B. Global Sustainability Science

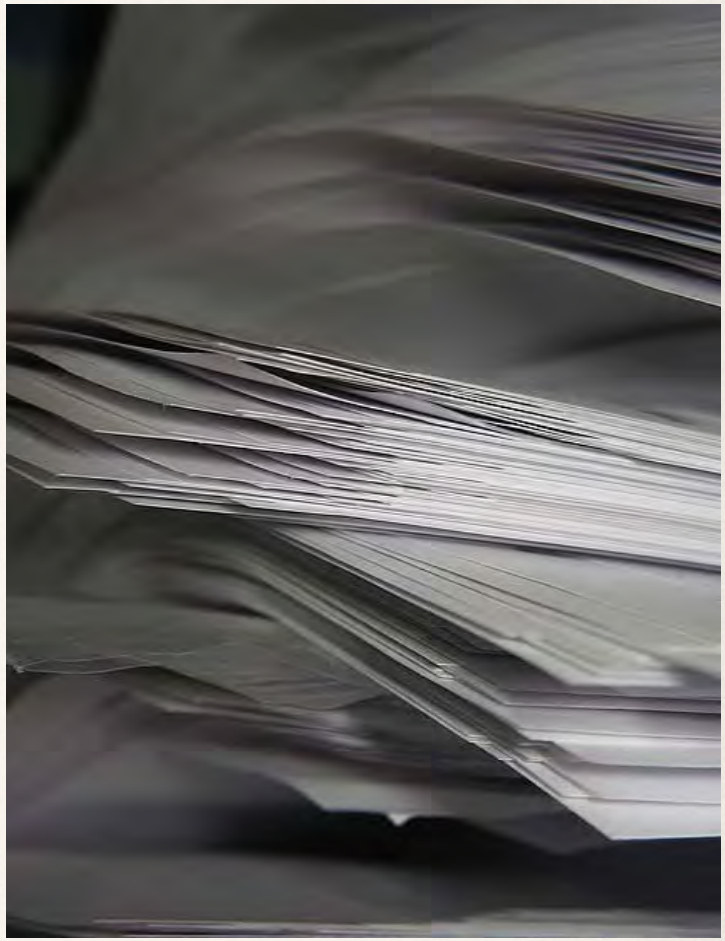
Sustainability Science

- Global sustainability challenges are complex, interrelated and global
- Sustainability Science: provides integrated solutions based on interdisciplinary cutting-edge S&T
- A minimum S&T capacity in each country is essential to generate local solutions and to enable effective participation in global efforts.

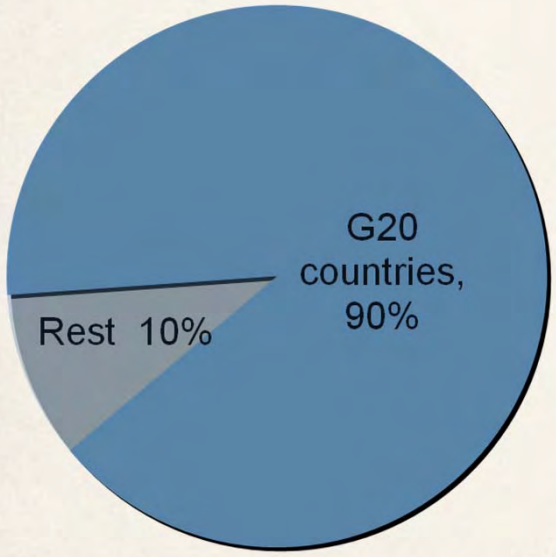
Knowledge Production

Knowledge Gaps

- Big disparities still exist in scientific productivity between North and South; although the gap is slowly narrowing.
- Small number of developing countries rapidly advancing in STI and slowly changing global patterns.
- Gaps in production of scientific knowledge are widening among developing countries.



Share of world's papers in science, medicine and engineering



90%
research production

90%
economic activity

80%
CO_2 emissions

G20
Argentina
Australia
Brazil
Canada
China
France
Germany
India
Indonesia
Italy
Japan
South Korea
Mexico
Russia
Saudi Arabia
South Africa
Turkey
UK
USA
European Union

Shares of S&T Poorest Countries

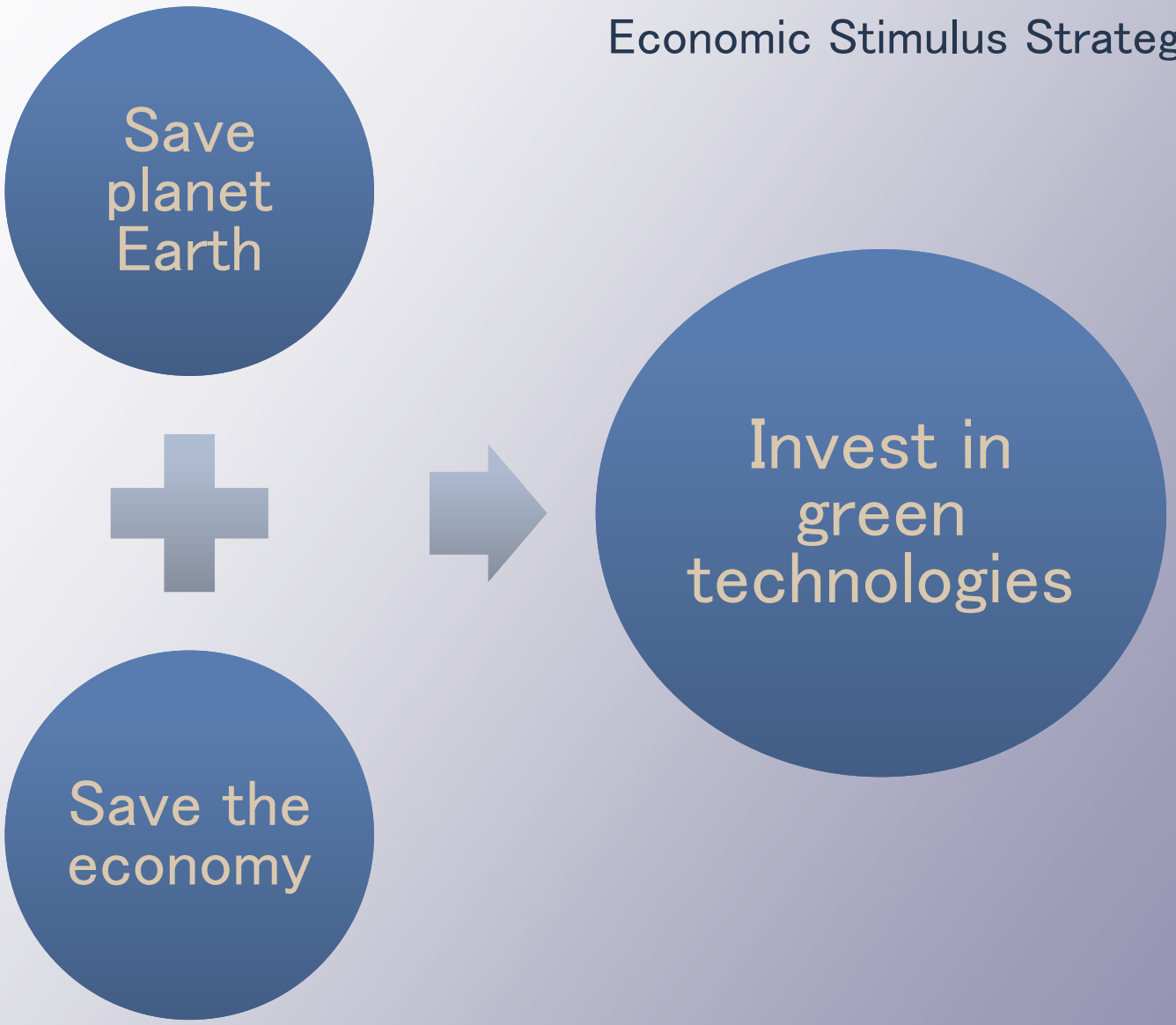
Region	Number of S&T Poorest countries	Share % of developing world	Share % of entire world
Africa	44	2.25	0.56
Asia & Pacific	23	1.13	0.28
Latin America & Caribbean	13	0.38	0.09
Total	**80** (1.5 billion people)	3.76	**0.93**

Two main challenges

Future Strategies for Planet Earth Sustainability should promote global partnerships to address two interrelated challenges:

- Improving quality and relevance of education and research, especially in S&T Poorest Countries
- Increasing investments in green-based and STI-based solutions to global sustainability problems

Economic Stimulus Strategy



Future global investment in green technologies

- UNEP proposal: 1% of GDP should be spent on green initiatives
- G20 endorsed proposal

Member	Expenditure on green technologies
China	3% of GDP
South Korea Japan	3% of GDP 0.8% of GDP
USA	0.7% of GDP
EU	0.2% of GDP

B. Frontier S&T for Sustainability

ICT's and Space Technologies

- Providing wireless communications and distance education to rural communities
- Monitoring environmental change, natural resources and Disasters
- Improving knowledge about oceans
- Improving early warning and response systems to disasters, through social media and mobile phones
- Improving forecasting of natural hazards through high resolution satellite data

Biotechnologies

- Modern biotechnology has promising new applications in agriculture, medicine and environment :
  - improving productivity of crops affected by natural disasters such as weather
  - developing pest-resistant, drought-resistant and higher crop yields
  - Developing biodegradable plastics and more effective methods to treat industrial waste and clean-up oil spills

Student finds new way of turning plastic into biofuels

Faiad says she hopes to see her idea become a 'tangible project on the ground' this year
European Commission
[CAIRO] A method for generating biofuel).

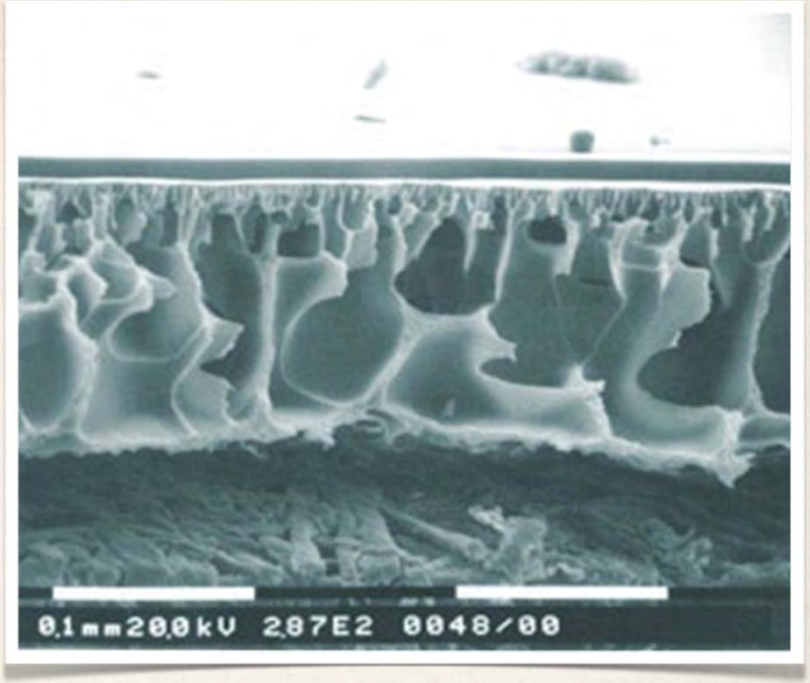
CAIRO] A method for generating biofuel by breaking down plastics using a low-cost catalyst will be developed further in the United Kingdom next month (16 July).

The process was developed by a sixteen-year-old Egyptian student, Azza Abdel Hamid Faiad, from the Zahran Language School in Alexandria, Egypt.

Faiad won the European Fusion Development Agreement award at the 23rd European Union Contest for Young Scientists — involving 130 competitors from 37 countries — held in Finland last year (23-28 September, 2011)

Nanotechnologies

- Nanotechnology is the fastest growing technology in the world today with estimated global market $ 2.4 trillion in 2015 and applications in all sustainability areas
- It provides inexpensive, efficient water purification filters
- It promises a new generation of more efficient and affordable nanosolar cells
- It helps mitigate the impact of disasters



Thailand's nanotech research tackle disaster prevention

Nano-sacks could replace traditional sandbags for flood

BANGKOK] Recent flooding in Thailand has given the country's nanotechnology research centre an opportunity to show how nano products ranging from antimalarial bednets to flood prevention technology could help mitigate the impact of future natural disasters. One example is the nano-sack or N-Sack, a product that resembles giant, superabsorbent diapers (nappies). It uses hydrogel and nano coating to absorb water, and is being promoted as a potential replacement for traditional sandbags for flood control.

"It is our hope that the nano-sack development will be refined and can be used before the next rainy season," Sirirurg Songsivilai, executive director of the state-run National Nanotechnology Center told

SciDev.Net. 25 January 2012

Cleaning up oil spills with magnets and nanotechnology

(CNN) – September 21, 2012

Oil spills from container ships or offshore platforms are a frequent hazard to marine and coastal ecosystems and an expensive one to clean up. BP expects the Gulf of Mexico oil spill in 2010 –– the worst environmental disaster in U.S. history –– to cost it $40 billion.

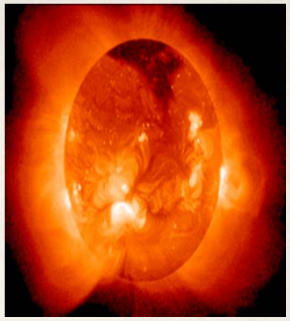
However, researchers from the Massachusetts Institute of Technology (MIT) say they have found a method of recovering oil after a spill using magnets, potentially saving companies like BP money in clean up bills.

On it's own, oil is not magnetic, but MIT researchers say that when mixed with water–repellent nanoparticles that contain iron, the oil can be magnetically separated from the water. The nanoparticles can later be removed

Nuclear Technologies

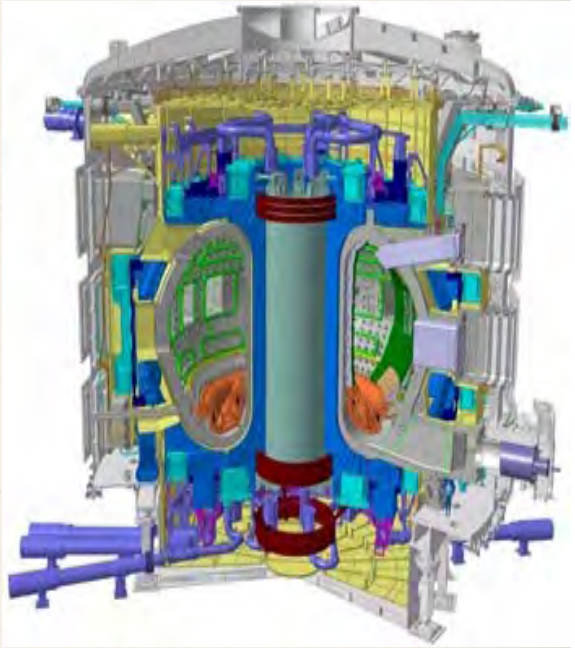
- Wide range of applications from smoke detectors to nuclear energy
- Agricultural, medical, environmental and industrial applications
- **Nuclear fission energy**:
  - Accounts for 16% of world electricity production (France: 80%)
  - Further expansion requires careful assessment of advantages and disadvantages
  - New generation of reactors: smaller, safer, transportable

Fusion Energy



ITER – *International Thermonuclear Experimental Reactor*

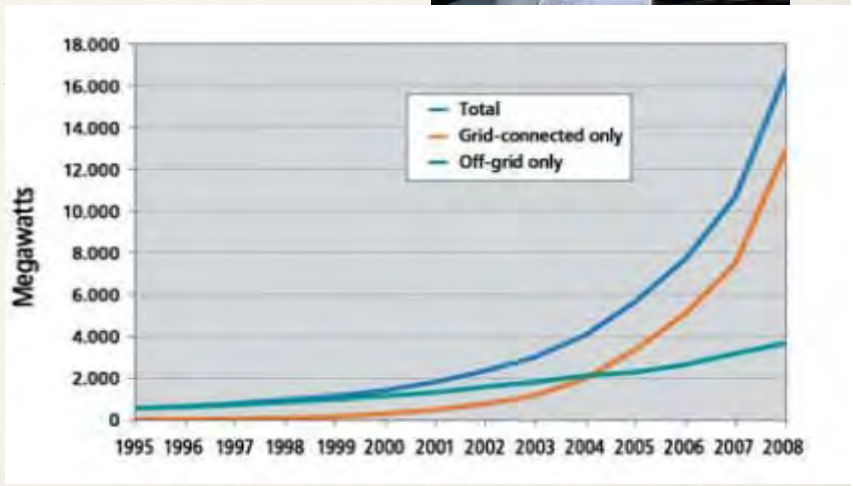
- road towards unlimited clean fusion energy
- completion scheduled: 2020
- mission: demonstrate feasibility of fusion
- cost estimate : $ 25 billion
- sponsors : EU, USA, Japan, Russia, China, India, Brazil, Korea



The incredibly complex ITER Tokamak will be nearly 30 metres tall, and weigh 23,000 tons. The ITER Tokamak is made up of an estimated one million parts.

Solar Energy Technologies

- Technologies to harness solar energy are developing rapidly worldwide and especially in developing countries: investment increased from $ .6 billion in 2004 to $ 33.5 billion in 2008
- Solar Energy Technologies (SET) provide best and most reliable option to generate electricity for rural communities, especiall in rural Africa, where 90% of population have no electricity.
- Two types of SET:
  - concentrated solar power (CSP)
  - solar photovoltaic (PV)

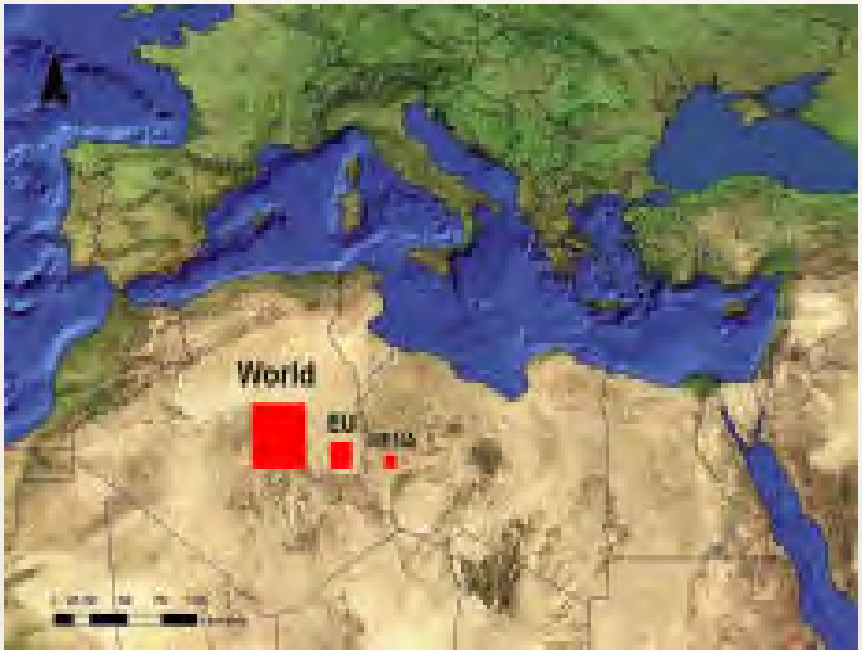


Global capacity in solar PV from 1995–2008. Source: Renewable Energy Policy Network for the 21st

Desert Solar Power

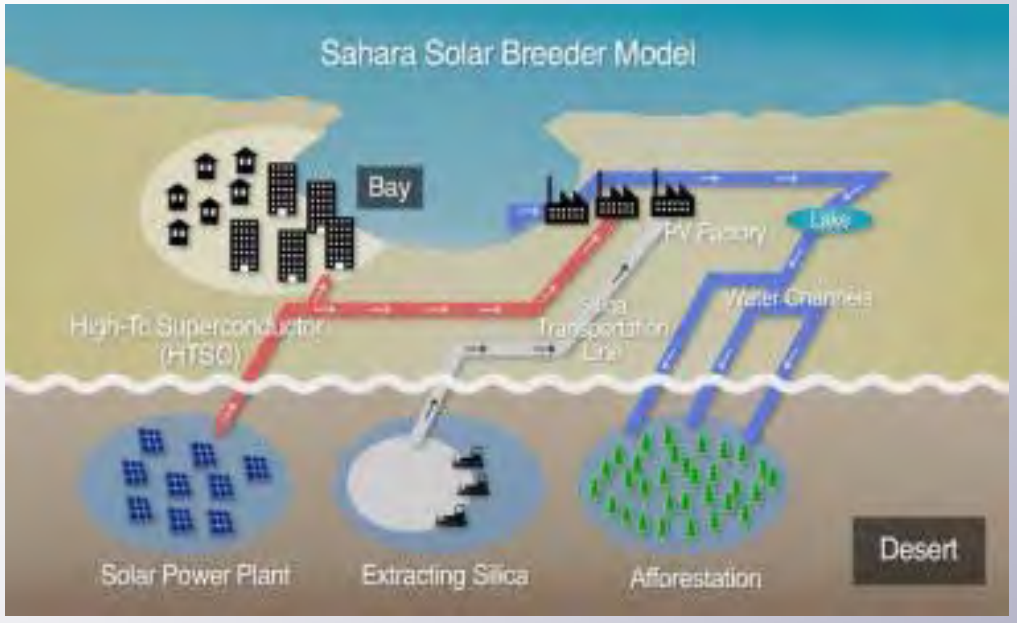
Desertec:

- plans to invest more than 500 billion Euros in solar thermal energy in Sahara desert
- concentrating solar thermal power uses mirrors to produce steam



Energy Desertec projects moves beyond planning stage

Sahara solar power breeder project aims to power half the world by 2050



Deserts should not be deserted

GROWING SILICON IN THE SAHARA FOR SOLAR PANELS

—— A joint project by universities in Algeria and Japan is planning to turn the Sahara desert, the largest desert in the world, into a breeding ground for solar power plants that could supply half the world's electrical energy requirements by 2050.

Missing Links