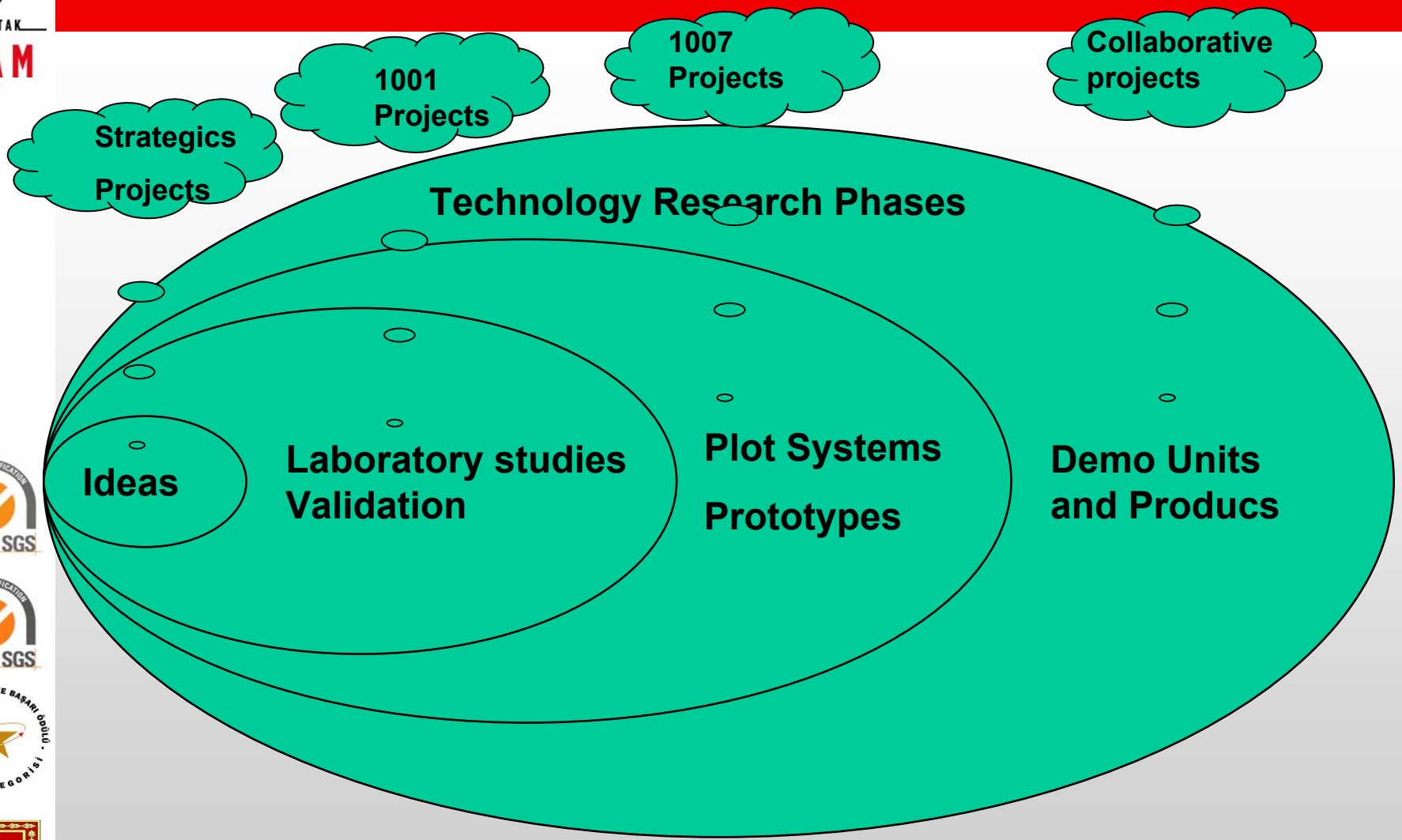
Energy Technologies

- Buildings:
  - **Intelligent buildings, construction components, standards etc.**
- Transportation
  - **Clean vehicle technologies (gasoline and diesel)**
  - **Biofuels,**
  - **Synthetic fuels,**
  - **Hybrid vehicles**
  - **Energy storage techologies (batteries, capacitors etc.)**
  - **Hydrogen and fuel cell vehicles**
- Industry
  - **Energy efficient production processes**
- Energy production sector
  - **Diversity of energy supplies,**
  - **Increasing the ratio of renewable energies as much as possible**
  - **Clean and efficient use of fossil fuels**
  - **Central and distributed power plants**

Energy Technologies



FROM IDEAS TO TECHNOLOGICAL PRODUCs



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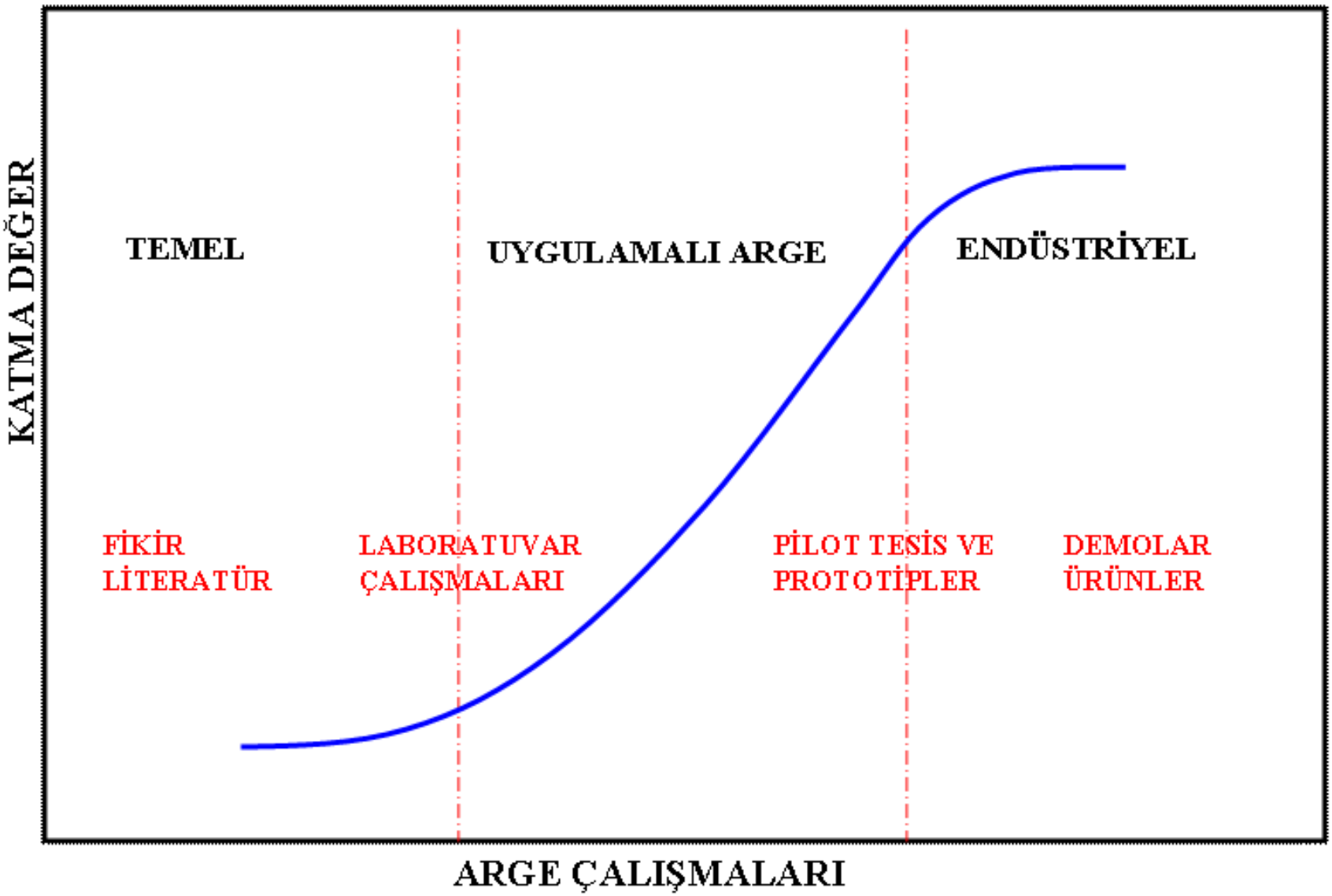

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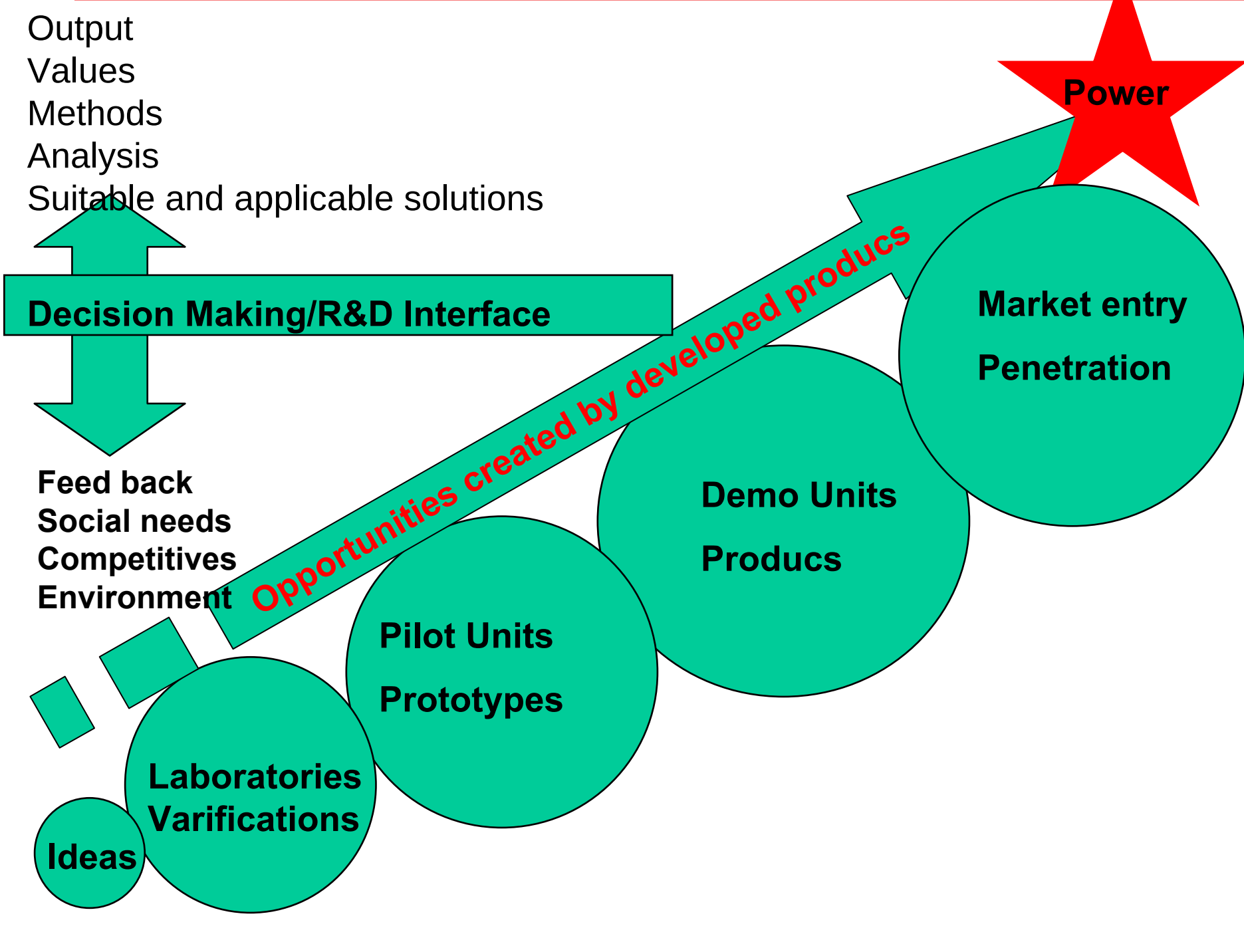
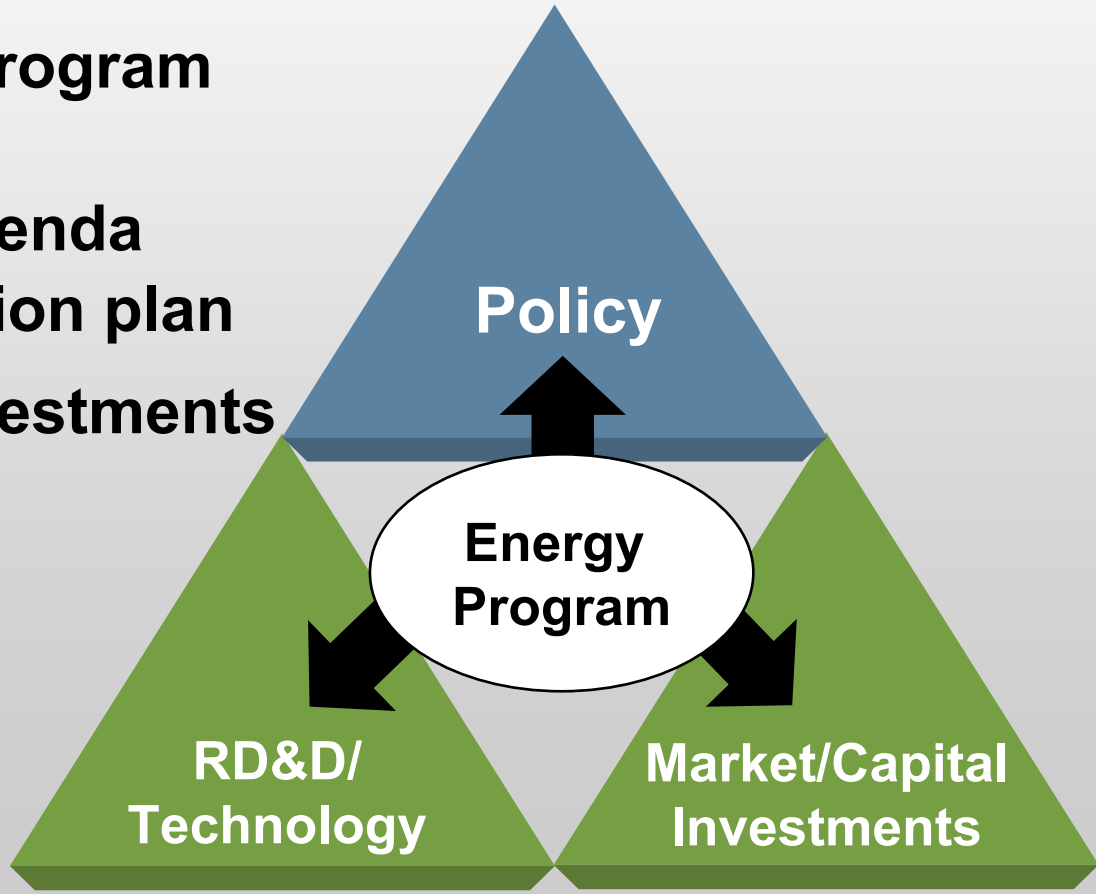
Output
Values
Methods
Analysis
Suitable and applicable solutions



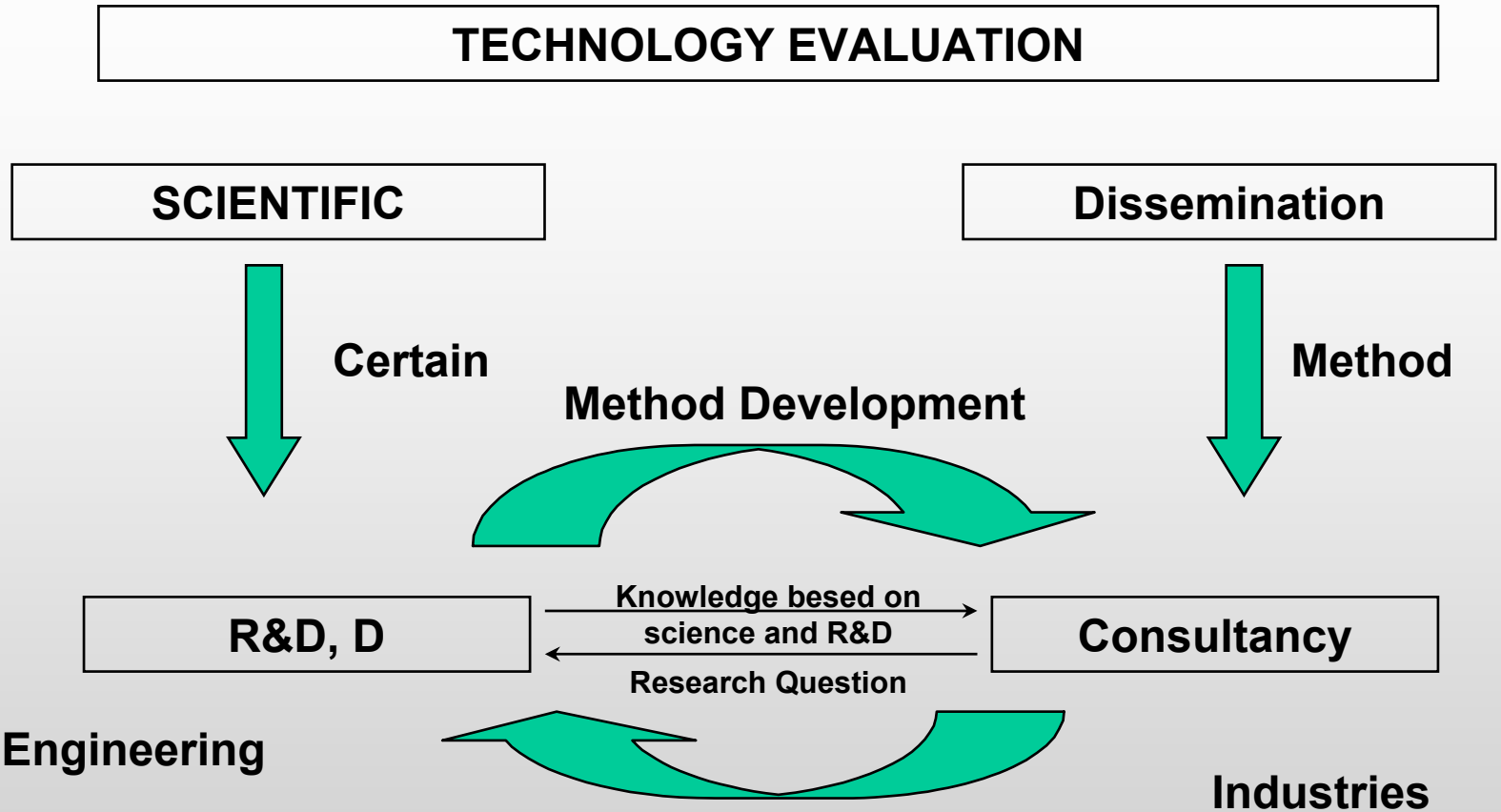
Main Approach on Energy Program

Three-pronged approach

- Effective policies
- Effective RD&D Program
  - Vision
  - Research agenda
  - Implementation plan
- Private sector investments



Main Approach on Technology Evaluation



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Managing R&D Program-Dominant Society

- Developed/expand technology forecasting capability
- Monitor emerging technologies
- Identify appropriate technologies
- Developed and update technology audits
- Determine technology acquisition needs and channels
- Develop a global technology plan (NOT DOMESTIC)

Policy preparation steps

- Literature survey
- Determination of research areas
- Determination of cross technology
- Identification of key drivers, which can have the biggest impact not only on the energy system but also on the society and the environment.
- Identification of crucial research areas for future

➢ *Policy preparation* requires a special approach by research.
➢ The key relation and dialogue here is the one between government and its citizens, *not* the one between science and society even though scientists may want to believe so!

Policy Determination Actions

- Basic and applied R&D: **Basic and applied R&D are important for Identification technologies**
- Fiscal measures
- Public acceptance

Selection

- Definition of priorty areas/technologies and research clusters
- Select projects according to support for strategic objectives
- Select integrated projects on the basis of support for strategic objectives
- Fund related clusters of projects

Strategic and Operational Management and Analysis of R&D

Strategic Management "Decision Focused"

- Focused on important issues
- Consider long term horizons
- Explores and chooses among significantly different alternatives
- System thinking
- Concentrate on the external world
- Discrete decision

Operational Management "Results Focused"

- Attend to details and follow thorough
- Focused on near term results
- Avoid new alternatives
- Strong internal focus
- Repetitive continuous decisions

Strategic Management of R&D Program

- Integrate technology into Country's R&D strategy (NOT ONLY ENERGY)
- Determine R&D needs to support technology strategy
- Integrate R&D into technology strategy
- Evaluate the impacts of R&D on overal mission and objectives
- Quantify R&D decisions whenever possible
- Aggree on measurable goals for R&D
- Develop metrics for measurement of R&D progress and results
- Develop R&D agenda in alignment with the strategic pathway of County

Managing Innovation-Reality

Technology management is a unique approach which requires unique capabilities for unique activities including:

- **Technology Strategy development**
- **Technology needs assesment**
- **Technology gap anaysis**
- **Technology availability assesment**
- **Technology evaluation**
- **Technology selection**
- **Technology acquisition**
- **Technology adaptation**
- **Technology impementation**
- **Technology improvment**
- **Technology innovation**

Challenge: **Technologyies are changing to fast**

Opportunity: **We can lead those changes and position ourselves in the center of gravity of global power (NOT DOMESTIC LEVEL)**

Policy monitoring & evaluation

- Overall impact
- Impact on wealth creation
- Impact on ecological balance
- Impact on quality of life
- Impact on security of supply

Project Systematics for Decision Making

Technology planning,implementation, and monitoring requires multi level funding mechanisms.

- Basic Research
- Guided Applied R&D Projects
- Large Scale Projects

Support to Decision Makers

Knowledge Support

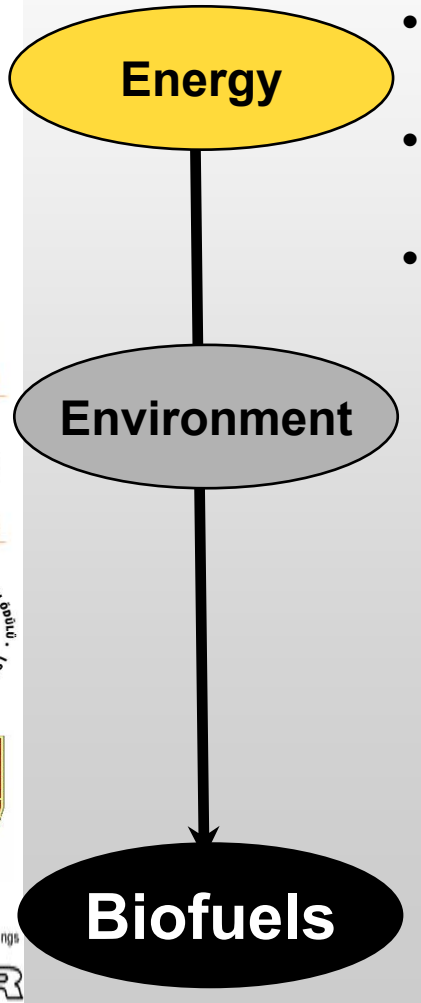
- Do scoping & determine research question
- Investigate (scientifically), collect and review evidence
- Provide main research findings

Decision Support

- Clarify policy need (issue, timelines, etc.)
- Interact with reseachers, policiy makers
- Identify guidance options
    - contextual factors that affect local application
    - Benefit, harm/risk and cost
- Determine recommendation

Technology R&D Program on Biofuel: Policy Definition

Policy Drivers & Incentives Supporting Biofuels



- Energy Security/ Political Tensions
- Resource Diversification
- Petroleum Prices/Volatility

- Climate Change
- Air Pollution

- Economic Development
- Farm Income

Examples of Policies

United States

- Energy Policy Act of 2005 (federal policy)
- State tax credits, blend requirements…

Europe

- Tax credits: most common incentive
- EU set target for biofuels consumption (similar to RFS, but not a mandate)

Asia

- China, India, and Malaysia introducing policies to support biofuels
- Japan has tax credits in place

South America

- Brazil: Ethanol blending requirements in place and a requirement for biodiesel starting in 2008

Technology R&D Program: Focus on Biofuel

Objective: *Develop and transform our renewable and abundant biomass resources into cost competitive, high performance biofuels, bioproducts, and biopower.*

- ***Policy***
- ***Partnerships***
- ***Interagency Coordination***

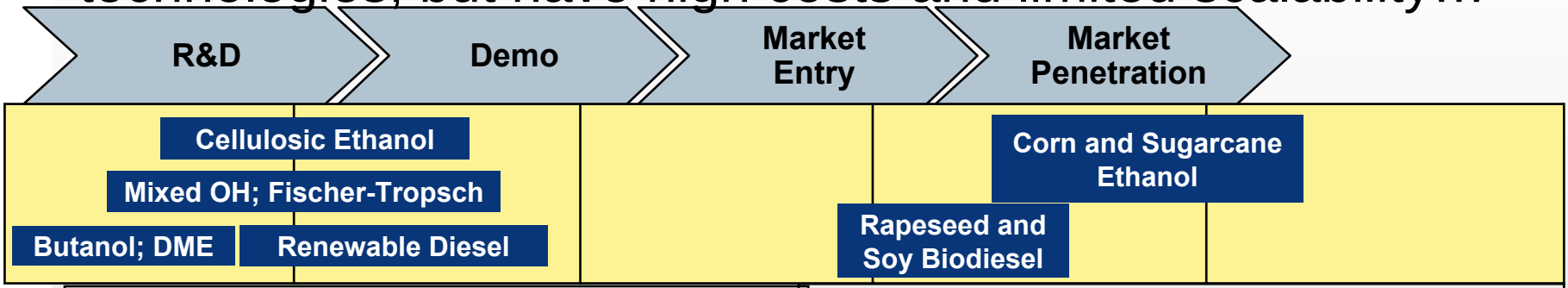
Collaborative R&D

Integrated Biorefineries: Systems Integration and Demonstration

Core activities accelerate the technological advances needed to support a domestic bioindustry producing cellulosic ethanol and other biofuels in integrated biorefineries.

Technology R&D Program on Biofuel Roadmap, Scope, Evaluation

First generation" biofuels are commercially developed technologies, but have high costs and limited scalability…



2nd Generation Biofuels

- **R&D efforts are focused on**:
  - Increasing the range of feedstock from which to produce biofuels
  - Reducing biomass-to-liquid conversion costs
- **Two main technology platforms in development:**
  - *Biochemical pathway*: conversion of the cellulose to sugars and fermentation to alcohol fuels
  - *Thermochemical pathway*: gasification of biomass to syngas and synthesis to fuels
- **Construction of commercial renewable diesel plants**

1st Generation Biofuels

- ***Ethanol*** is a clean burning, high-octane alcohol fuel used as a replacement and extender for gasoline
  - –Has been commercially produced since the 70s in the US and Brazil, still the market leaders
  - –Corn ethanol is cost competitive (with no subsidies) with gasoline when crude oil is above $50/barrel ($30/brl from sugar cane)
- ***Biodiesel*** is a high-cetane, sulfur-free alternative to (or extender of) diesel fuel and heating oil
  - –Commercialized in Europe in the 90's
  - –Worst economics (and smaller market) than ethanol

Technology R&D Program on Biofuel: Definition of Bariers and Solutions

Targeted R,D &D: Overcoming Barriers

Barriers	Solutions
• High cost of enzymatic conversion	• R&D to improve effectiveness and reduce costs of enzymatic conversion
• Inadequate technology for producing ethanol from sugars derived from cellulosic biomass	• R&D on advanced micro-organisms for fermentation of sugars
• Limitations of thermochemical conversion processes	• Re-establish thermochemical conversion as a second path to success
• Demonstration/integration of technology in biorefineries	• Fund loan guarantees, commercial biorefinery demonstrations, and 10% scale validation projects
• Inadequate feedstock and distribution infrastructure	• Form interagency infrastructure and feedstock teams

Technology R&D: Focus on Energy Efficiency

Industrial Reaction & Separation

Develop technologies for efficient reaction and separation processes

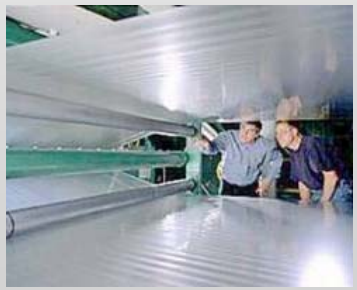
High-Temperature Processing

Develop energy-efficient, high-temperature process technologies for producing metals and non-metallic minerals

Energy Conversion Systems

Develop high-efficiency steam generation and combustion technologies and improved energy recovery technologies

Fabrication & Materials



Develop energy-efficient technologies for making near net-shape finished products from basic materials

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Conclusion

- Technology is the dominant force in the world in this century,
- Rapid technological changes are leading to rapid societal changes,
- Cost reductions and efficiency measures are MUST but NOT enough anymore,
- Average time from scientific discovery to technological innovation has usually taken at least 10 years from laboratory to product. So, LONG TERM POLICY and STRATEGY has a CRUTIAL importance.
- If we manage technology we can harness its opportunities for the betterment of our country,
- So
  - Those who can manage technology development will be the WINNERS
  - Those who can manage by technology developer will be LOSSERS.

Conclusion

Policy Preperation and Decision Making Process for any technological program should be based on Scientific Community under;

- Basic Research
- Guided Applied R&D Projects
- Large Scale Projects

It requires:

- interagency collaboration with goverment, industry, institues and universities
- well organized actions at the stages of
  - Definition,
  - Monitoring,
  - implemetration,
  - Evaluation etc

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THANK YOU

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