IHTC
SINCE 1951

Room A, 15:50-18:10, August 14, 2014

Panel Discussion on

The Role of Thermal Science in Meeting Societal Challenges

Panelists

Yildiz Bayazitoglu
Rice University

Yogesh Jaluria
Rutgers University

Joon Sik Lee
Seoul National University

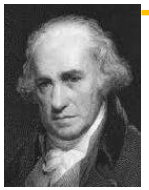
Dimos Poulikakos
Swiss Federal Institute of Technology in Zurich

Peter Stephan
Technische Universitat Darmstadt

Moderator **Nobuhide Kasagi**
Japan Science & Technology Agency / The University of Tokyo

What Is Our Role Beyond the History of Thermal Science?


Newton


Watt

Thermodynamics


Carnot


Joule


Fourier


Biot

1800

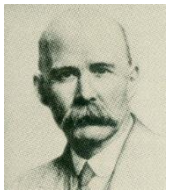

Reynolds

Fluid Mechanics


Rayleigh


Graetz


Prandtl


Stanton


von Karman


Schmidt

Non-equilibrium Thermodynamics

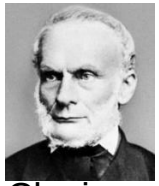

McAdams

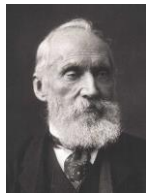

Nukiyama


Prigogine

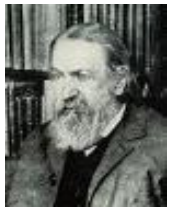

Sherwood


Tien


Clasius


Thomson


Grashof

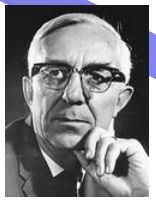

Mach

1900

Heat Transfer


Jakob


Nusselt


Eckert

2000

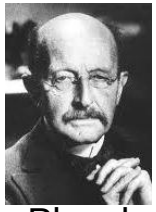

Maxwell


Stefan

Quantum Mechanics

Statistical Mechanics


Boltzmann


Planck


Colburn


Luikov

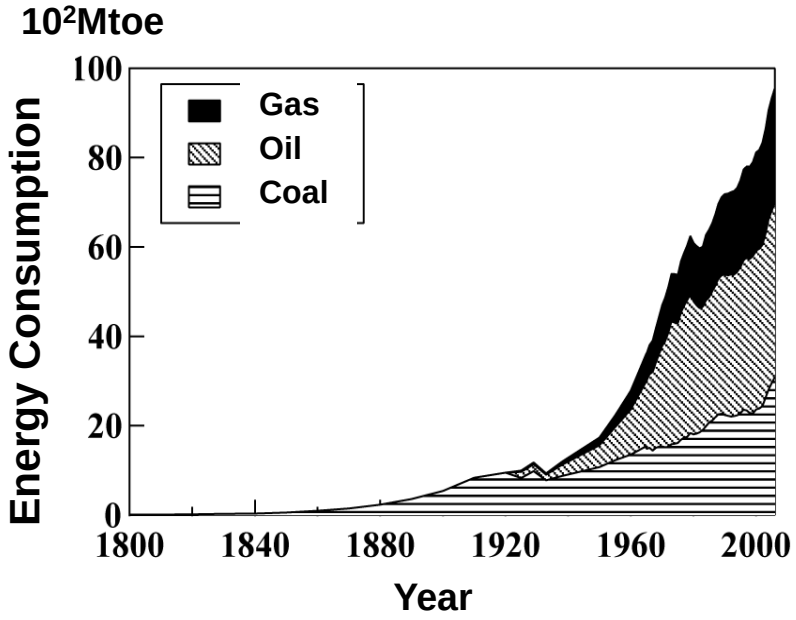

Rohsenow

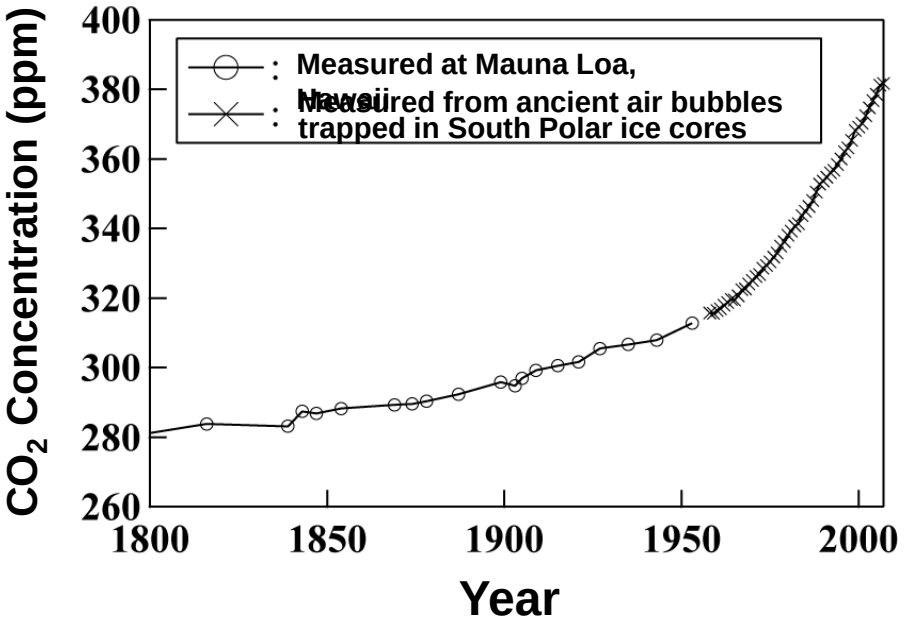

Smalley

?

Micro/Nano Science

Growth and Expansion on Our Planet





During the 20th Century:

- World population from 1.65 to 6.1 x10^9 (3.7 times)
- Energy consumption from 0.5 to 9 Btoe (19 times)
- CO_2 concentration from 300 to 380 ppm (400 ppm in 2013)

Global Trends and Social Wish in the 21st Century

- Technology breakthrough, innovation, and globalization leading to rapid changes in industrial structures and social systems
  - Nano, bio and information technologies
  - High-speed digital communication, massive transportation
  - Personalized health/medical care, smart energy, ubiquitous finance
  - Economy of scale to economy of satisfaction
- Social wish for "Sustainable Development" that meets the needs of the present without compromising the ability of future generations to meet their need
  - *Our Common Future* (Brundtland Report) (UNEP, 1987)

Science in Society and Science for Society

- *Declaration on Science and the Use of Scientific Knowledge* adopted by the World Conference on Science (ICSU), Budapest, 1 July 1999
  1. Science for knowledge; knowledge for progress
  2. Science for peace
  3. Science for development
  4. Science in society and science for society
- *Social Contract for Science* proposed by J. Lubchenco (Science, 1998):

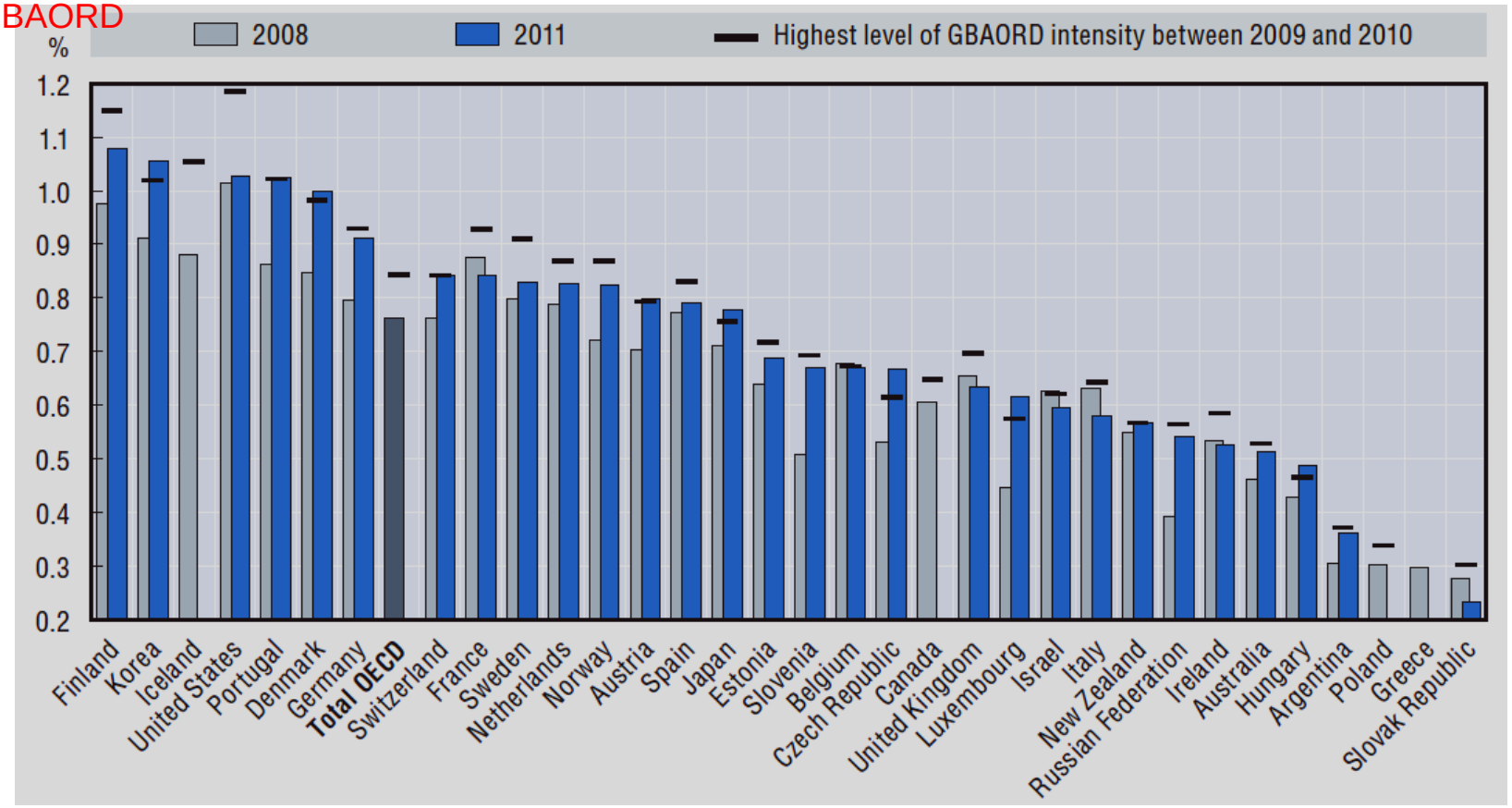
STI Policy Movement in Japan

- Major issues such as recovery and rebuilding, future energy plan, deindustrialization, aging with declining population, sovereign debt, economic crisis …….. after 2011 Great East Japan Earthquake

- **4th Science and Technology Basic Plan** (rev. 2011)
  - Restoration and reconstruction
  - Green innovation, Life innovation
  - Issue-driven R&D strategy
  - …….
  - S&T budget for FY2013 ~ ¥4.6T (US$46B) (+25%)

Research Funding as a % of GDP for 2008-11

GBAORD



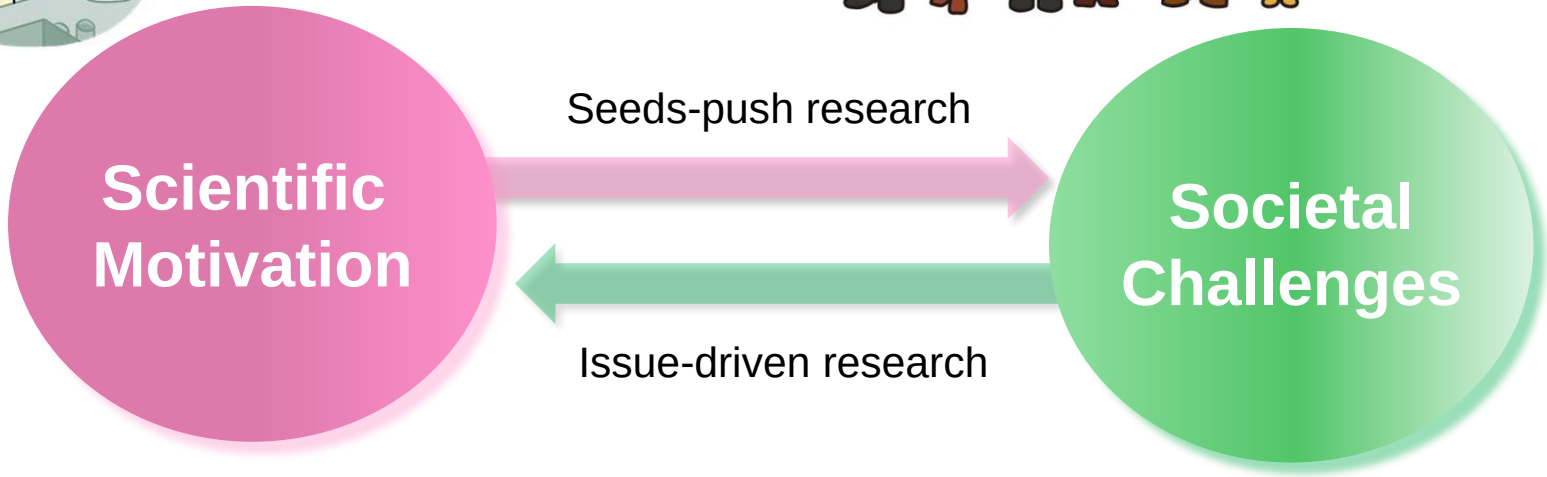
GBAORD: Government budget appropriations or outlays for R&D as a % of GDP

(STI Outlook 2012, OECD)

Seeds-push vs Issue-driven Research (Bottom-up vs Top-down)

Scientific research in most cases driven by scientist's curiosity

Society wants fulfillment of their wishes



- How to effectively link science to innovation, economic growth and social welfare

Important Questions

- Roles of scientists and engineers of thermal science in resolving various **societal issues** and enabling further **societal development**?
- How research themes and schemes to be designed in order to meet societal challenges, while keeping spontaneous **motivation of researchers in issue-driven (top-down) research**?