



Integrated Science

*Merging scientific disciplines to address
global challenges*

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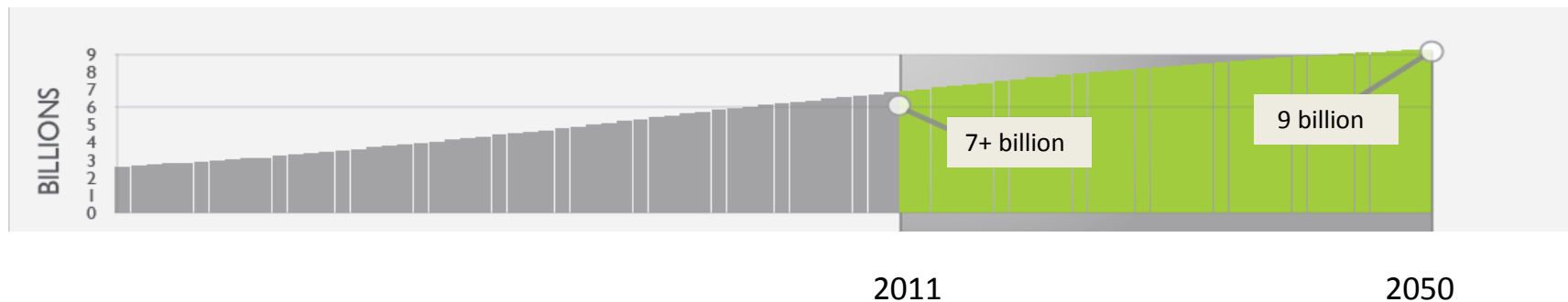
Key messages



- We are facing unprecedented global challenges in food, energy and protection.
- The chemical industry plays an important role in providing solutions.
- Ongoing success will require continued integration of science, diversification of ideas, and collaboration.

Population growth will bring challenges

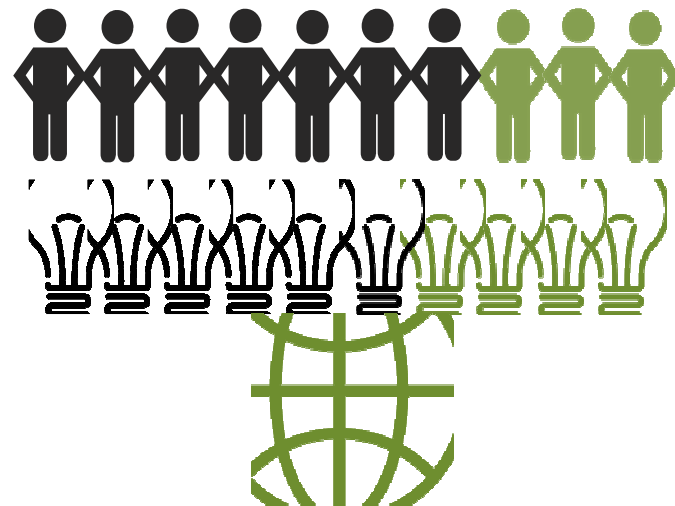
By 2050, the global population will grow by **2 billion people**:



Demand for food is projected to grow by 70%

Demand for energy is projected to rise by 40%

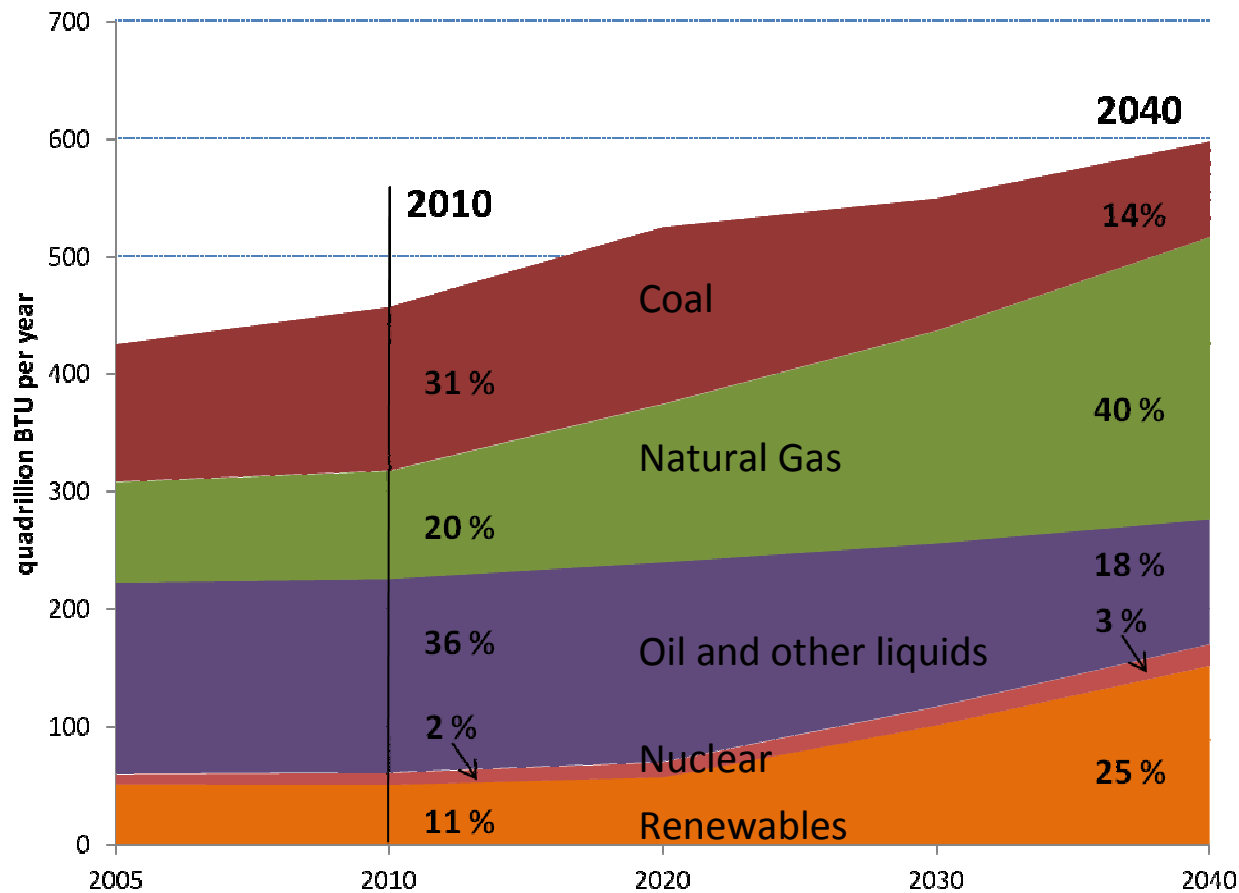
We must meet these demands while sustainably protecting people and the environment



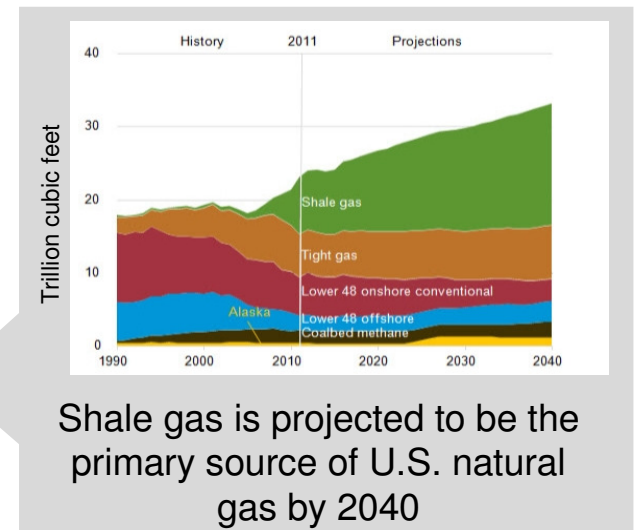
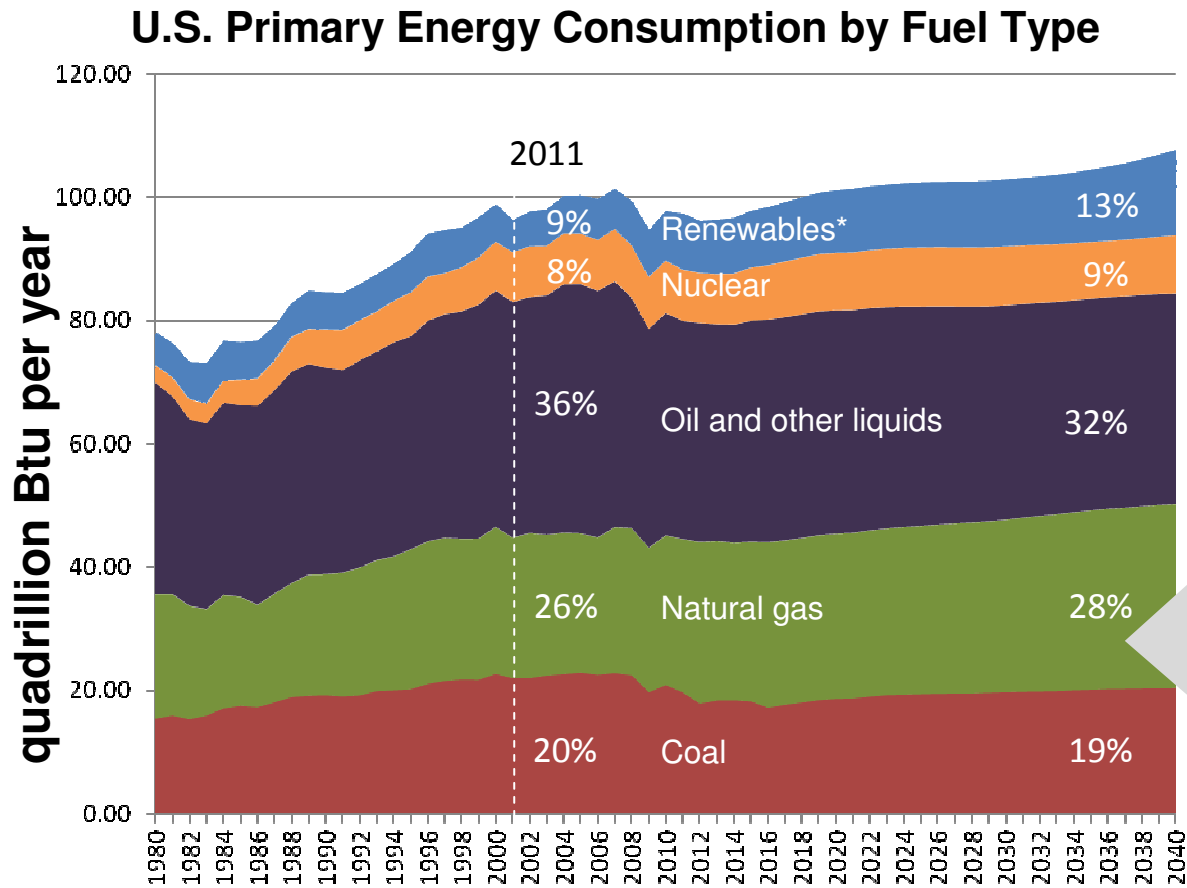
Global energy use will continue to increase

Energy sources are expected to shift

Forecast of Worldwide Primary Energy Consumption by Fuel
2005-2040



Shale gas will contribute...



*Renewables including liquid biofuels

Source: AEO2013 Early Release Overview, http://www.eia.gov/forecasts/aeo/er/early_fuel.cfm (downloaded April 26, 2013)

...but will not fundamentally change challenges

Increasing production costs

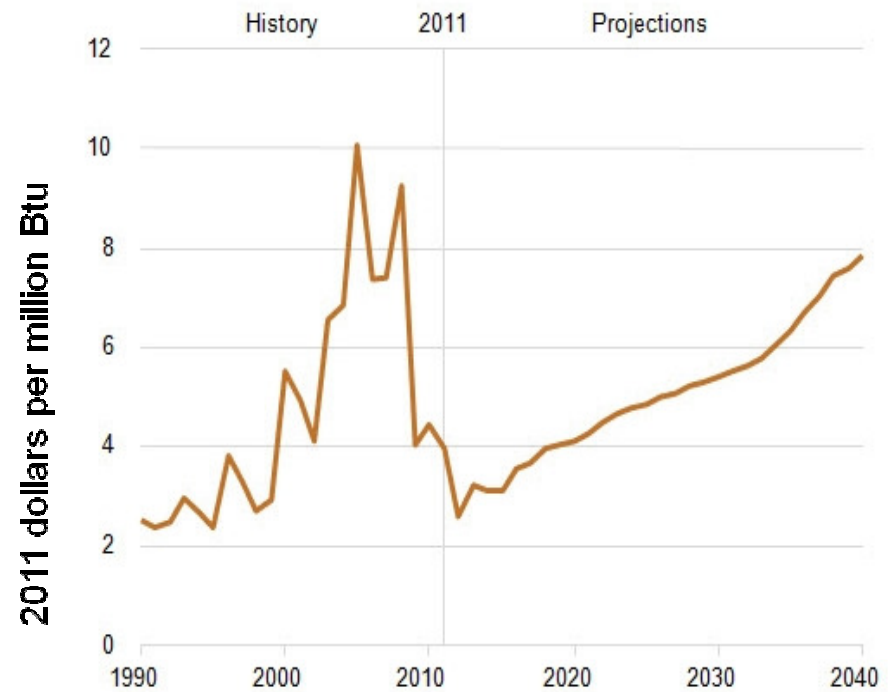
Resource constraints

Environmental impacts

New sustainable alternatives

New technologies & applications

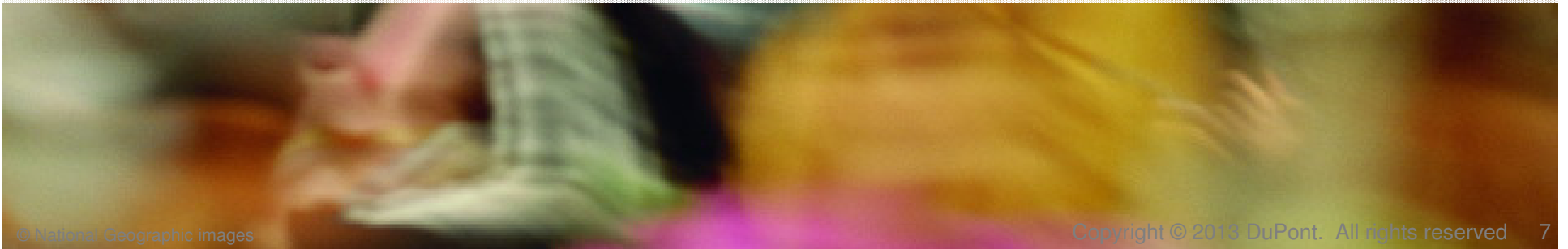
Annual average natural gas price is expected to more than double by 2040*



*Source: http://www.eia.gov/forecasts/aeo/MT_naturalgas.cfm#natgas_prices



To address the challenge, the chemical industry must continue to evolve by **integrating science, diversifying ideas** and **collaborating**

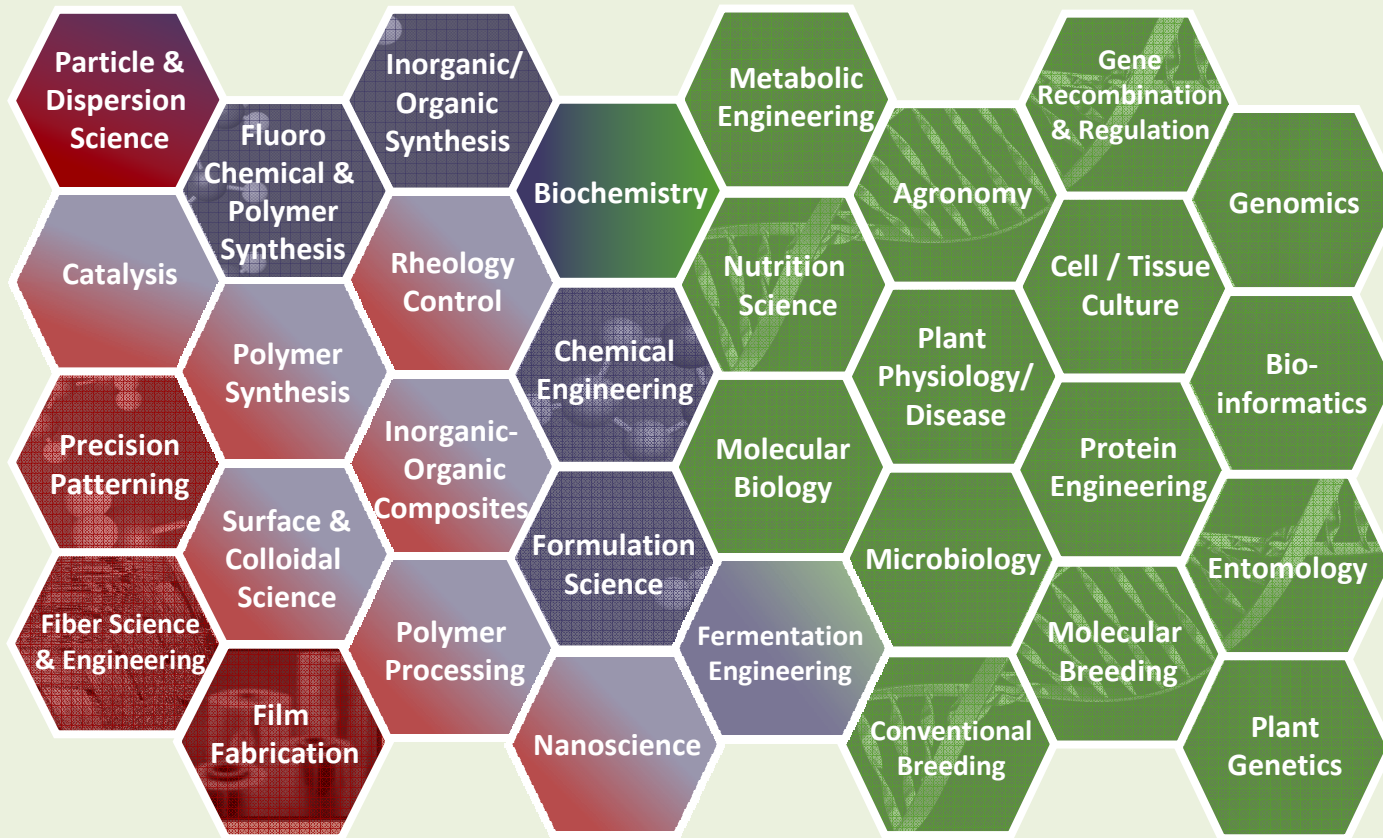


DuPont's approach: applying science to develop solutions to global challenges

- **Science-based innovations** will help make our consumption of valuable energy resources more efficient
- A more **reliable, increasingly clean energy supply** must be built on innovative technology applied to local conditions
- An energy solution is truly sustainable only when it is **economically feasible as well as environmentally sound**
- The development of viable clean energy technologies requires **collaboration** between scientists, and the policy, community and private sectors



Our broad capabilities enable pathways for future growth



Material Sciences

Chemical Sciences

Biological Sciences

Innovations in chemistry will continue to drive sustainable energy solutions

Biofuels

- Fermentation catalysts
- Replacement of oil-based products

Wind Energy

- Blade polymers

Solar Energy

- Photovoltaic materials

Energy Storage

- Electrode materials

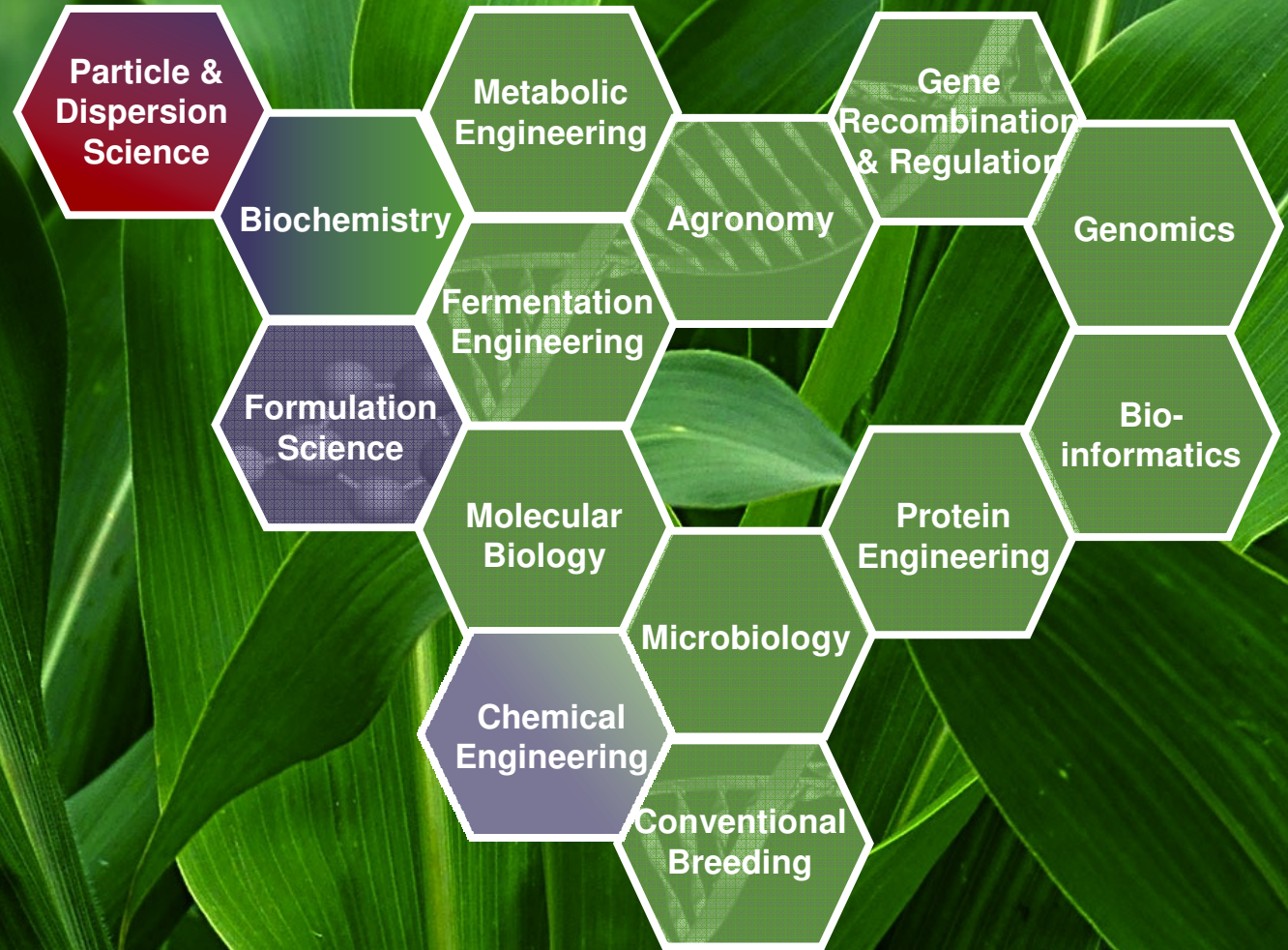
Light Weighting

- Fiber technology
- Polymers

We must continue to differentiate chemical offering

Advanced biofuels

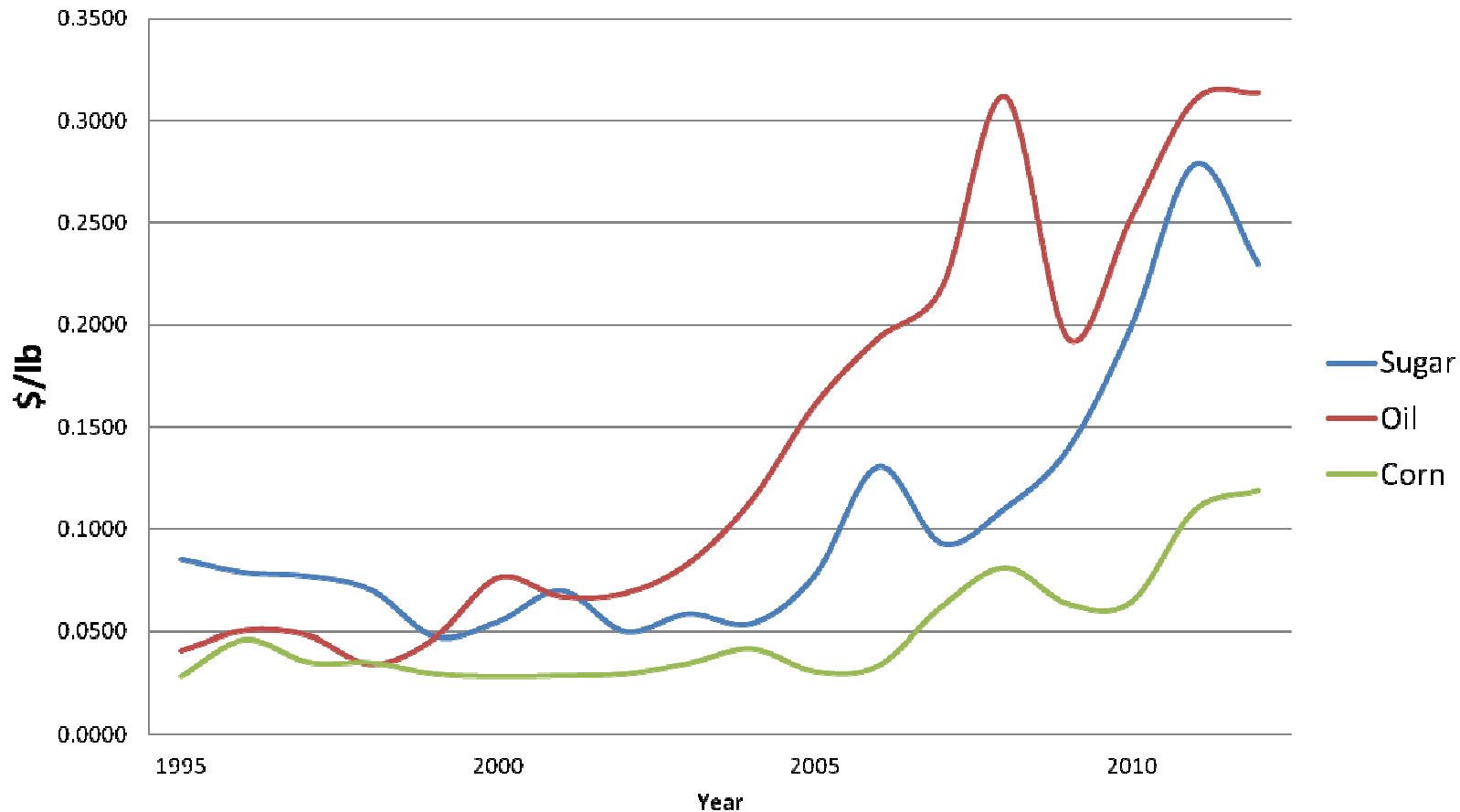
**Low carbon,
scalable,
sustainable**



Technology has driven a shift in feedstock cost

Cellulosic sugars can have a similar effect on energy sources

2012 Adjusted Oil, Sugar and Corn Prices*



In 2012 CPI Adjusted Dollars.

Sources:

Oil: DOE EIA- used WTI Cushing, Assumed 300#/bbl (took ave of API weights)

Sugar: USDA ERS World Raw Sugar Price ICE, Contract 11, near by contracts.

Corn: USDA ERS Feed Grains Database, Yellow Dent Number 2, St. Louis MO, Jan. price for each year

CPI Adjust- Oregon State University

DuPont cellulosic ethanol nearing commercialization

Demonstration Facility: Vonore, TN (2009)



Commercial Facility: Nevada, IA (2014)



Feedstock

Milling & Pretreatment

Saccharification

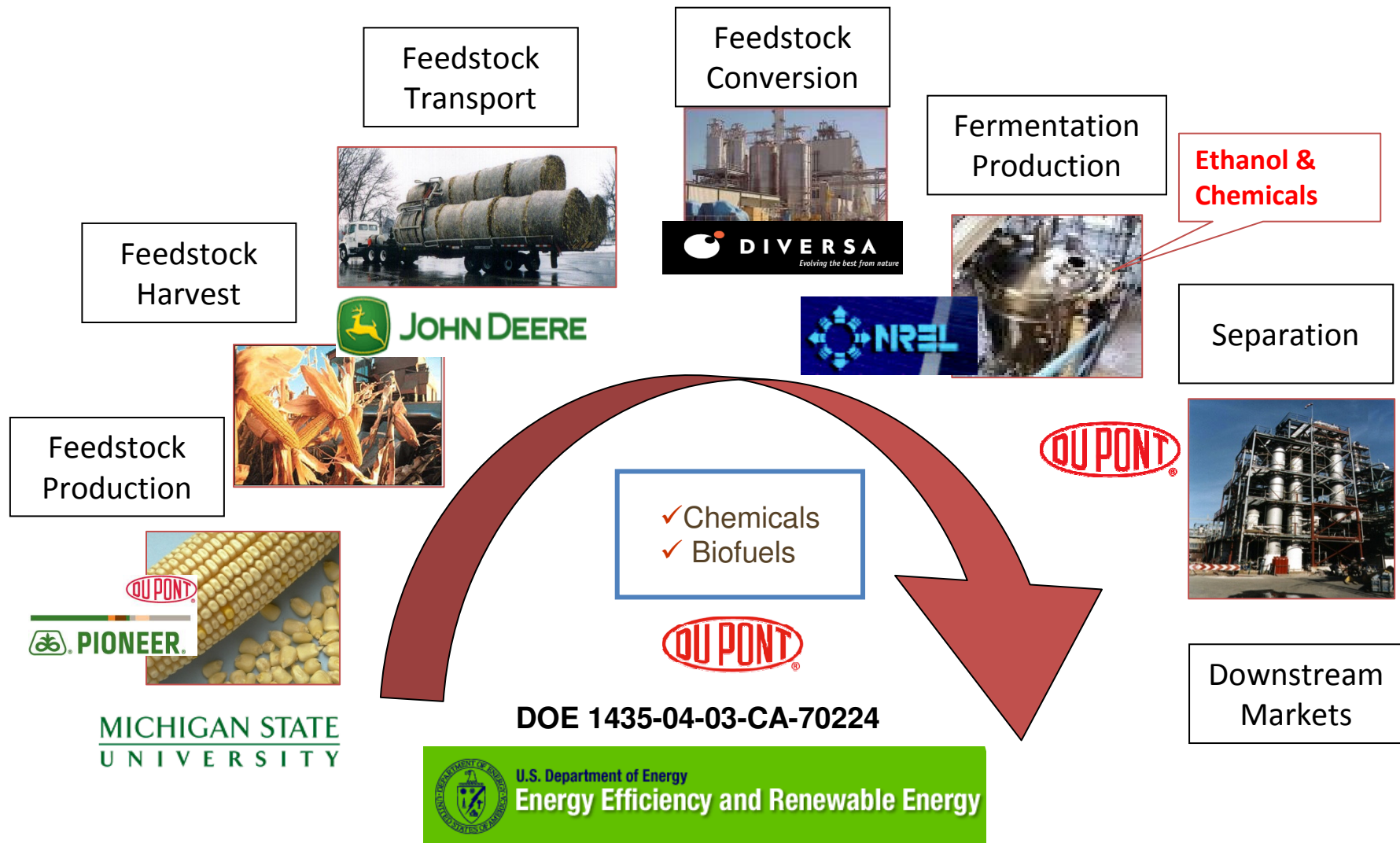
Fermentation

Separation

Integrated science and engineering allows optimization of the entire process, leading to lower-cost, lower-capital production technology

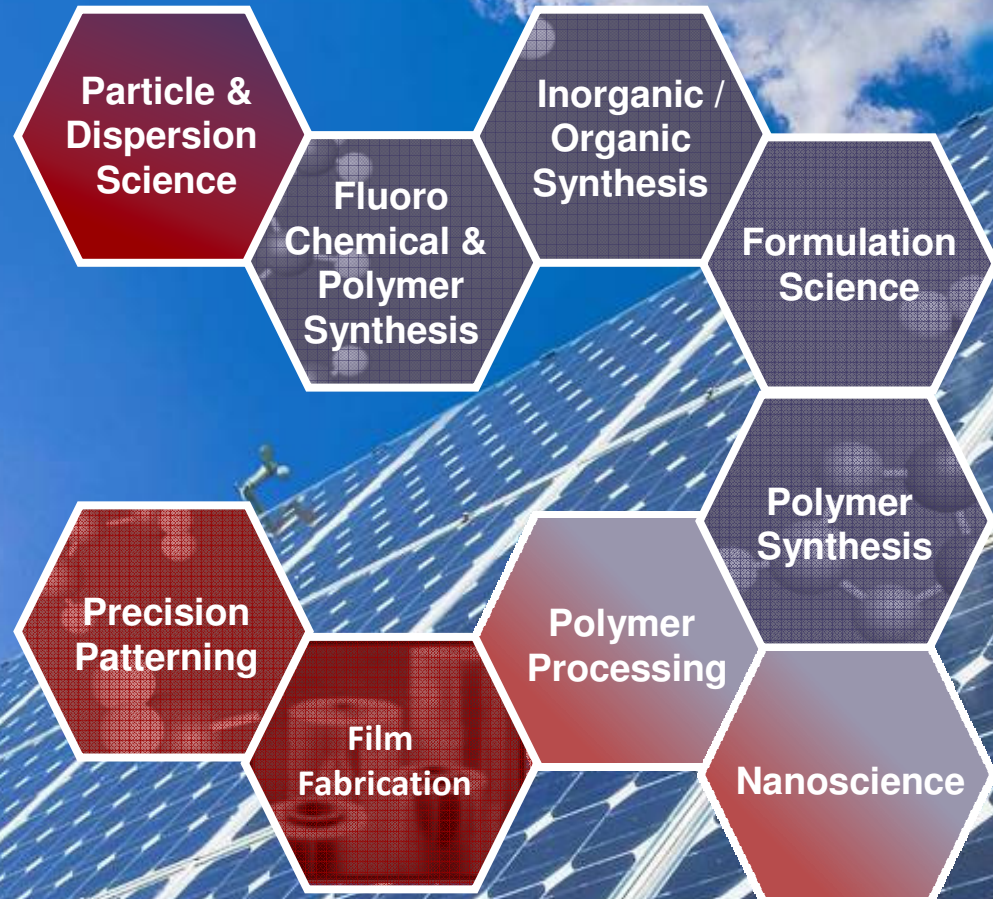
Cellulosic ethanol project approach

Originated through a government collaboration



Solar energy

Transform the sun's power into clean, efficient energy

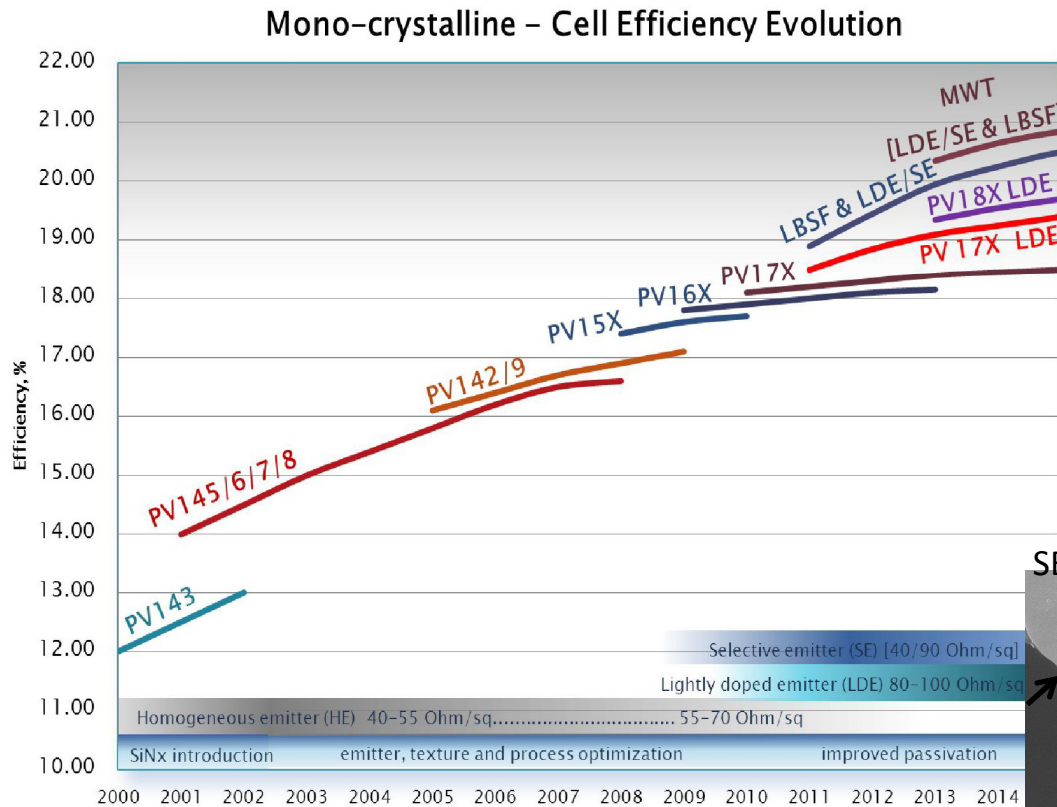


Photovoltaics

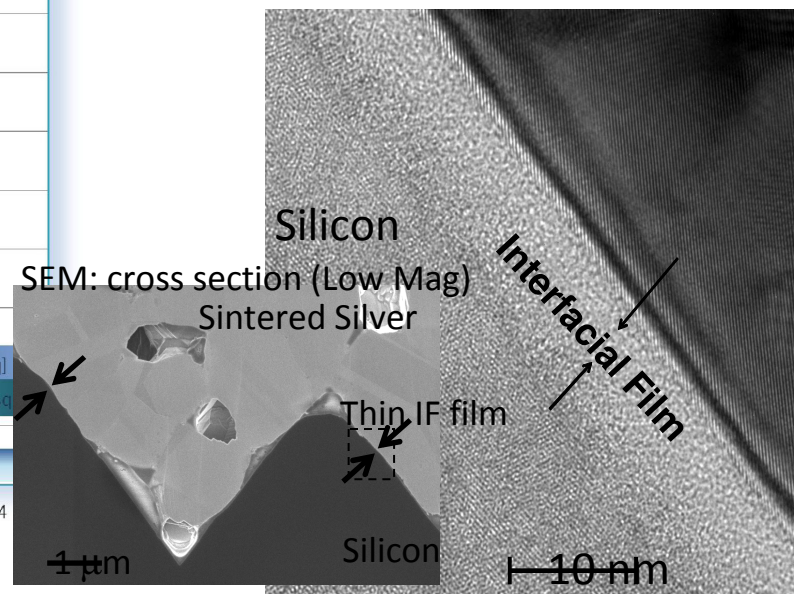
Increased solar cell efficiency

Ultra Thin Interfacial Film Contact

Tunneling contact via ultra thin interfacial films



TEM (High Mag)
Bulk Silver



Solamet® photovoltaic metallization pastes have nearly doubled solar cell efficiency within the last 12 years



WE'RE SOLVING THE WORLD'S GREATEST CHALLENGES

TOGETHER

Together we can accomplish
what no one can do alone.

INNOVATION
COLLABORATION
INTEGRATION

WELCOME TO
THE GLOBAL
COLLABORATORY