The DOE Biomass program and innovation:
process matters for a long term strategy

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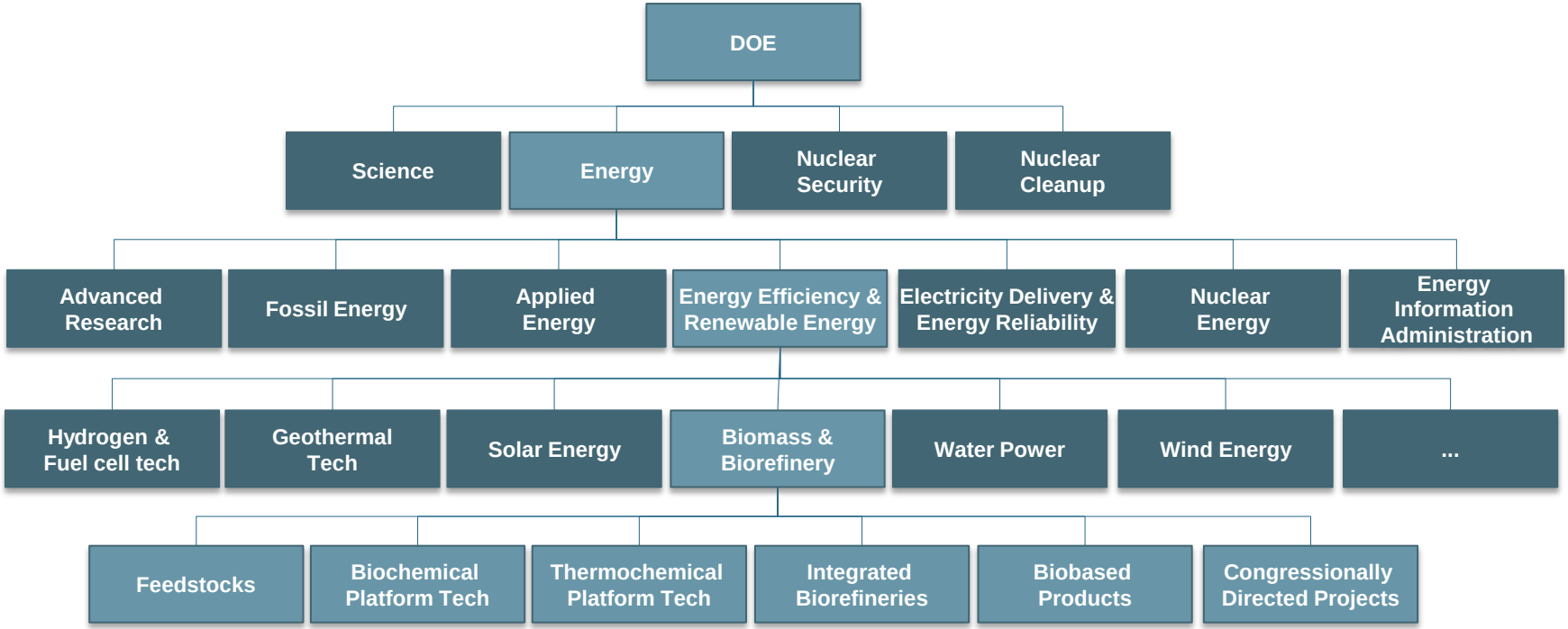
Outline

1. Assessment of the DOE Biomass Program
2. Impact on innovation
3. Lessons for Brazil applied to sugarcane
4. Questions for discussion

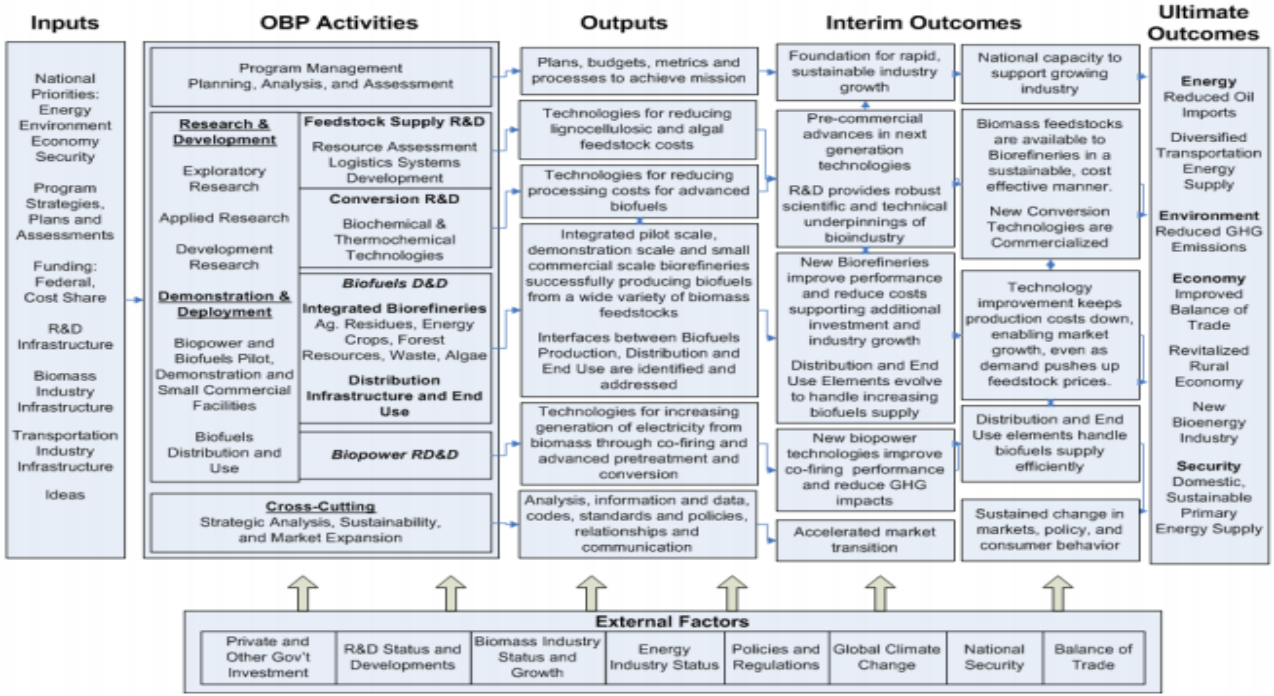
DOE organogram and the Biomass Program – EERE – Energy, Efficiency and Renewable Energy Division



Fonte: DOE e EERE

Biomass program within EERE

Logical framework



Fonte: Energy Efficiency & Renewable Energy (http://www.eere.energy.gov)

DOE Biomass Program – 1st phase

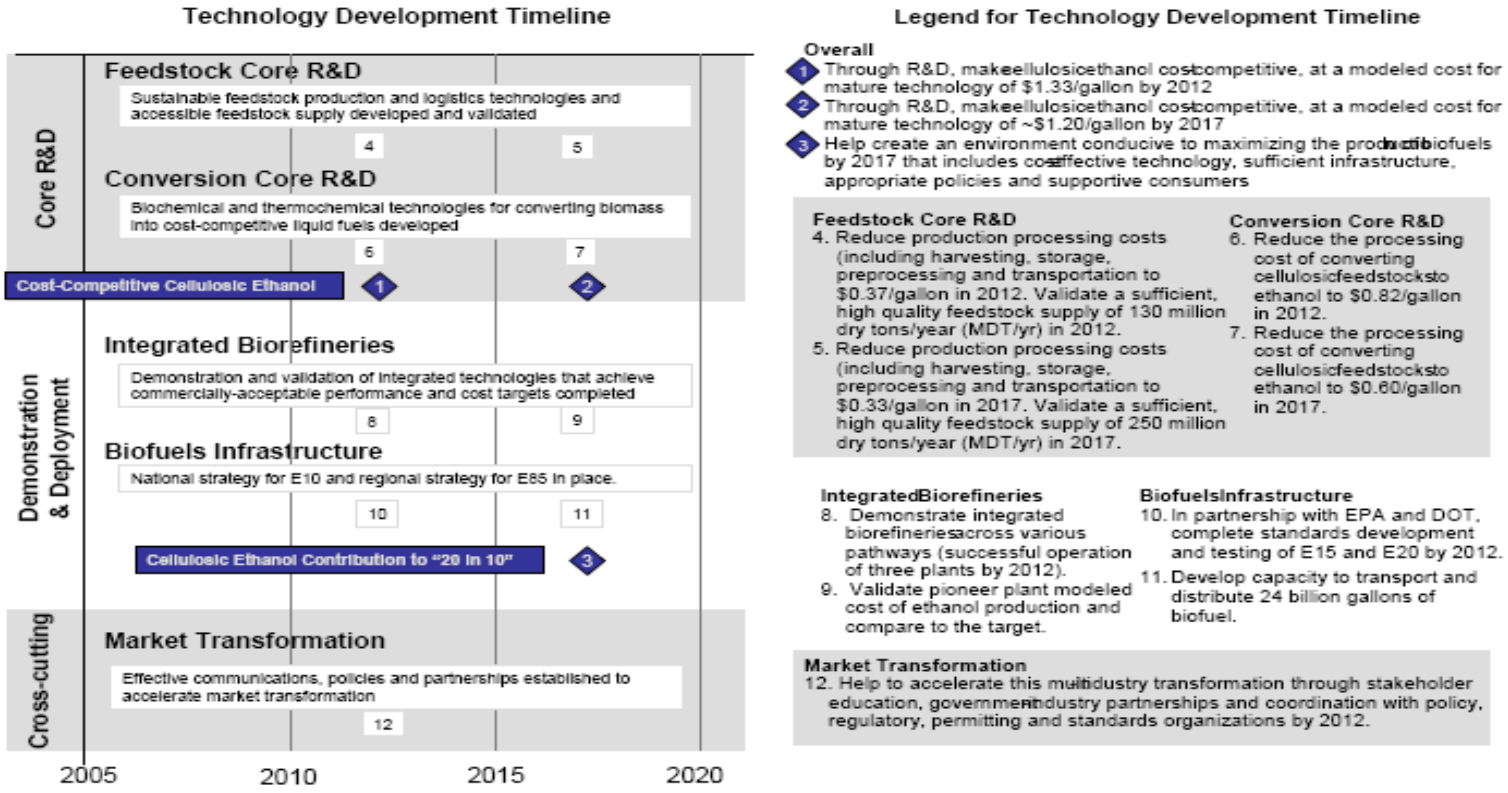


Figure C: Biomass Program Strategy for Technology Development

Fonte: DOE, USA 2008

2nd phase of the Biomass program

The Biomass Program is working to advance biomass technologies in support of DOE's mission to strengthen America's energy security, environmental quality, and economic vitality through:

Feedstocks

Developing lower cost feedstock logistics systems

Conversion technologies

Improving conversion efficiencies and costs

Integrated biorefineries

Systematically validating and deploying technology at first-of-a-kind facilities

Infrastructure

Evaluating vehicle emissions, performance, and deployment options

Biopower

Providing a clean, domestic, dispatchable renewable source of power

Advanced biofuels

Expanding portfolio beyond cellulosic ethanol to hydrocarbon fuels

Policies as drivers of the Program

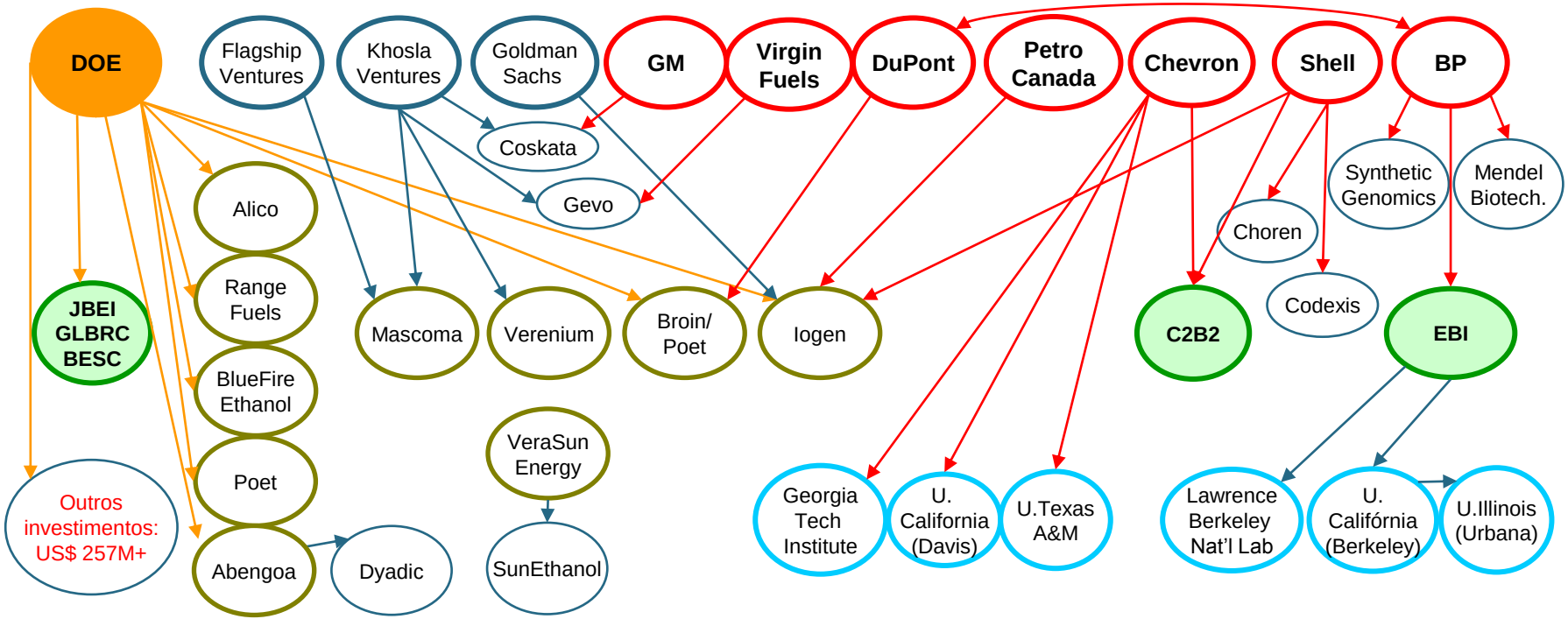
The DOE Program evolved from the first concepts coming from:

- **Energy Policy Act** (August 2005) and
- **EISA** (Energy Independence and Security Act – de dezembro de 2007), which creates the **RFS** (Renewable Fuel Standard), going to more integrated and complex programs, involving the following principles:

a) **Production & purchase guarantee of all** biomass produced– since the beginning of the program
b) **Mapping all feedstock available available** – the US billion ton update – potential, volumes, location and uses;
c) **Scope** – beyond the replacement of a single “fuel”– ex: project “Replacing the whole barrel”
d) **“Working across the supply chain”**

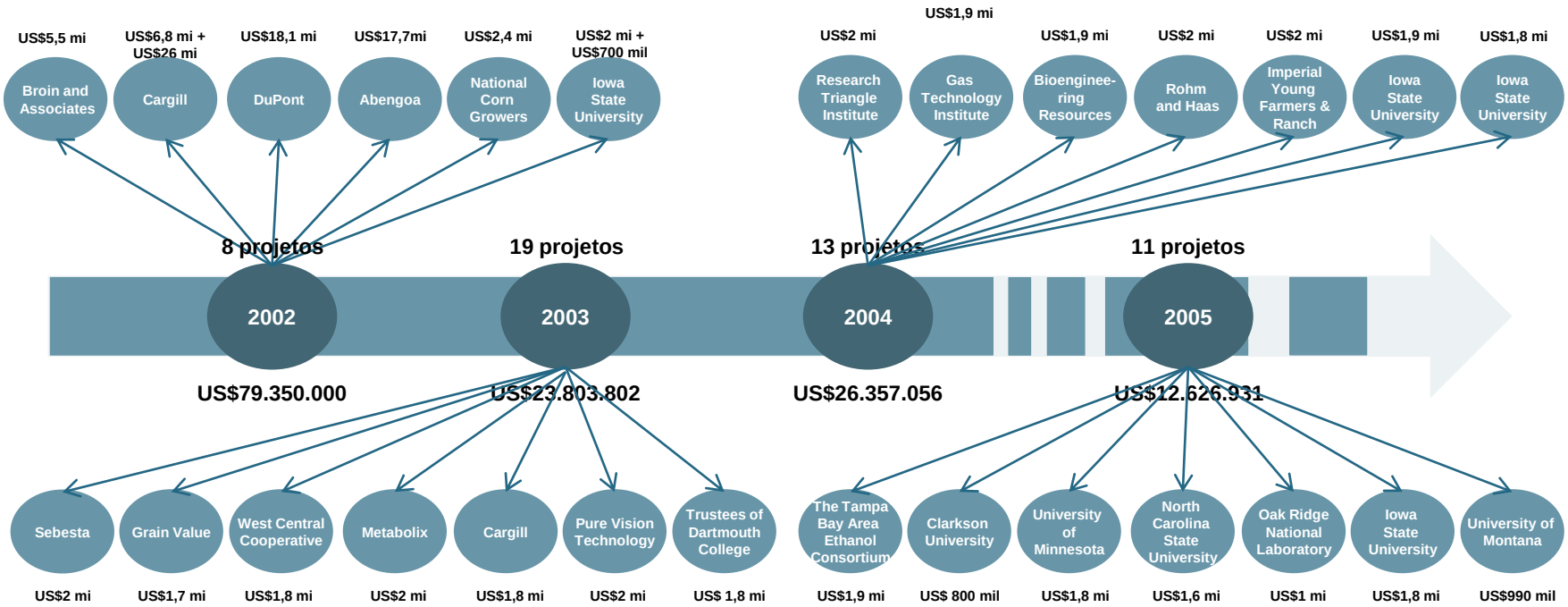
Innovation in the 1st phase

Assessment of the impacts on new ventures and innovation



Fonte: Site das Empresas; Site das Instituições; Checkthemarkets; Green Car Congress; State of Play in The Biorefining Industry

Joint funding initiatives – USDA and DOE



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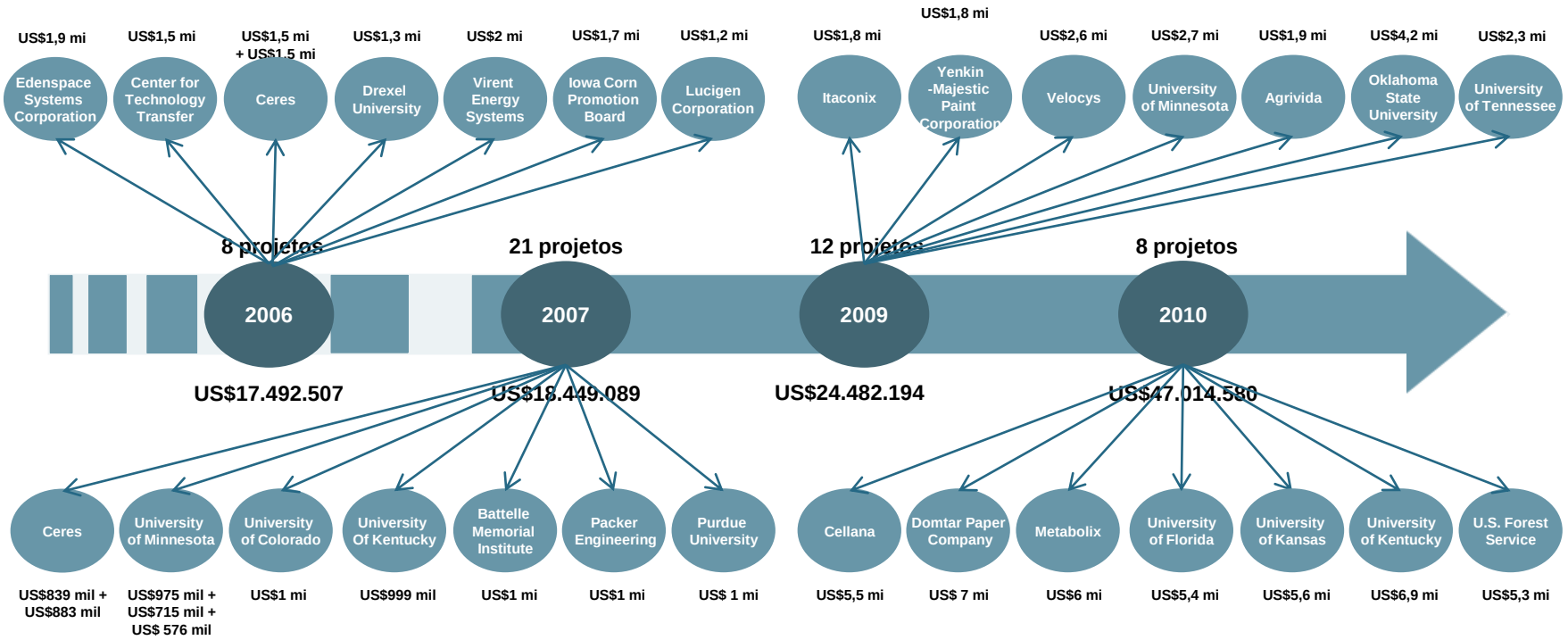


Next phases: Integrated Biorefinery Projects - IBR

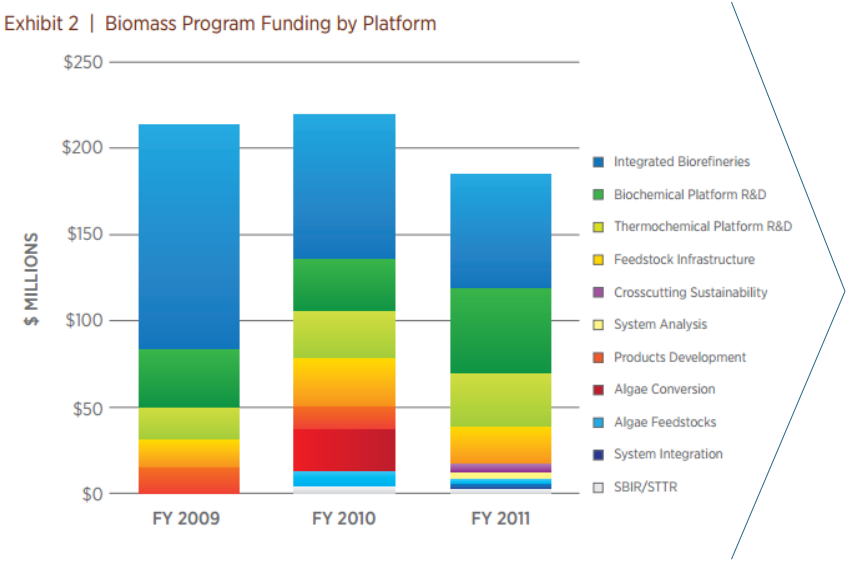
- **Integration of research projects, deployment of new technologies and new ventures** of the Biomass Program is consolidated in the IBR concept.
- One of the goals of the IBR is to support new enterprises to scape **The Valley of Death**, which affects broadly any company with associated technological risks
- Up till 2011, ca**. 3 B ($ US) were given to 29 projects**, involving companies of different stages of development: Start-ups, VC, PE, IPOs and JVs.
- **Monitoring program and assessment of impact of allocation of these funds – lessons for Brazil - PAISS – BNDES/FINEP and other Programs.**
- **We have no guarantee of success – when major breakthroughs are expected in "biological systems engineering" – no "free lunch".**
- **....**

Distribution of IBR Projects in the USA (2011-12)

http://www.eere.energy.gov/biomass/integrated_biorefineries.html

DOE Funding Projects

Allocation profile from 2009 -2011



Sub-divisions	Project examples
• Integração das biorefinarias	• Enerkem Heterogeneous Biorefinery Project, Pilot Integrated Cellulosic Biorefinery Operations to Fuel Ethanol, Integrated Algal Biorefinery (IABR) Commercial Demonstration Project
• Plataforma Bioquímica R&D	• Pretreatment and Enzymatic Hydrolysis, Enzyme Solicitation Support and Validation, Biochemical Processing Integration Task
• Plataforma Termoquímica R&D	• Effects of Bio-Oil on Reactor and Tank Materials, Catalytic Deoxygenation of Biomass Pyrolysis Vapors to Improve Bio-Oil Stability, Stabilization of Fast Pyrolysis Oils
• Infraestrutura para matéria-prima	• U-Mn Mississippi Watershed, ANL Biomass and Nitrogen, Land-Use Change
• Sustentabilidade	• Impact of projected biofuel production on water use and water quality, Forecasting water quality and aquatic biodiversity, Biomass Production Under Climate Change
• Análise do sistema • Integração de Sistemas	• Biomass Scenario Model (BSM) Development & Analysis, Algae Resource Assessment, Bioenergy Knowledge Discovery Framework (KDF)
• Conversão de Algas • Matéria-prima de Algas	• Microalgae Harvesting/Dewatering Technology Suite, Algal-Based Renewable Energy for Nevada, Assessment of Algal Production Systems
• Desenvolvimento de produtos	• Chemicals form Oilseeds, Fungal Genomics, Production of Polyhydroxyalkanoate Polymers
• Pequenos negócios	

Fonte: Peer Review Portal (http://obpreview2011.govtools.us/review/)

Lessons learned and underlying policies

DOE's vision of supporting new ventures and partnerships – academia, private sector and investors...

- Main instrument to supporting these goals was the creation of the **ARPA – E. Advanced Research Projects Agency – Energy**.

- This new Agency besides financial support, make the necessary links between National Labs, Industry, facilitating the negotiations of IP rights by the **ACT – Agreement for Commercializing Technology**, expanding previous policies (**CRADAs** – Cooperative Research and Development Agreement e o **WFO** – Work for Others).

- This new Agency (**ARPA-E**) was conceived based on the success of another Agency - **DARPA – Defence Advanced Research Project Agency.**

Lessons: clear and long term rules and policies gives private sector the necessary conditions for investments and commitment – even in projects associated with technological risks

Issues and questions for discussion

- **DOE's Biomass Program** – evolving and monitoring – **reflecting a process oriented program – long term and clear rules and policies -**

- Brasil – **National Plan of Action and Strategy** for the deployment of all opportunities from the sugarcane chain

- **Road to innovation – still not fully paved** – had progress and still not straight foward – ex. New call from FINEP/BNDES for Agro – restrict the application of SME and lengthy process

- **Look beyond biofuels** – ie. Green Chemistry platforms – assessments being carried out in BR by CGEE – but still not involving all relevant players…

- Our major asset – **sugarcane** – **has been neglected from key funding call for proposals** – grants and loans – productivity, long term sustainability, impacts of mechanically harvesting, new pests and diseases, expansion into new areas …

Acknowledgements

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