

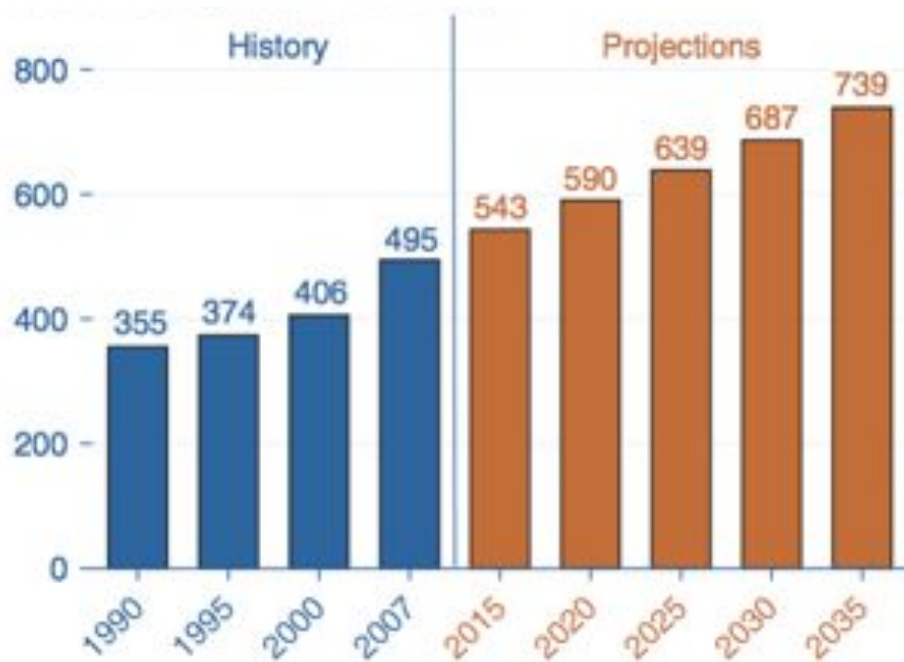
Nanotech-Inspired Clean Energy

David Thomas, VP Nanogenesis Group
A Division of AEGIS Technologies

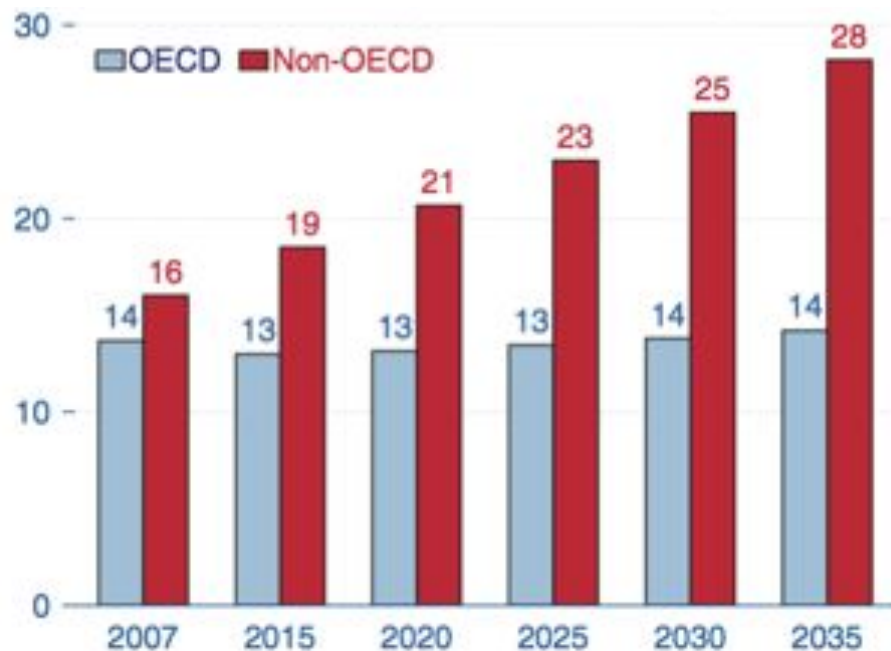
www.NanogenesisGroup.com



*World Energy Consumption
(quadrillion BTU)*



*World CO2 Emissions
(billion metric tons)*

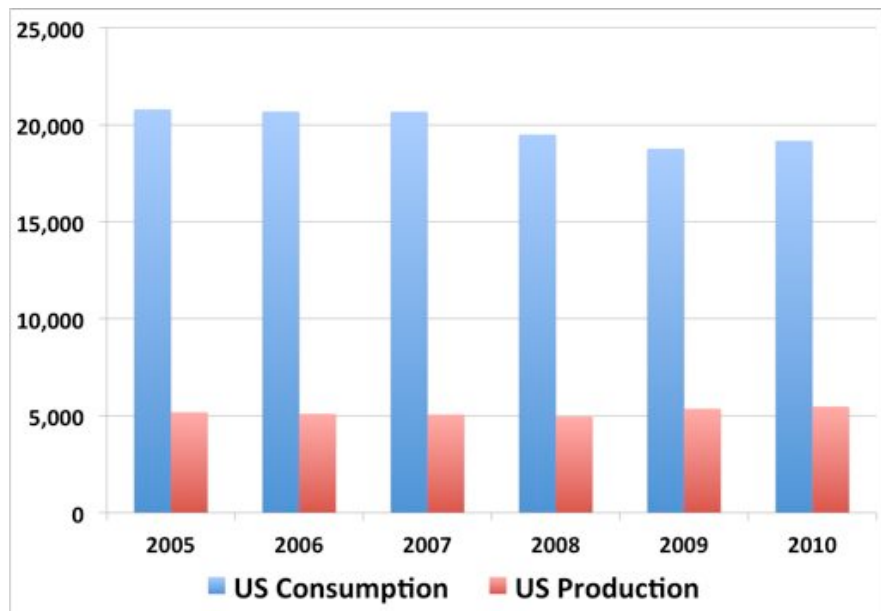


OECD is the Organization for Economic Co-operation and Development

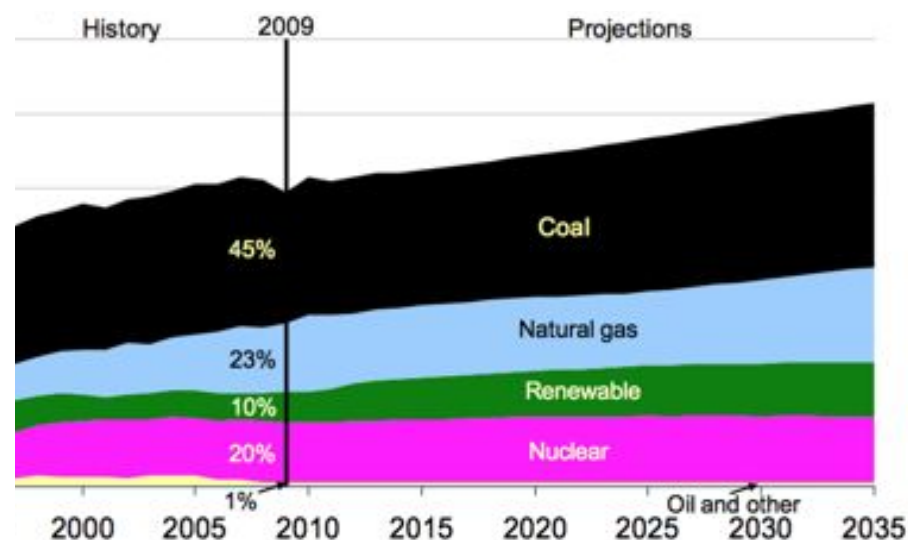
Source: US Energy Information Administration (EIA)

*Electricity production will shift to lower carbon emissions
Renewable energy sources will grow by 73% - Is that enough?*

*Recent US Petroleum Statistics
(Thousands of Barrels Per Day)*



US Electricity Generation Forecast



Source: US Energy Information Administration (EIA)



Engineering at the molecular scale allows us to tailor material properties for specific applications

“AEGis is investing heavily in Nanotechnology because we believe **Nanotech is every bit the industrial revolution of the next 30 years** that integrated circuits were in the last 30”

-- *Steve Hill, President and CEO, AEGis Technologies*

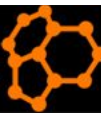
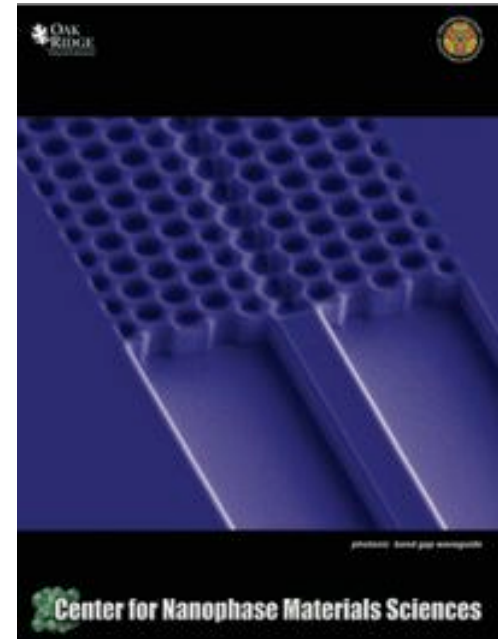
“We see it (nanotechnology) as having **virtually unlimited potential to transform the way we produce, deliver, and use energy**, not to mention its likely effect on medical technology and national security.”

-- *Former U.S. Energy Secretary Spencer Abraham*

Features are:

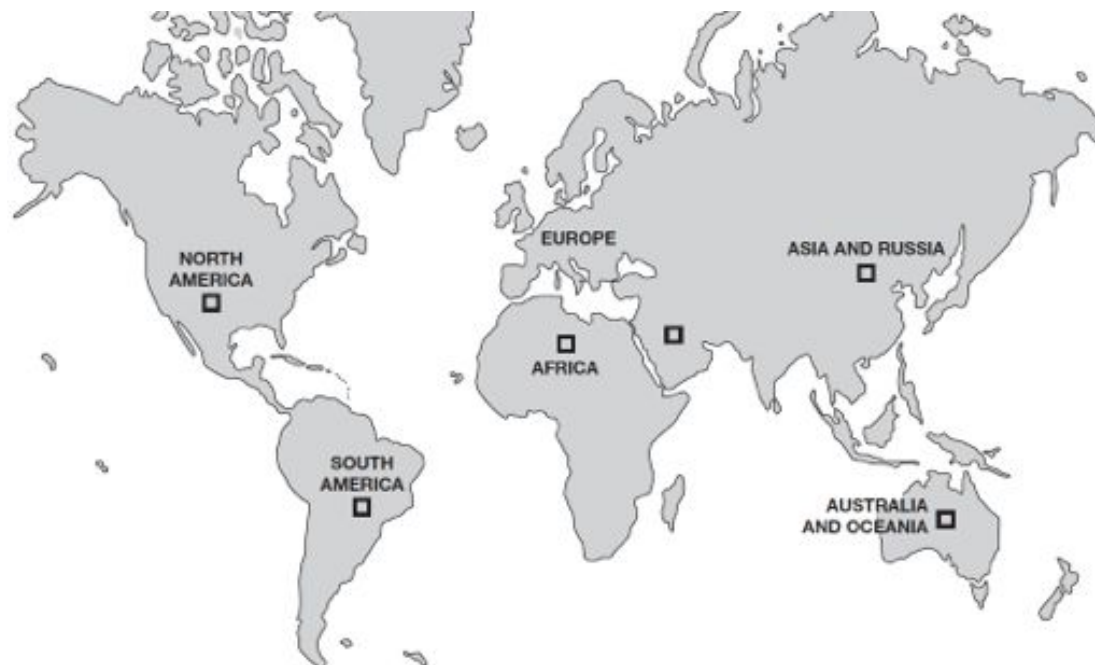
250 times smaller than a human hair

30 times smaller than a red blood cell



Without doing anything, we enjoy the effect of 165,000 terawatts of power hitting the earth's disk every moment of every day.

Richard Smalley, Nobel Laureate, Rice University



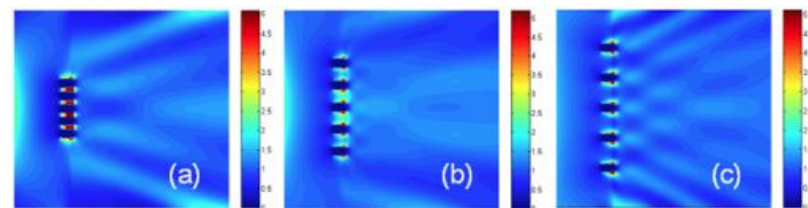
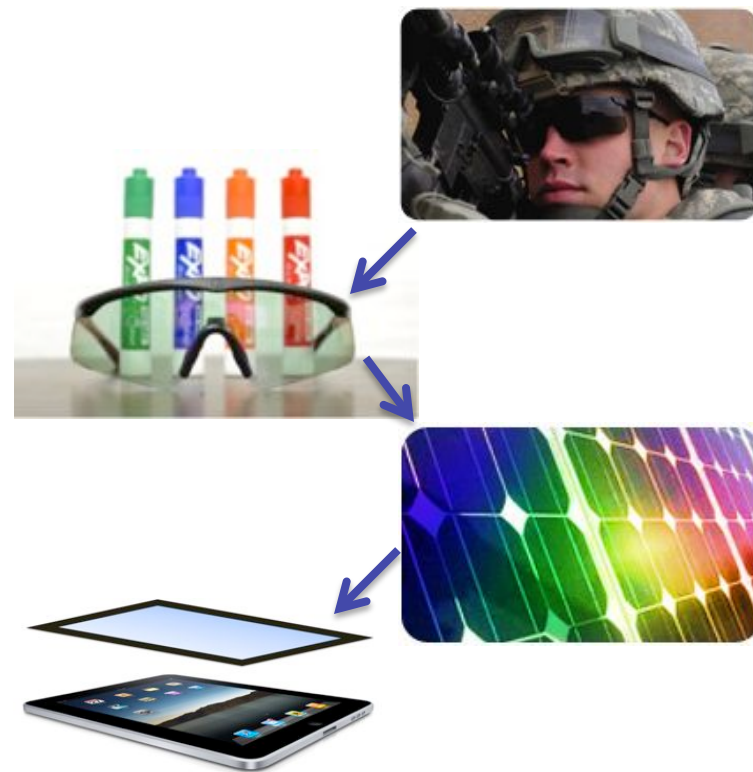
Land area requirement for 10% efficient solar cells that would solve humanity's energy problem. Nate Lewis, California Institute of Technology.

We can control how light interacts with matter

Nanogenesis is developing solar cells with higher efficiency than current photovoltaic (PV) devices (DARPA, Army)

This technology has the potential to enhance the efficiency of the cell *and* offer reduced cost to manufacture

Our research includes transparent solar technology with widespread commercial implications



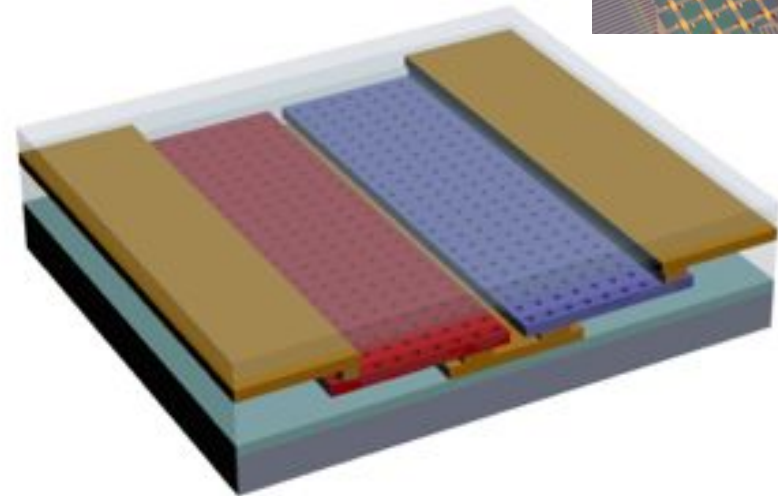
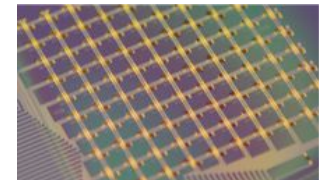
*The best solar cells have an efficiency of around 45%
Roughly half of all energy collected by solar cells is lost to heat*

We can capture the heat generated by the sun and convert it to electricity

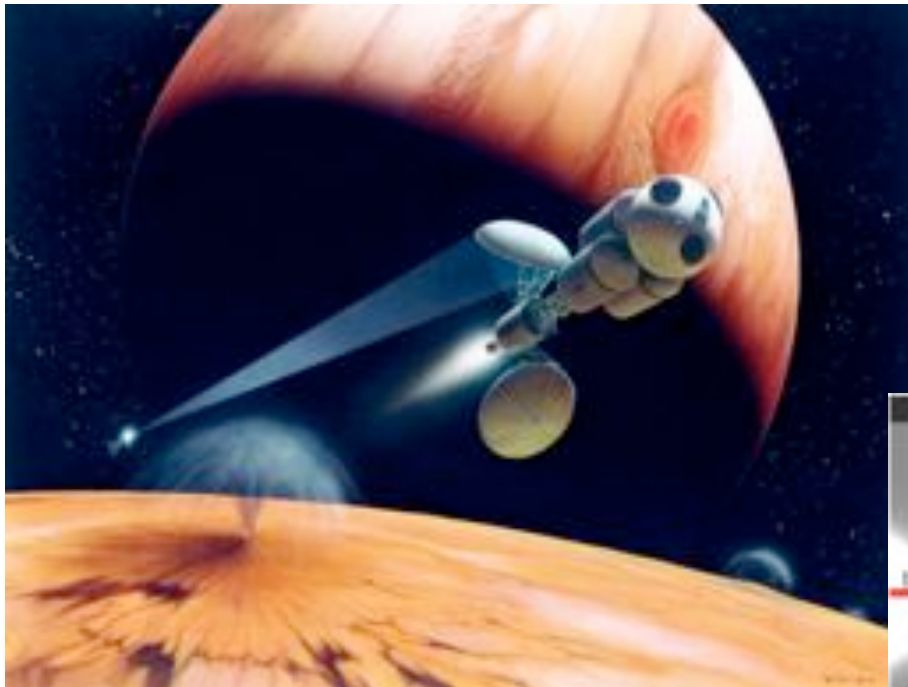
Nanogenesis is developing high temperature, conformal thermal harvesting technology

We are leveraging expertise from our experience in building micro/nano scale technology on thin metal foils

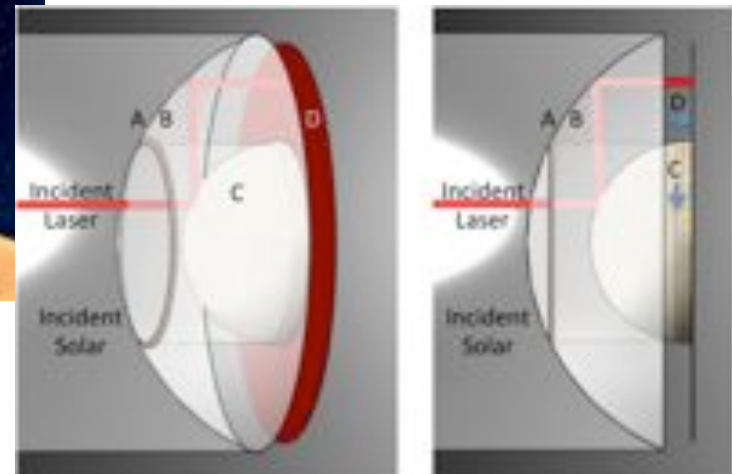
Nanogenesis metal foil platform (right) and Thermoelectric Generator (TEG) design (below)



NASA is interested in providing auxiliary power to satellites using energy from a high power laser beam



NASA concept of a laser power station (top) and Nanogenesis solar-thermal collector design for the NASA "Ride the Light" effort (right).

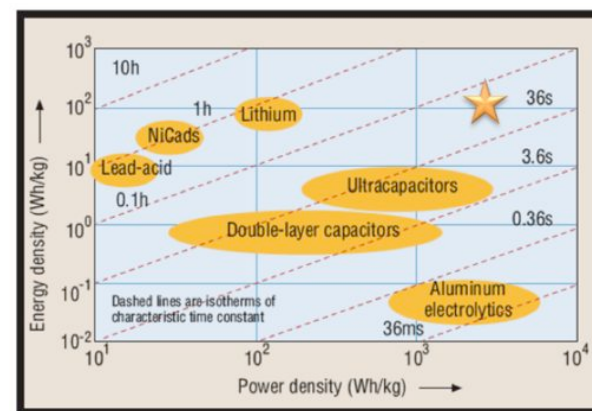


Molecular engineering allows us to pay attention to physical, electronic, and ionic requirements

Intermittent renewable sources require better energy storage to be fully utilized

Nanomaterials can amplify the performance of energy storage devices

Nanogenesis is developing a concept to maximize both the energy density and power density in a large array of storage elements



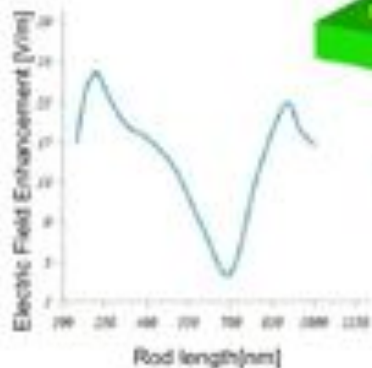
Energy and power density map



Semiconductor solar cells have a theoretical efficiency of ~55%

Optical antennas have a theoretical efficiency of ~94%

Bow-tie. $\alpha=30^\circ$



*** Simulation results of aperture $\alpha=30^\circ$

Linear Modulated Arrays

