



**Daniel K. Inouye
Asia-Pacific Center for Security Studies**

**POST Conference Scene Setter
March 7, 2017**



Who are we?

■ **DKI APCSS** receives:

- Policy Guidance from the Office of the Secretary of Defense for Policy (**OSD(P)**)
- Operational Direction from U.S. Pacific Command (**PACOM**)
- Funding from the Defense Security Cooperation Agency (**DSCA**)



Established in 1995, DKI APCSS is one of five U.S. Department of Defense Regional Centers



What do we do?

Build Capacities, Networks and
Shared Understanding by

Educating, Connecting, and Empowering

Civilian and Military Security Practitioners to
Enable Outcomes in the Indo-Asia Pacific





How do we do it?



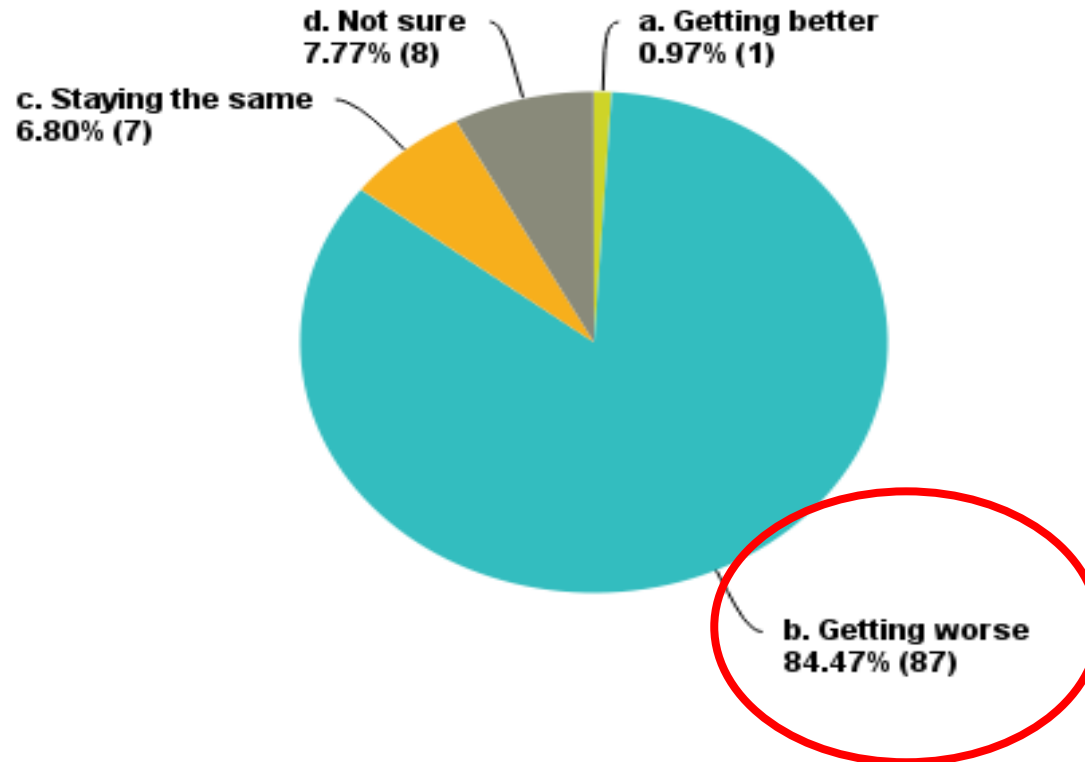
- **Executive Education**
 - Suite of 5 **Courses**
 - Attendees are senior and mid-level military and civilian security practitioners
- Tailored, responsive **Workshops & Dialogues**
- **Alumni** engagement
 - Over 11,000 alumni worldwide
 - 57 alumni chapters in 54 countries



Pre-conference Survey

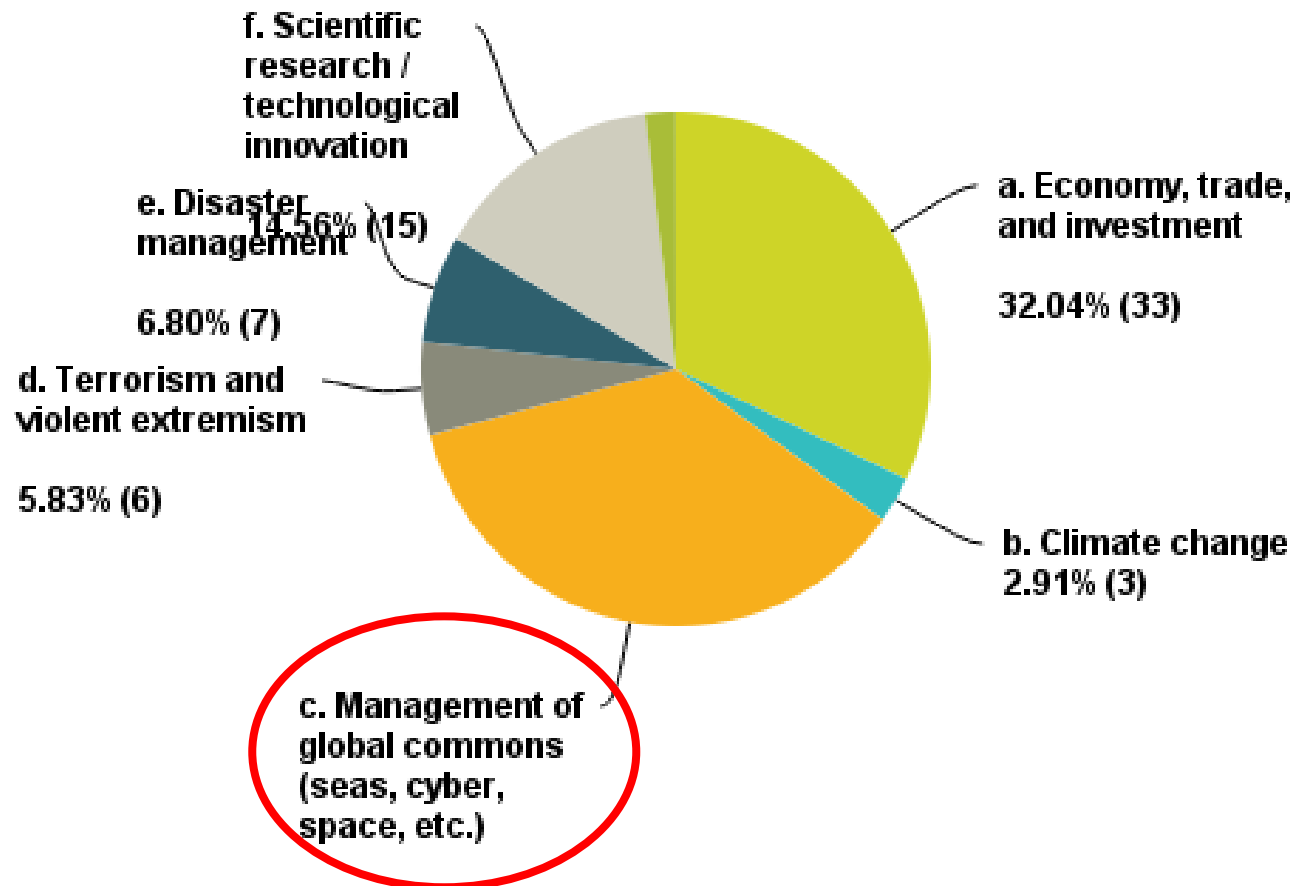
The security environment in the Indo Asia-Pacific region is...

Answered: 103 Skipped: 0



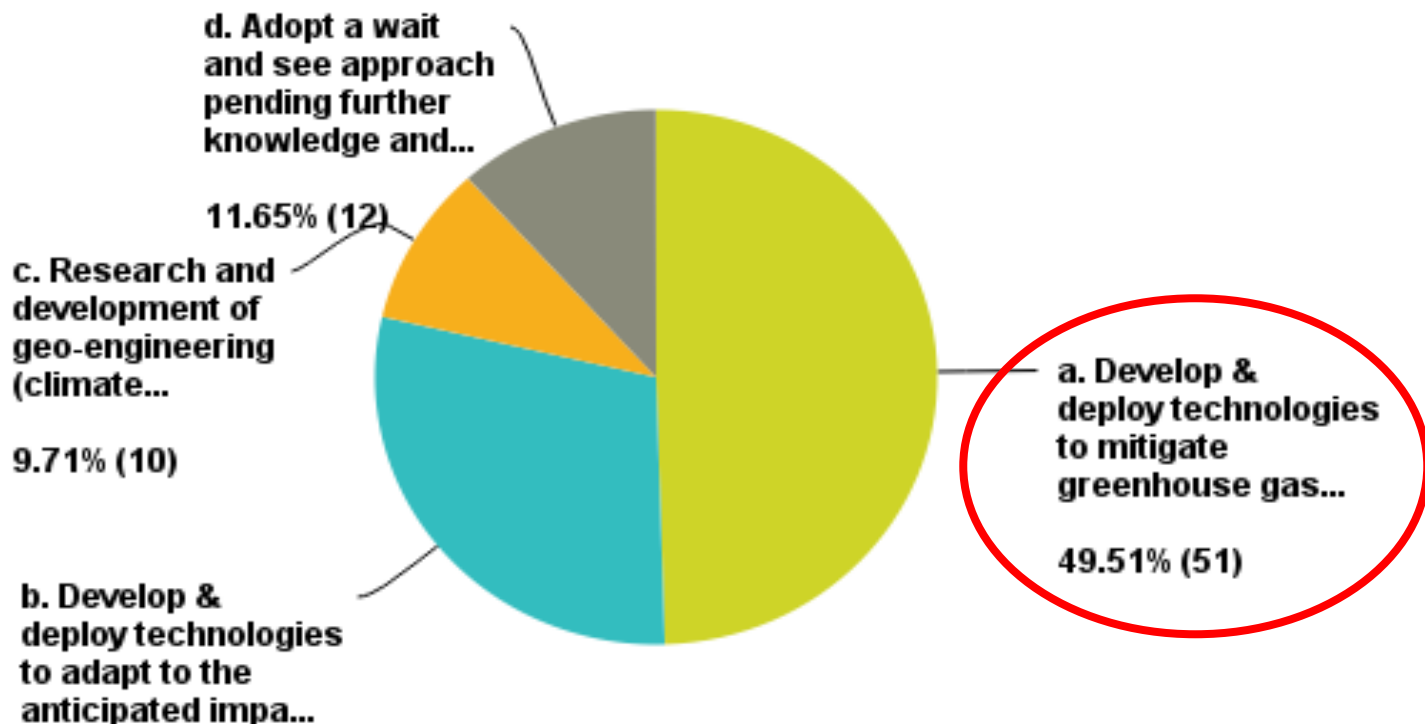
The issue presenting the greatest opportunity for collaboration in the Asia-Pacific region is...

Answered: 103 Skipped: 0



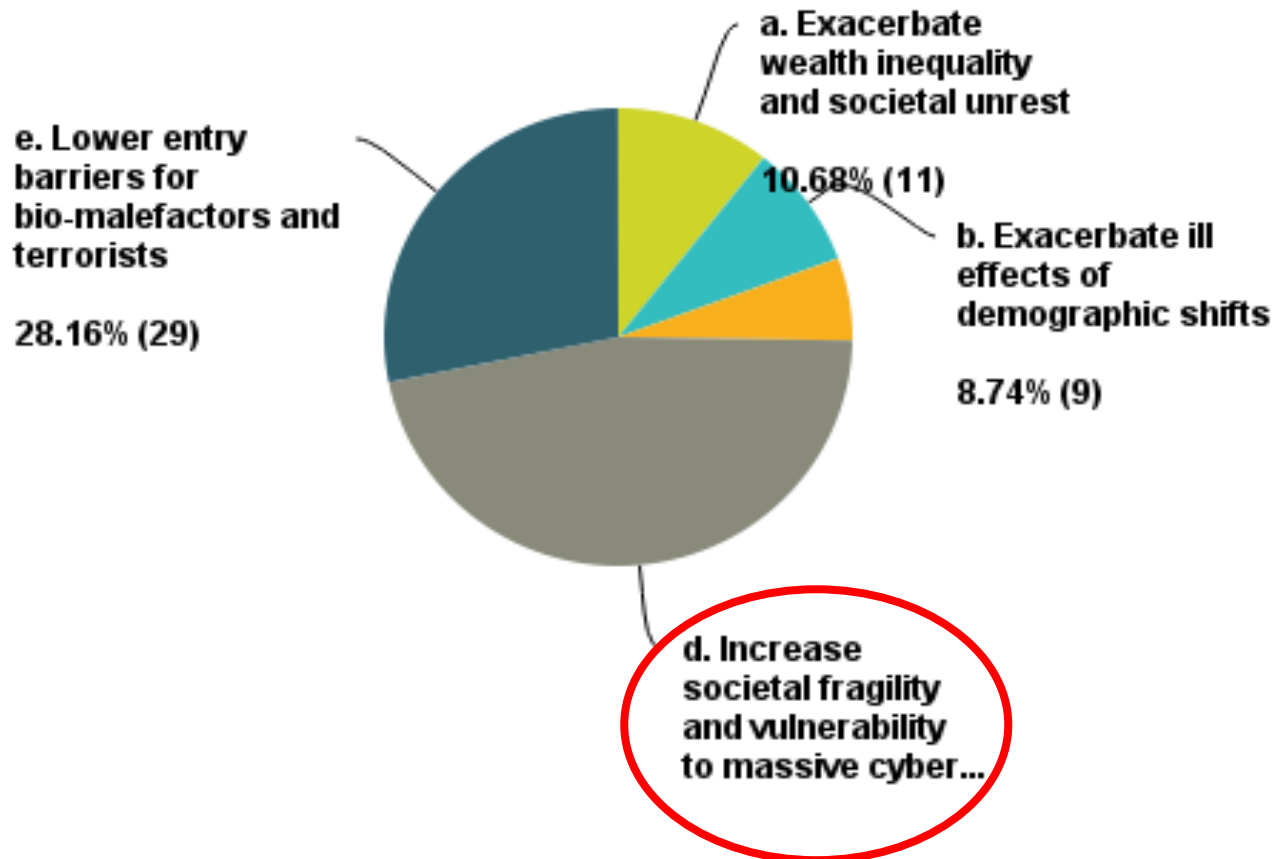
The policy approach governments should prioritize to deal most effectively with the security implications of climate change is...

Answered: 103 Skipped: 0



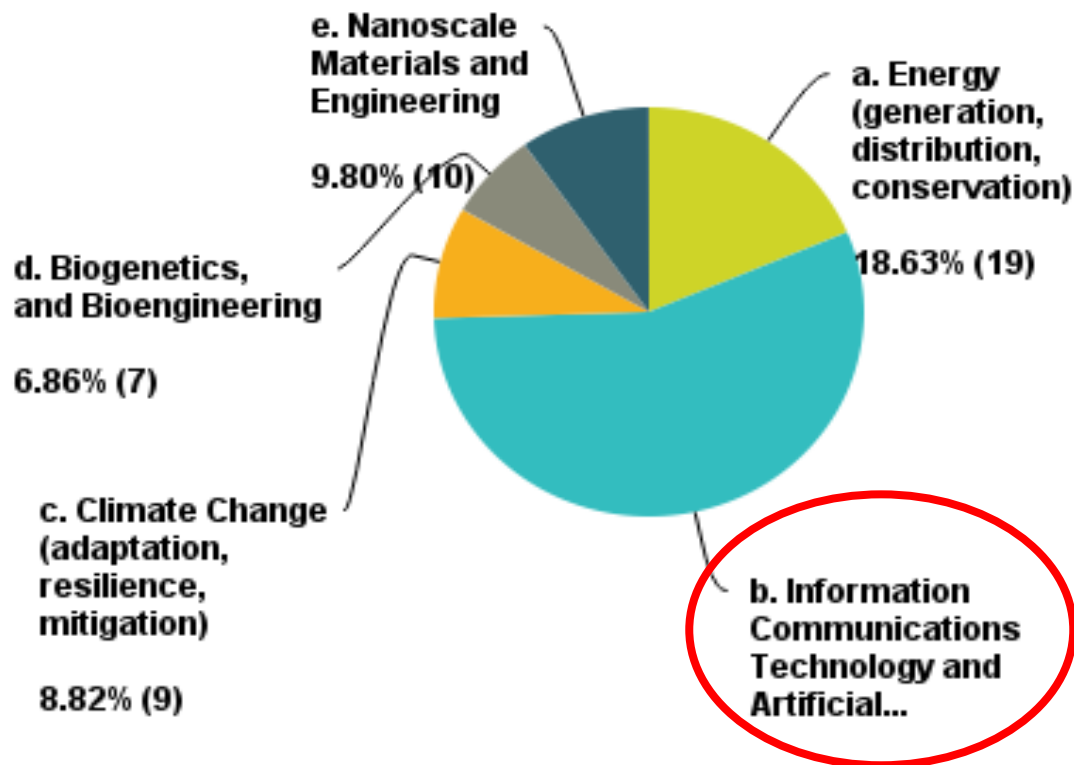
The greatest challenges emerging technologies pose to comprehensive security are in their capacity to:

Answered: 103 Skipped: 0



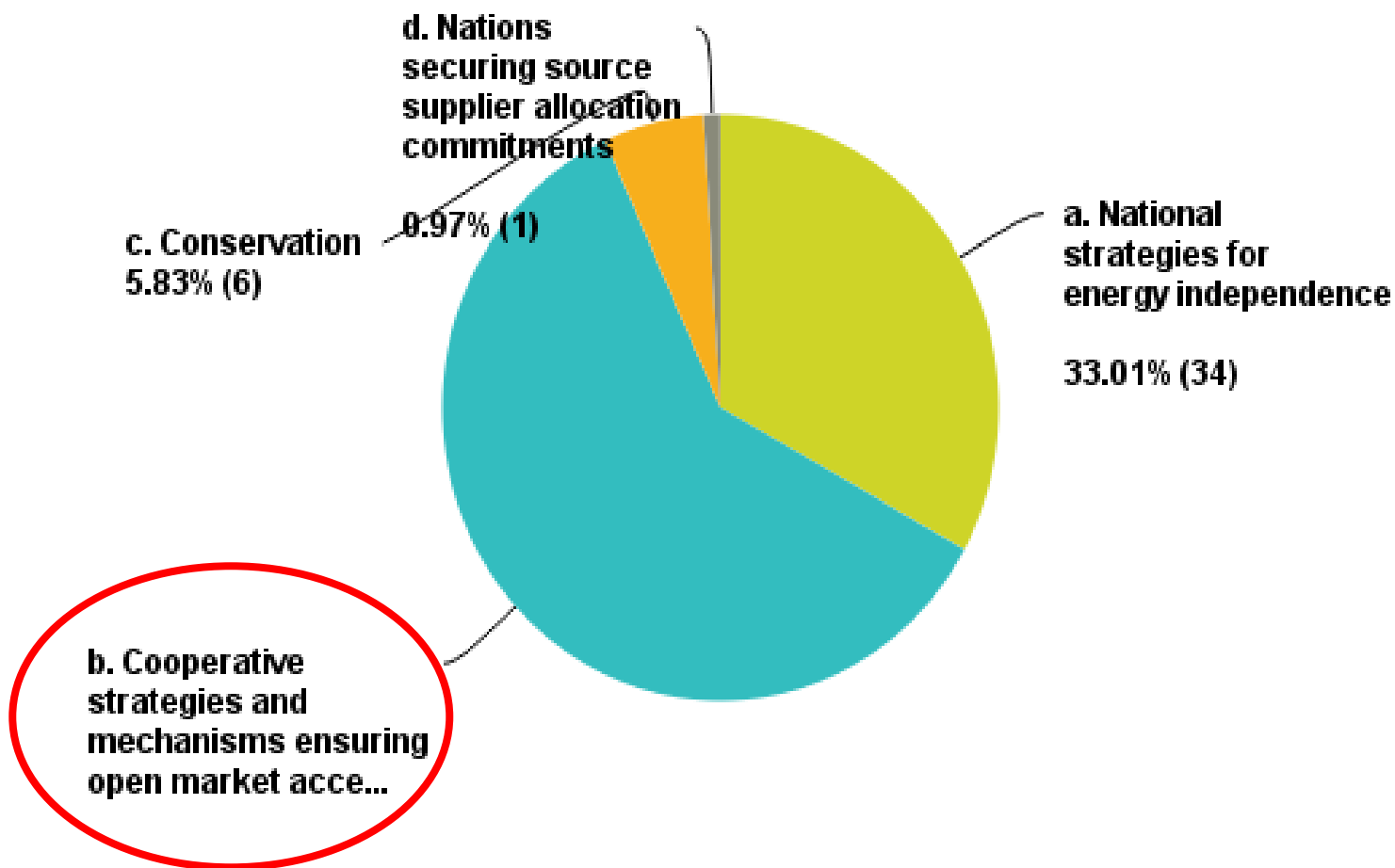
The most profound impact on comprehensive security (social, economical, political, diplomatic and military) in the next 5-15 years will be caused by advances in...

Answered: 102 Skipped: 1



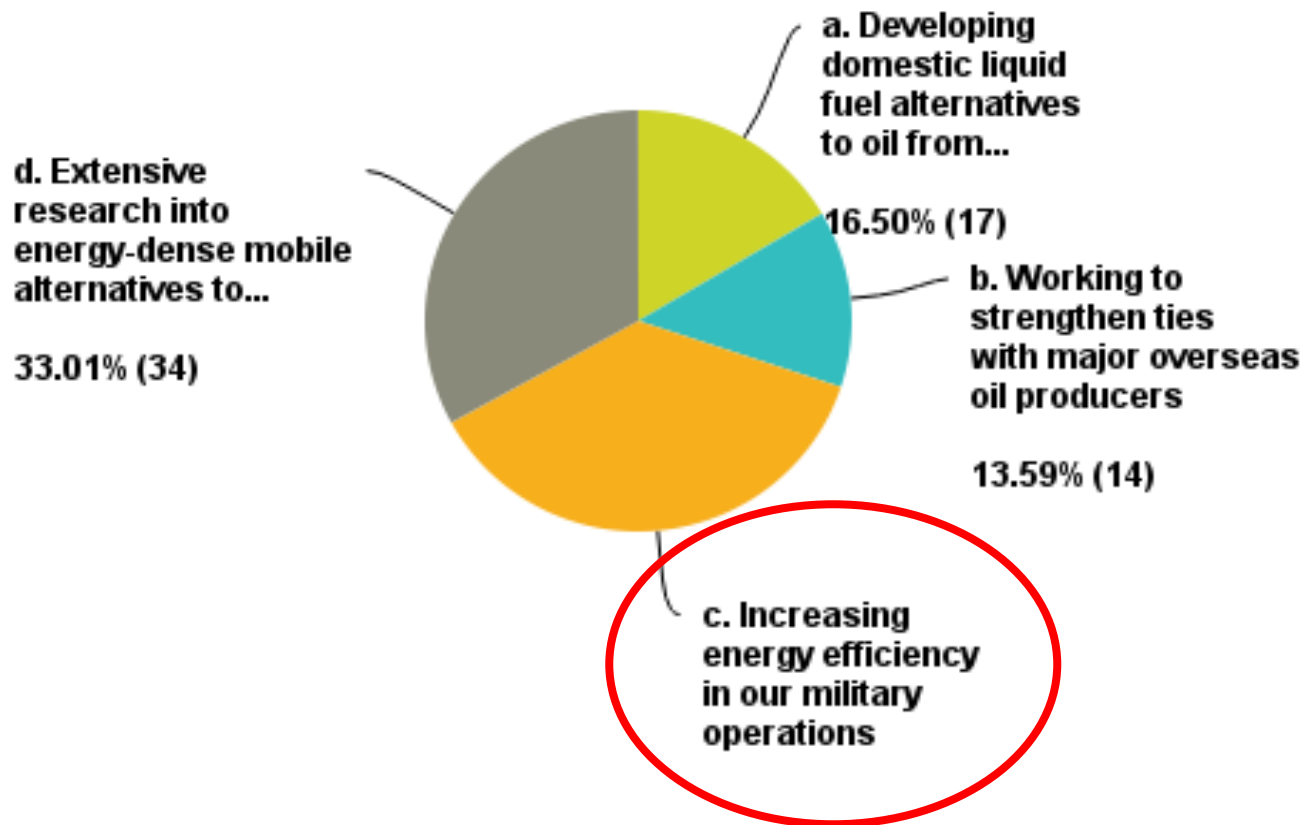
Energy Security will be best ensured by policy approaches that emphasize...

Answered: 103 Skipped: 0



The best path to ensure operational energy sufficiency for military operations is...

Answered: 103 Skipped: 0





Today's DKI APCSS Panel



DR. J. SCOTT HAUGER

Climate Change



PROF. DAVID SHANAHAN

**Security Implications
of Emerging Technologies**



DR. WILLIAM WIENINGER

Energy Security

Pacific Operational Science and Technology Conference: S&T Opportunities to Strengthen the Asia-Pacific

7 March 2017

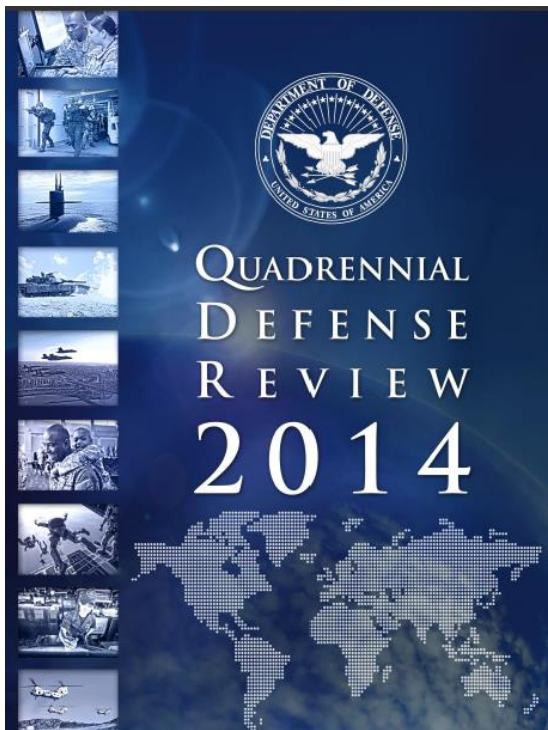


Opportunities in climate
change and environmental
security

J. Scott Hauger, Ph.D.
DKI APCSS

Image source: NPR

Opportunities in climate change and environmental security



“Climate change ... creates both a need and an opportunity for nations to work together, which the Department will seize through a range of initiatives.”

-- QDR 2014, p. 25

Agenda

- **The security threat of climate change**
- **Knowledge needs to address the threat**
- **S&T opportunities to strengthen Asia Pacific**

Agenda

- **The security threat of climate change**
- Knowledge needs to address the threat
- S&T opportunities to strengthen Asia Pacific

Environmental impacts of climate change:

- **Higher ocean temperatures.**
 - Evaporation, precipitation.
 - Tropical cyclones.
 - Rising sea levels.
- **Higher air temperatures.**
 - Ice melt / snow runoff.
 - More extreme weather
- **Higher ground temperatures**
 - Desertification.
 - Permafrost melting.
- **Ocean acidification**



**Narathiwat Province, Thailand
January 4, 2017**

Image source: [The Guardian](#)

Image credit: AFP/Madaree Tohlala

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**Super Typhoon Nepartak,
Putian, China, 9 July, 2016.**

Image credit: [Xinhua News Agency](#)

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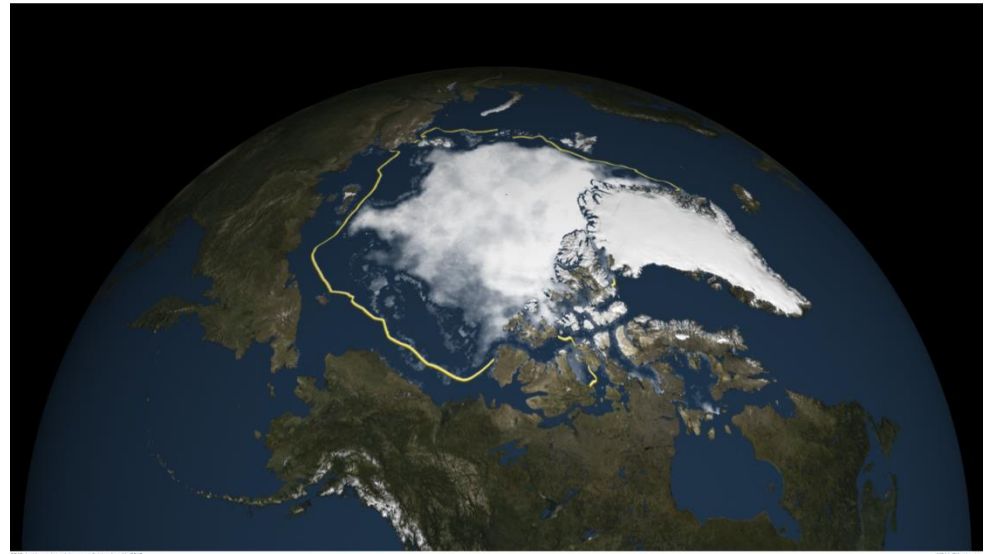
Kili, Marshall Islands, Jan 2015

Source: [Wall Street Journal](#)

Image credit: Bikini Atoll Local Government

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**Arctic sea ice minimum 2015
vs. average 1981-2010**

Image source: [NOAA](https://www.noaa.gov)

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**Southeast Asian Drought,
Stung Treng Province Cambodia
April 23, 2016.**

Source: [Radio Free Asia](#)

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Minqin, China 2016

Image source: [The Telegraph](#)

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**Methane Hydrate Ejection from Melting Permafrost
Siberia, Summer, 2014**

Source: Environmental Defense Fund²³

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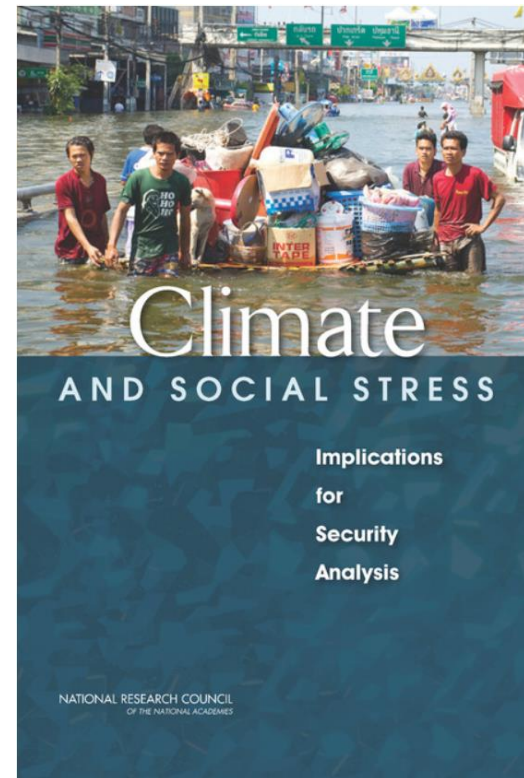


**Coral bleaching, off Lizard Island
Australia, March 2016**

Image credit: [XL Catlin Seaview Survey](#)

U.S. National Research Council Findings

- **Expect increasingly more serious climate surprises in the coming decade.**
- **Essential for the intelligence community to understand adaptation and changes to vulnerability to climate events.**
- **Prudent to expect some climate events that exceed the capacity of affected societies to manage.**



NIC Assessment



Implications for US National Security of Anticipated Climate Change

*This memorandum was prepared by the
National Intelligence Council and was coordinated
with the US Intelligence Community.*

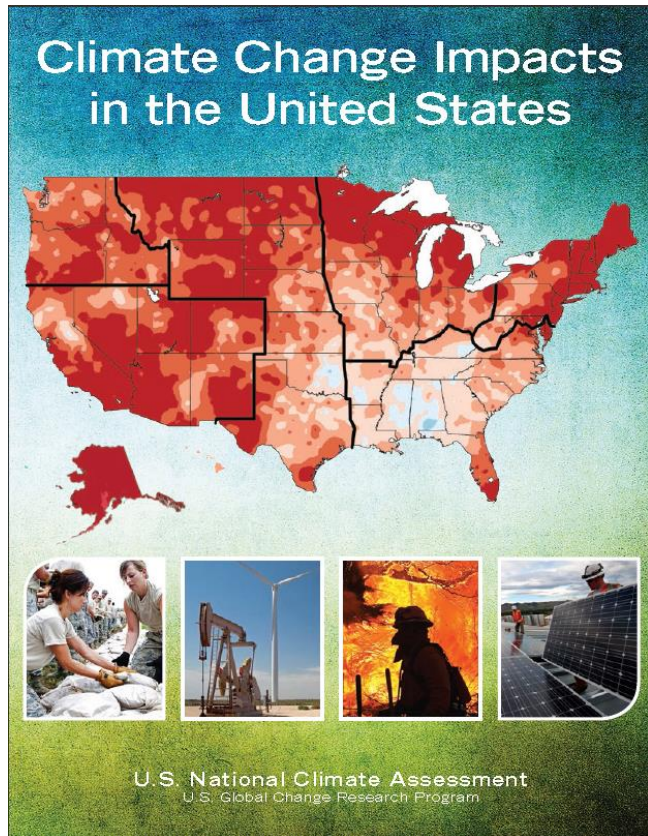
21 September 2016
NIC WP 2016-01

“Long-term changes in climate will produce more extreme weather events and put greater stress on critical Earth systems like oceans, freshwater, and biodiversity. These in turn will almost certainly have significant effects, both direct and indirect, across social, economic, political, and security realms during the next 20 years. These effects will be all the more pronounced as people continue to concentrate in climate-vulnerable locations, such as coastal areas, water-stressed regions, and ever-growing cities.”

Agenda

- The security threat of climate change
- **Knowledge needs to address the threat**
- S&T opportunities to strengthen Asia Pacific

Research Needs



Research to Improve Understanding of Human-Environment Systems

- Climate forcings, feedbacks, responses, and thresholds in the Earth system
- Climate-related human behaviors and institutions

Research to Support Effective Responses to Climate Change

- Vulnerability and adaptation analyses of coupled human-environment systems
- Research to support strategies for limiting climate change
- Effective information and decision support systems

Research Tools and Approaches to Improve Both Understanding and Responses

- Integrated climate observing systems
- Improved projections, analyses, and assessments

Source: *US National Climate Assessment 2014*, p. 709.

NRC Recommendations

- **Improve ability to quantify likelihoods of climate events.**
- **Research to understand when climate disasters do/don't lead to security-relevant outcomes.**
- **Immediately begin a WoG strategy for monitoring threats connected to climate change.**
- **“Stress test” countries, regions & global systems for ability to manage disruptive climate events.**
- **Intelligence community should provide appropriate research support.**

Technologies for Mitigation



Canal Top Solar Power Plant

[by Hitesh vip - Own work.](#)

Image source: Wikipedia Commons

CO2 scrubber concept

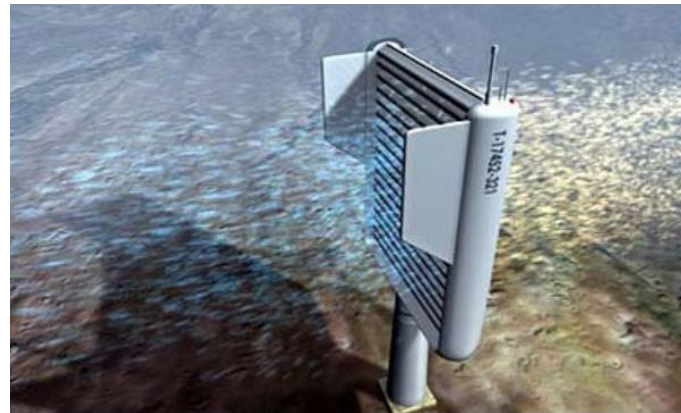
Columbia University

Image source: [The Telegraph](#)
[15 Aug 2014](#)

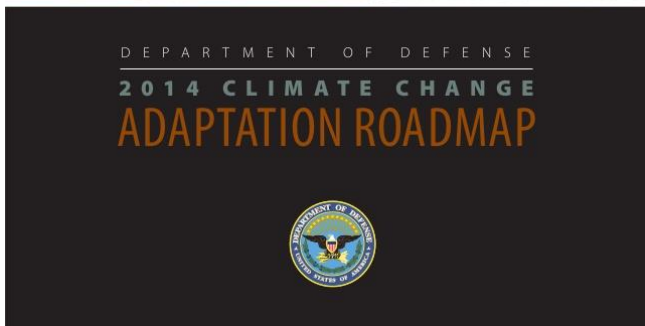


Asia Pulp & Paper plantation,
Indonesia

Image source: [Business Green Plus, 20 Oct 2013](#)



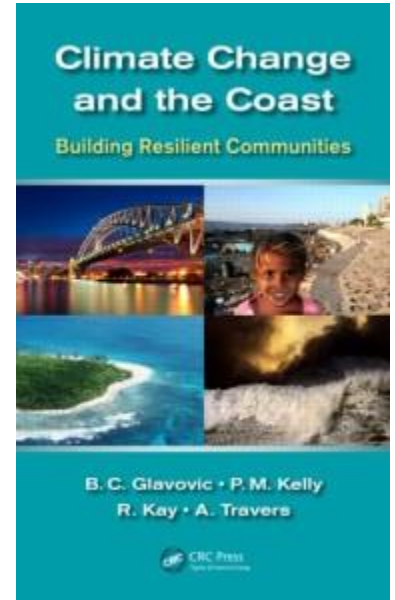
Technologies for Adaptation



Blending traditional knowledge and modern technologies

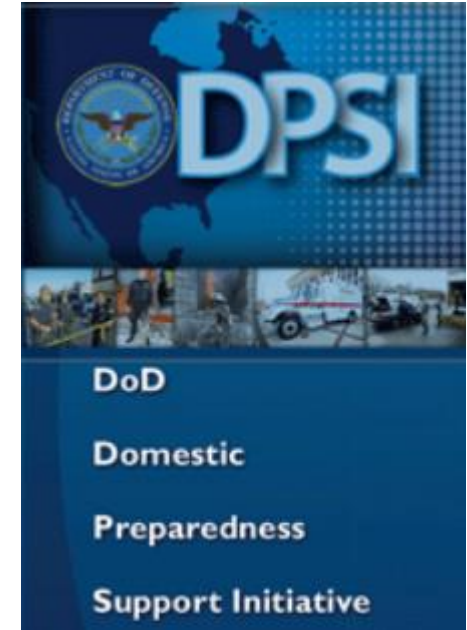
e.g. Arctic Climate Impact Assessment; Cybertracker

CO2 scrubber concept
Columbia University
Image source: [The Telegraph](#)
[15 Aug 2014](#)



[Climate Adaptation Technologies Bangladesh 2015](#)

Technologies for Response



Smart Emergency Response System
(SERS)

[Smart America.org](http://SmartAmerica.org)

[Texas A&M Engineering](#)
[\\$3-year \\$1.5 M contract from](#)
[DoD Domestic Preparedness](#)
[Support Initiative. July 2016.](#)

Technologies for Knowledge Creation

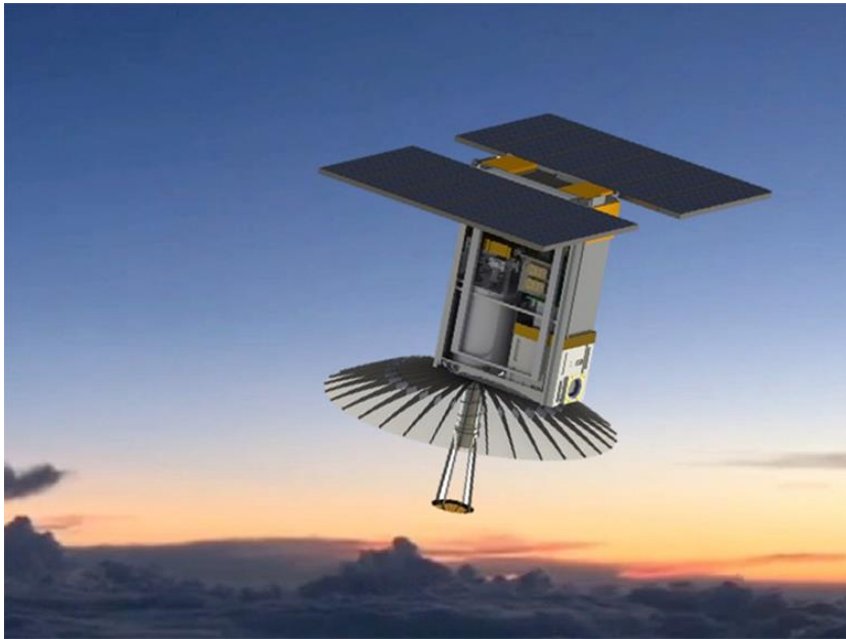
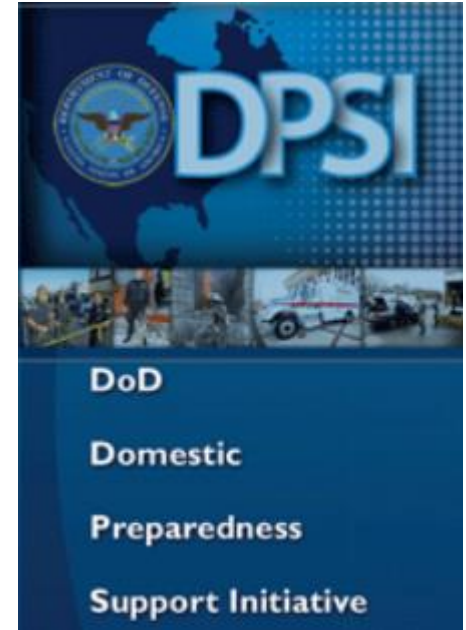


Illustration of Raincube
[NASA inVEST Program](#)



[Texas A&M Engineering](#)
[\\$3-year \\$1.5 M contract from](#)
[DoD Domestic Preparedness](#)
[Support Initiative. July 2016.](#)

Agenda

- The security threat of climate change
- Knowledge needs to address the threat
- **S&T opportunities to strengthen Asia Pacific**

Conclusion: S&T Opportunities

- A DoD / U.S. / regional observation system for relating climate change to security threats.
- Methodologies that integrate social & ecological sciences for threat characterization & prediction.
- Impact assessments & “stress tests” using new data and knowledge to develop an ability to manage disruptive climate events.
- Develop local expertise in Asia Pacific region in civil engineering, hydrology, energy, agriculture, land use & infrastructure planning so developing nations can benefit.
- Regional networking for information sharing, planning and response.



Emerging Technologies and Security

David M Shanahan
Professor, DKI APCSS



Bottom Line Up Front

- Exponentially growing and cross fertilizing technologies are vastly increasing the rapidity and effects of change
- Barriers to entry for many Emerging Technologies are dropping significantly and mature technologies are being used in new ways, offering offset opportunities to regional partners, rivals and non-state actors
- Technology use and impacts are too important to left to the technologists – Policy makers must insert themselves into the game proactively vs reactively

Technology Development Dynamics

- **Exponential growth**
- **Interdependent and Synergistic**
- **Touching all aspects of society and security**
- **Moving to operational deployment**
- **Complex, Adaptive**
- **Merging Man, Machine, and Data**

Asia Pacific Technology Dynamics

- U.S. Remains preeminent technology actor but is being significantly challenged
- 3 Developments drive opportunities for less advanced militaries in Asia to punch above their weight class
 - Robust Economic Growth
 - Geopolitical Currents
 - Accelerated Pace of Tech Proliferation

Offset Capacity Building

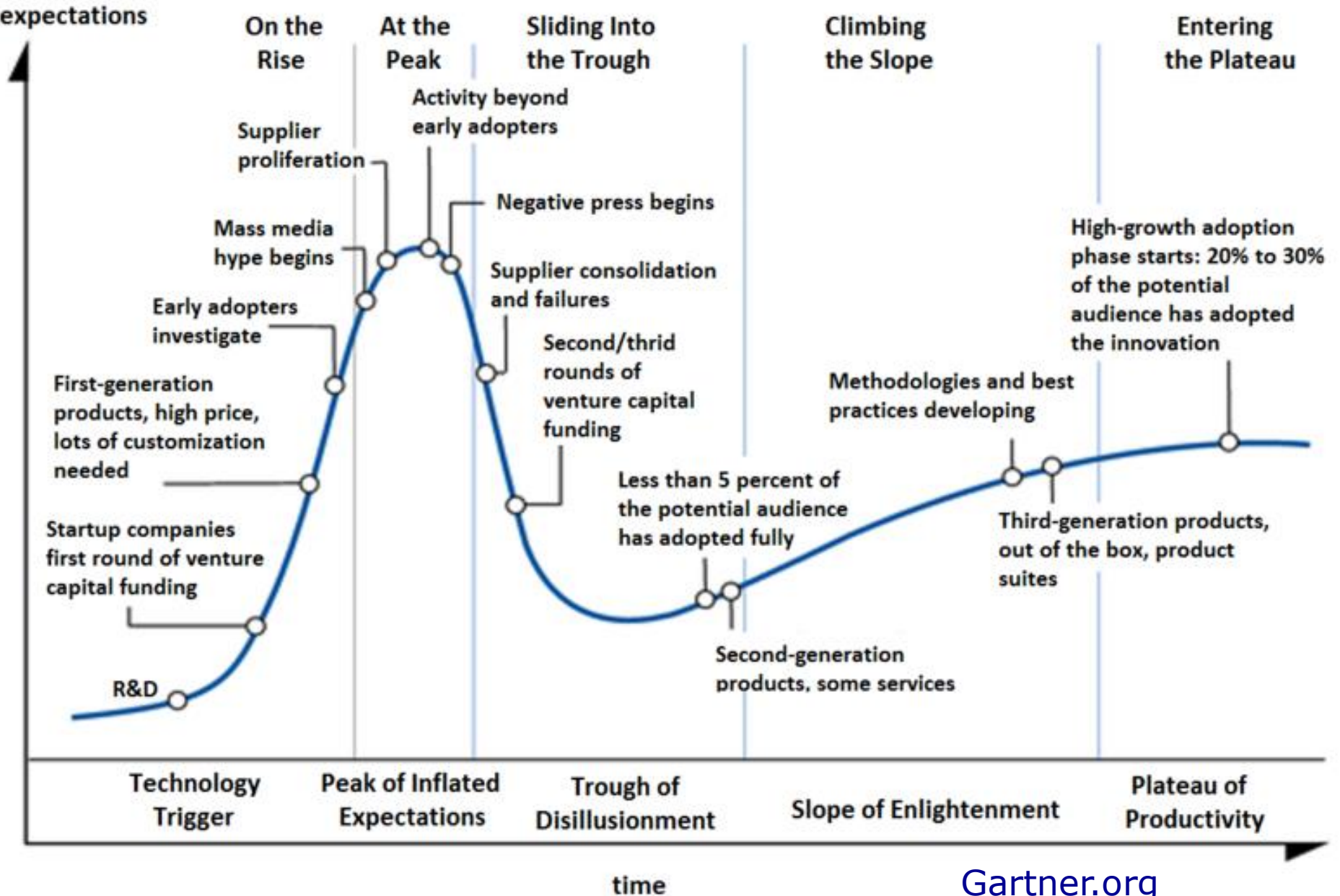
Increasing for Partners and Rivals

- Balancing acquisition of materiel and technological know-how with the acquisition of new institutional arrangements and relationships
- Key Virtues:
 - Develops indigenous R&D capability
 - Long run: develop potential niche counter-technologies

Disruptive Emerging Technologies

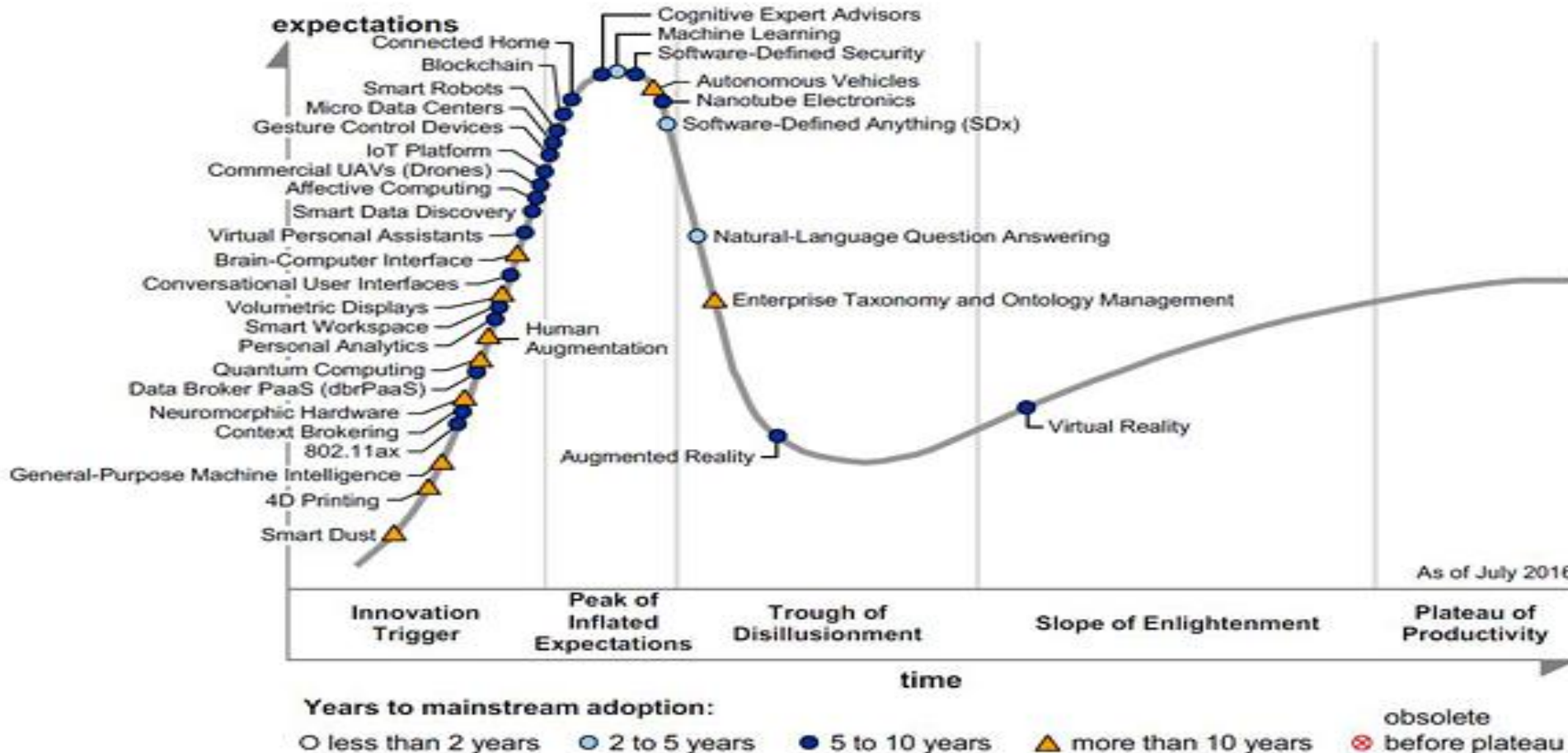
- Disruption Trends
 - **Who are we:** Bio Genetics, Bio Mechanics, Bioengineering
 - **What we can build:** 3D printing, Robotics, Nanotechnology, and Advanced Materials
 - **What we can and think we know:** Advanced ICT, Big Data, Predictive/Prescriptive Analytics, Artificial Intelligence,

Hype Cycle



Hype Cycle

Emerging Technology Hype Cycle



Source: Gartner (July 2016)

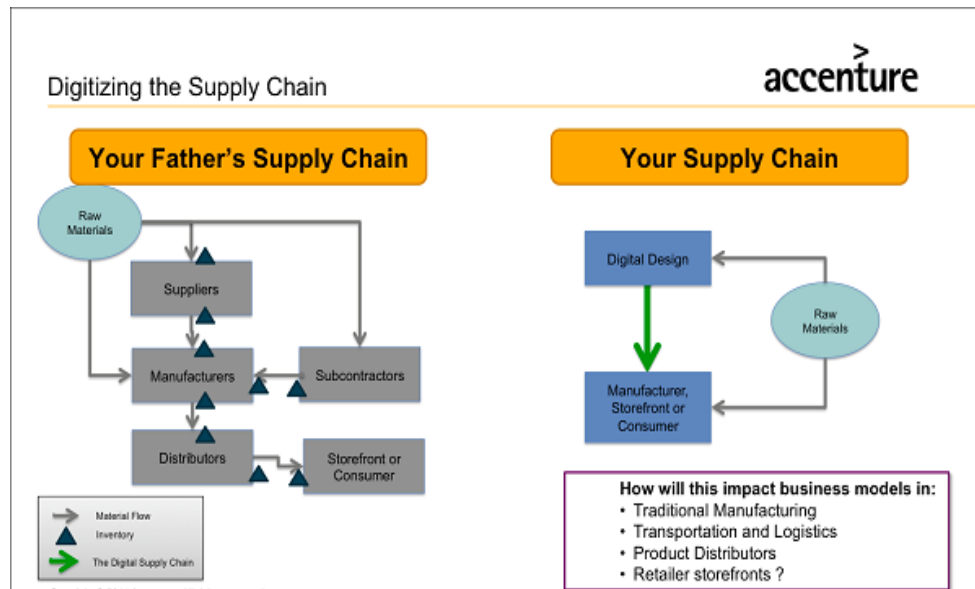
Emerging Technologies with Highly Disruptive Potential

- Materials
 - Nano level fabrication
- Additive Manufacturing (AM) (3D Printing)
- Big Data - AI - Autonomous systems- Robotics
- Energy and power technologies
- Bio-genetics and Bio-Engineering

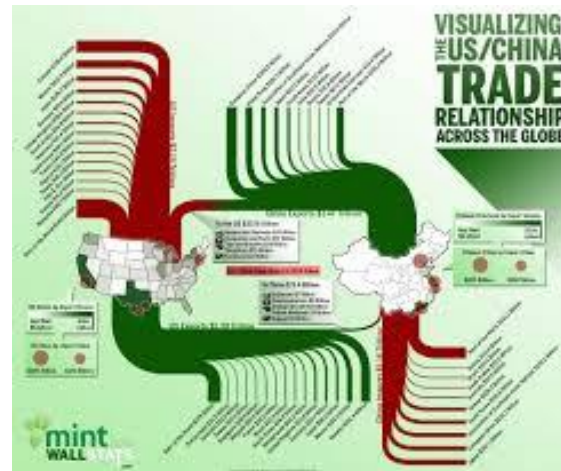
Additive Manufacturing



Additive manufacturing could reduce energy use by **50 percent** and reduces material costs by up to **90 percent** compared to traditional manufacturing.

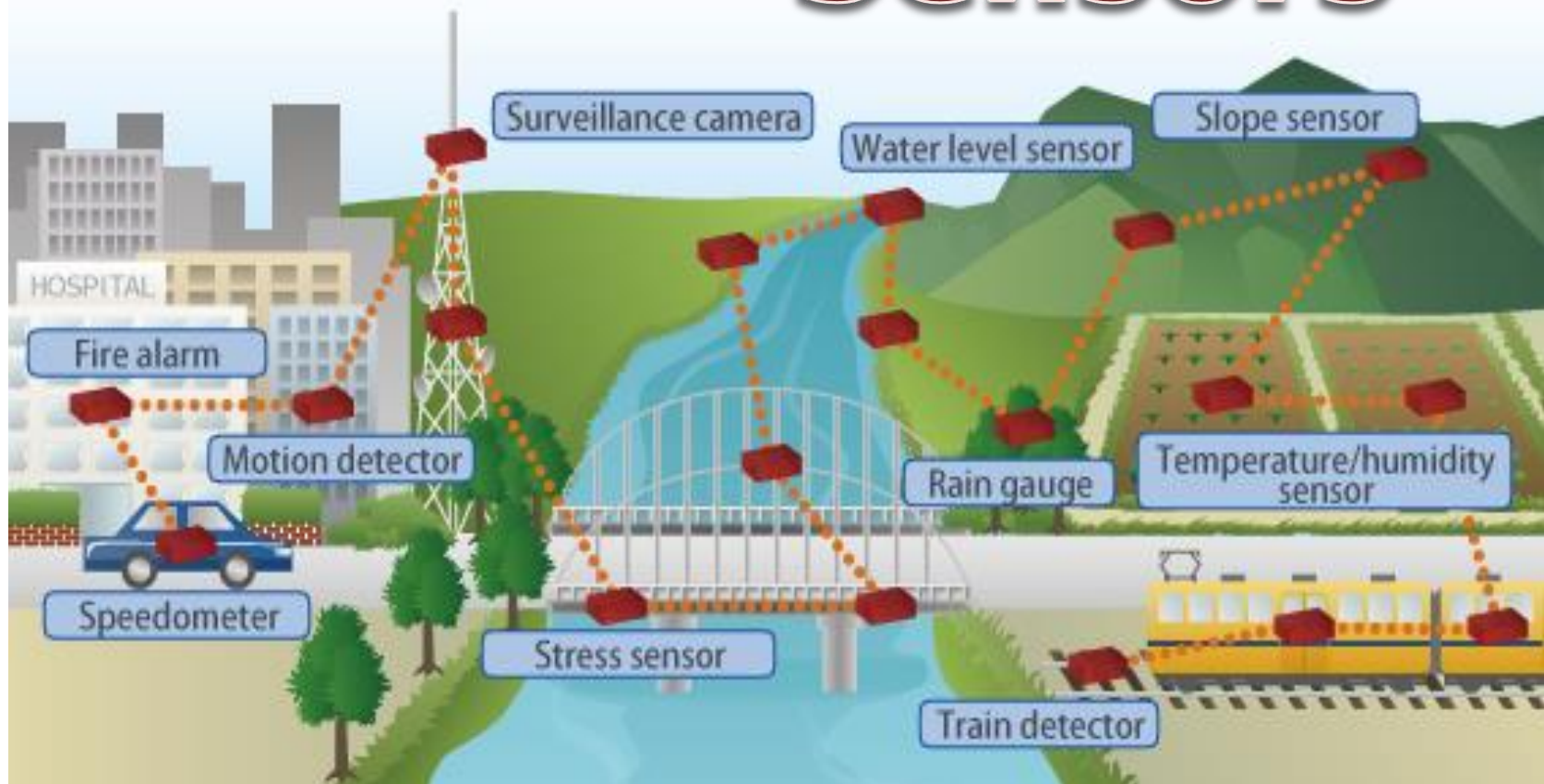
Impacts on Global Manufacturing and Transportation Paradigm?



Creating knowledge from data

- **Accumulating**

Sensors

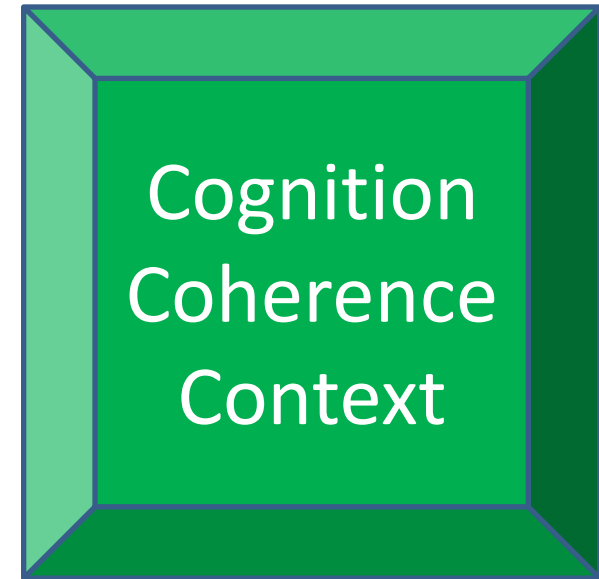


The Challenge

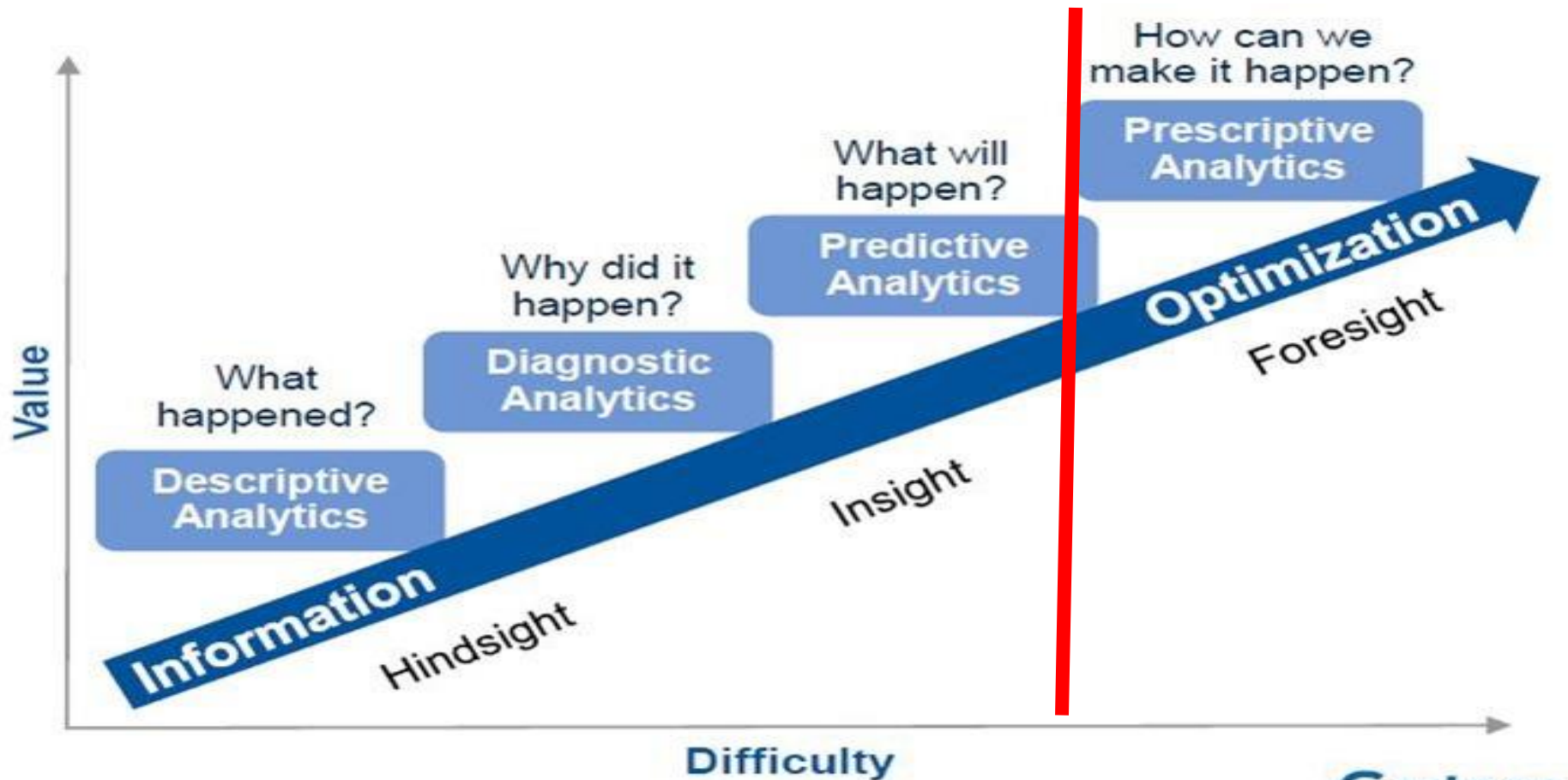
Big Data



<http://www.practicaldb.com/data-visualization-consulting/big-data-analytics/>

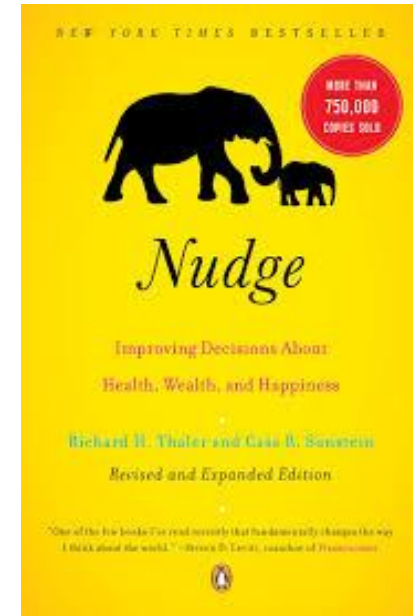


Constructing knowledge from data

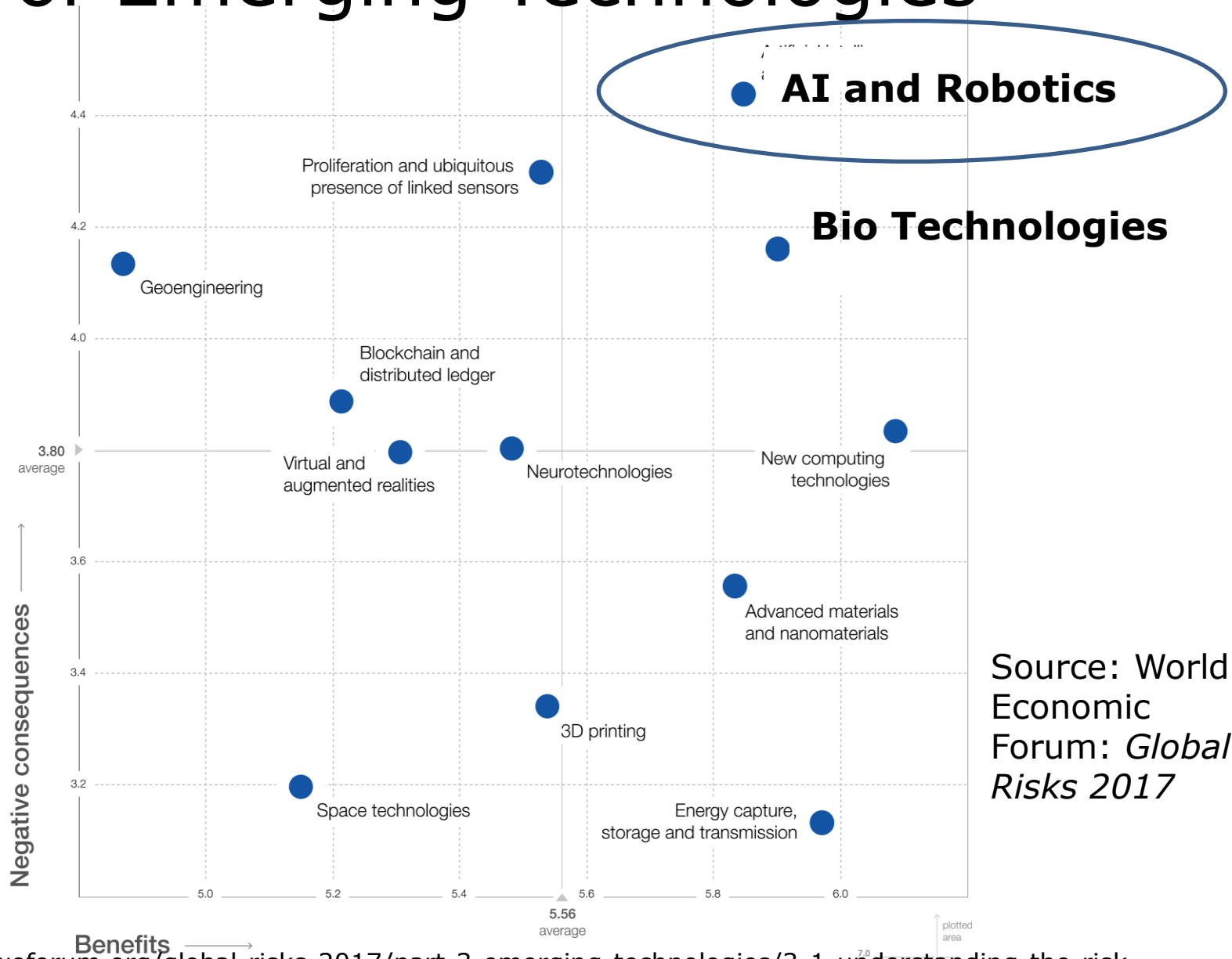


Will Democracy and Freedom Survive Big Data and Artificial Intelligence?

- Nudge has been the term applied to the mostly benign practice of guiding behavioral choices to improve Health, Economic and Environmental outcomes.
- Combining Big Data and Artificial Intelligence produces “Big” Nudge which has more challenging implications
- Programming Computers to Programming People? What could possibly go wrong...



Benefits and Negative Consequences of Emerging Technologies



Source: World Economic Forum: *Global Risks 2017*

Artificial Intelligence

- The development of full [general] artificial intelligence could spell the end of the human race,”

Stephen Hawking

- "I think we should be very careful about artificial intelligence. ...*our biggest existential threat* ... there should be some regulatory oversight, maybe at the national and international level, just to make sure that we don't do something very foolish. With artificial intelligence we're summoning the “ demon.

Elon Musk, Tesla and SpaceX founder

Ethical Dilemmas

Ethical dilemmas permeate where clear policy boundaries are not evident



**THE ETHICS OF DRONE STRIKES:
DOES REDUCING THE COST OF CONFLICT
ENCOURAGE WAR?**

James Igoe Walsh
Marcus Schulke



Ethical Dilemmas

- Many elements of Emerging tech enable human manipulation at unprecedented scale in key areas
 - Information Technology **Logic** Malleability
 - Nanotechnology **Material** Malleability
 - Genetic Technology **Life** Malleability
 - Neurotechnology **Mind** Malleability
- A few contenders needing clearer governance:
 - **Autonomous Weapons Systems**, Real-time commercial satellite surveillance video, Enhanced pathogens, Robot swarms, Artificial life forms, Brain-to-brain interfaces
- As technology revolutions increase their social impact the number of ethical issues they portend increase

AI and Robotic Standards

Isaac Asimov's Three Laws of Robotics

- **Law Zero:** A robot may not injure humanity, or, through inaction, allow humanity to come to harm.
- **First Law:** A robot may not injure a human being, or, through inaction, allow a human being to come to harm.
- **Second Law:** A robot must obey orders given it by human beings, except where such orders would conflict with the First Law.
- **Third Law:** A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

Military Robots?



Autonomous Weapons Systems (AWS): Ethical Issues

- Exclusion of human oversight from the battlespace can too easily lead to inadvertent violation of human right and inadvertent escalation of tensions.
- The variety of direct and indirect customers of AWS will lead to a complex and troubling landscape of proliferation and abuse
- By default, the type of automation in AWS encourage rapid escalation of conflicts.
- There are no standards for design assurance verification of AWS.
- Understanding the ethical boundaries of work on AWS and semi-autonomous weapons systems can be confusing.

In Closing ...

- Exponentially growing and cross fertilizing technologies are vastly increasing the rapidity and effects of change
- Barriers to entry for many Emerging Technologies are dropping significantly and mature technologies are being used in new ways, offering offset opportunities to regional partners, rivals and non-state actors
- Technology use and impacts are too important to left to the technologists – Policy makers must insert themselves into the game proactively vs reactively
- Many of you are, or will be, those policy makers (or their trusted advisors)

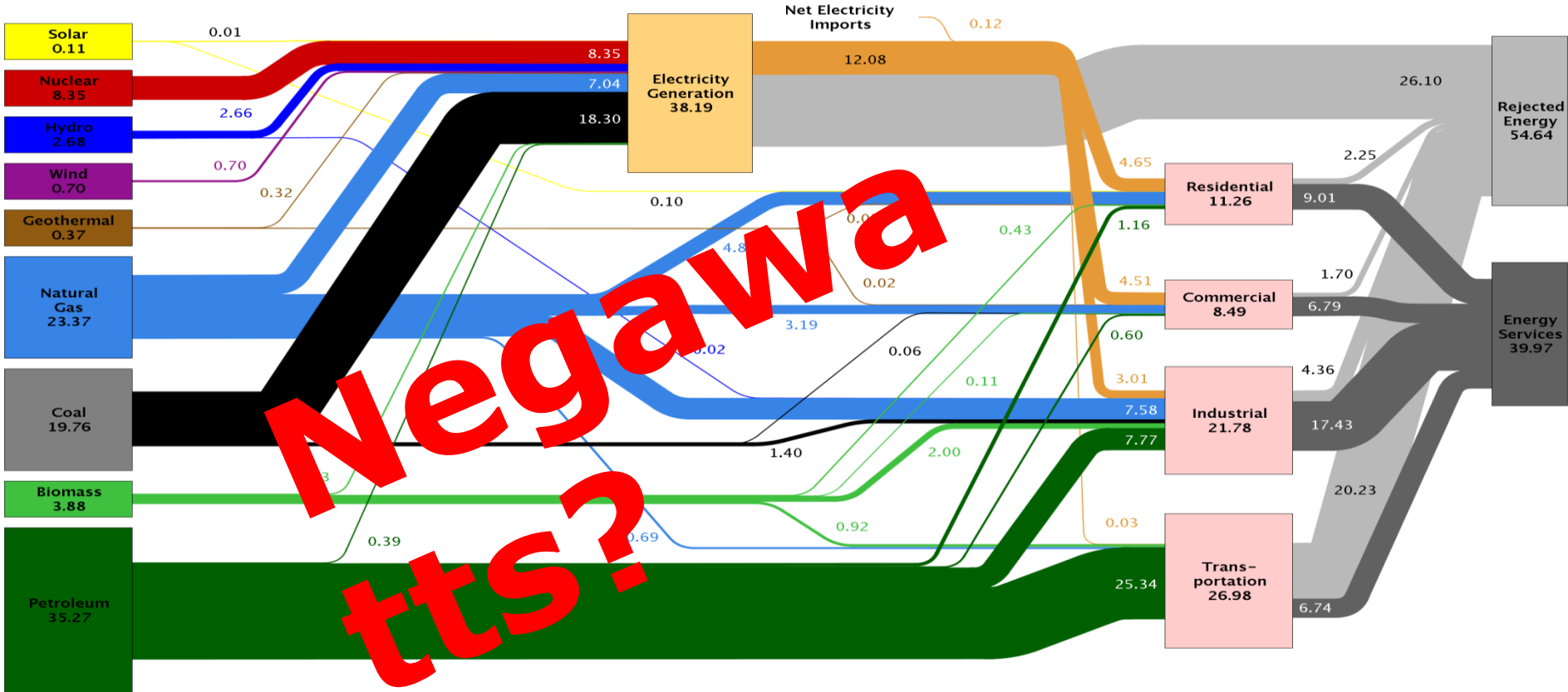
Energy Security in the Indo Asia-Pacific

Dr. Bill Wieninger

Energy Security - Overview

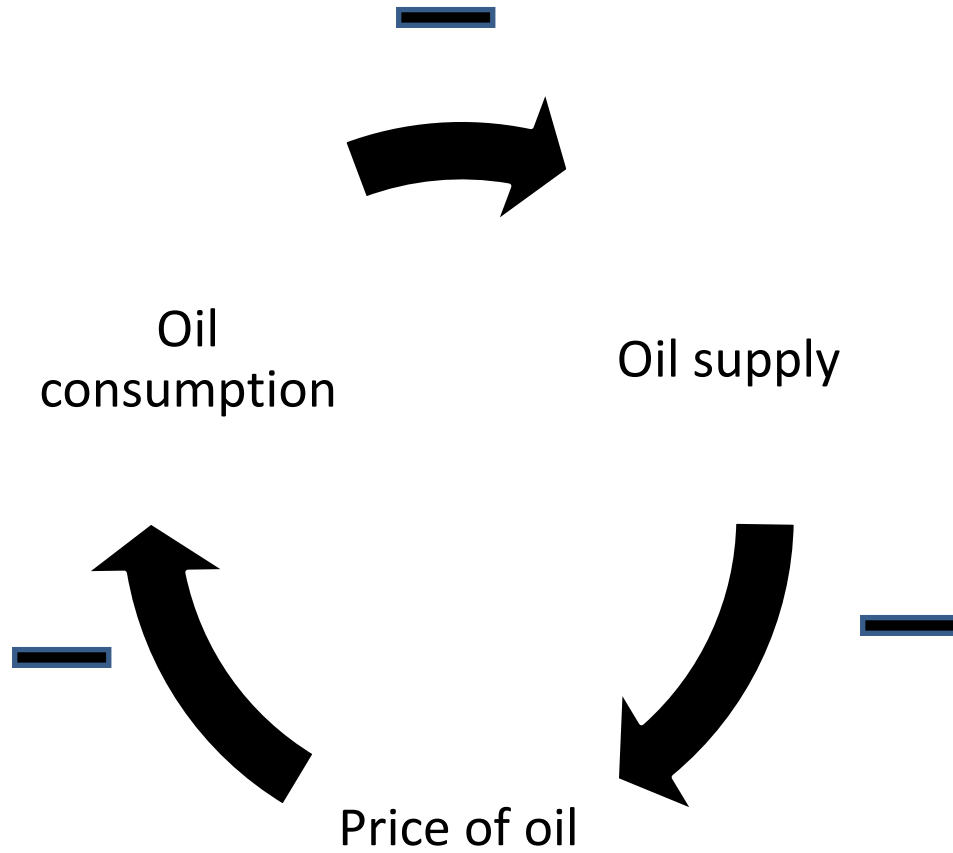
- Energy is the bedrock of modern society
- There is **ONE** Global energy SYSTEM
- It is a **COMPLEX** system
 - Non-linear
 - Feedback loops
 - No root causes
 - Many externalities not accounted for
- Holistic Awareness Essential

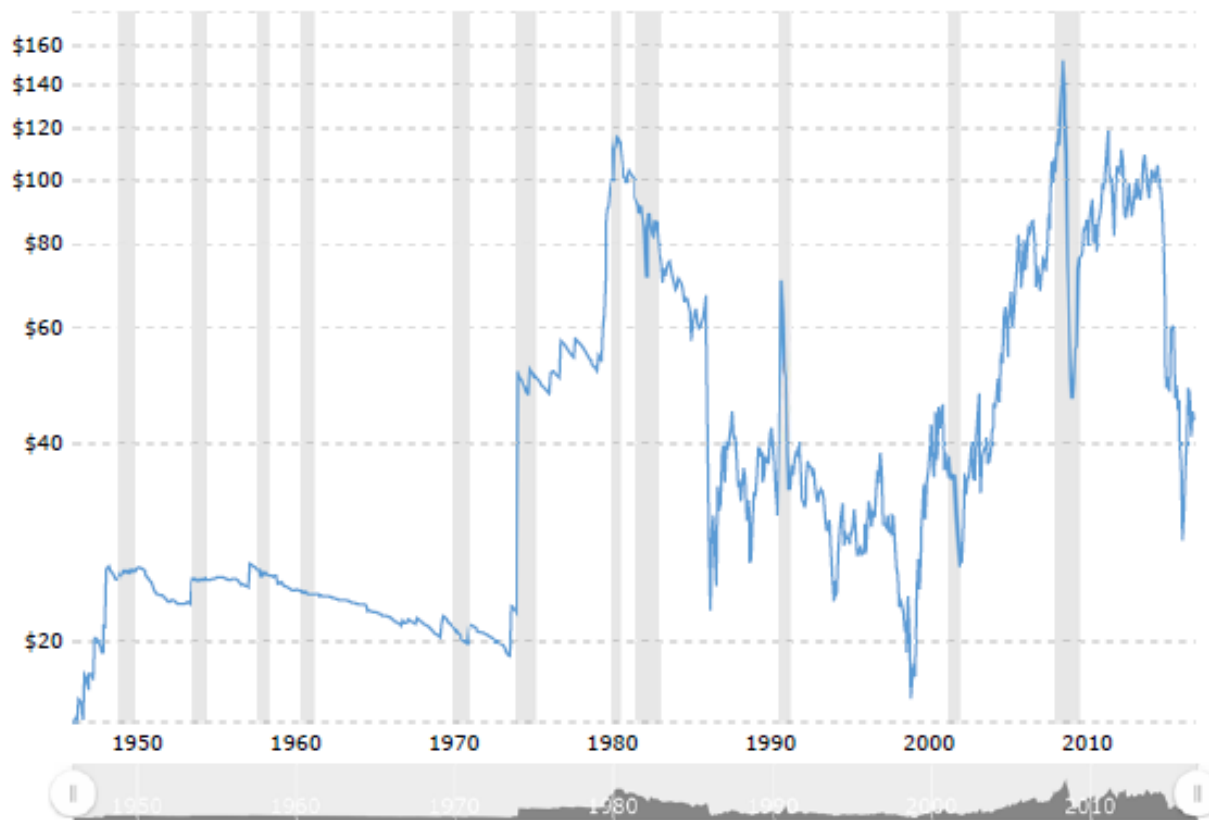
Estimated U.S. Energy Use in 2009: ~94.6 Quads



Source: LLNL 2010. Data is based on DOE/EIA-0384(2009), August 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 80% for the residential, commercial and industrial sectors, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

Energy is a feedback loop





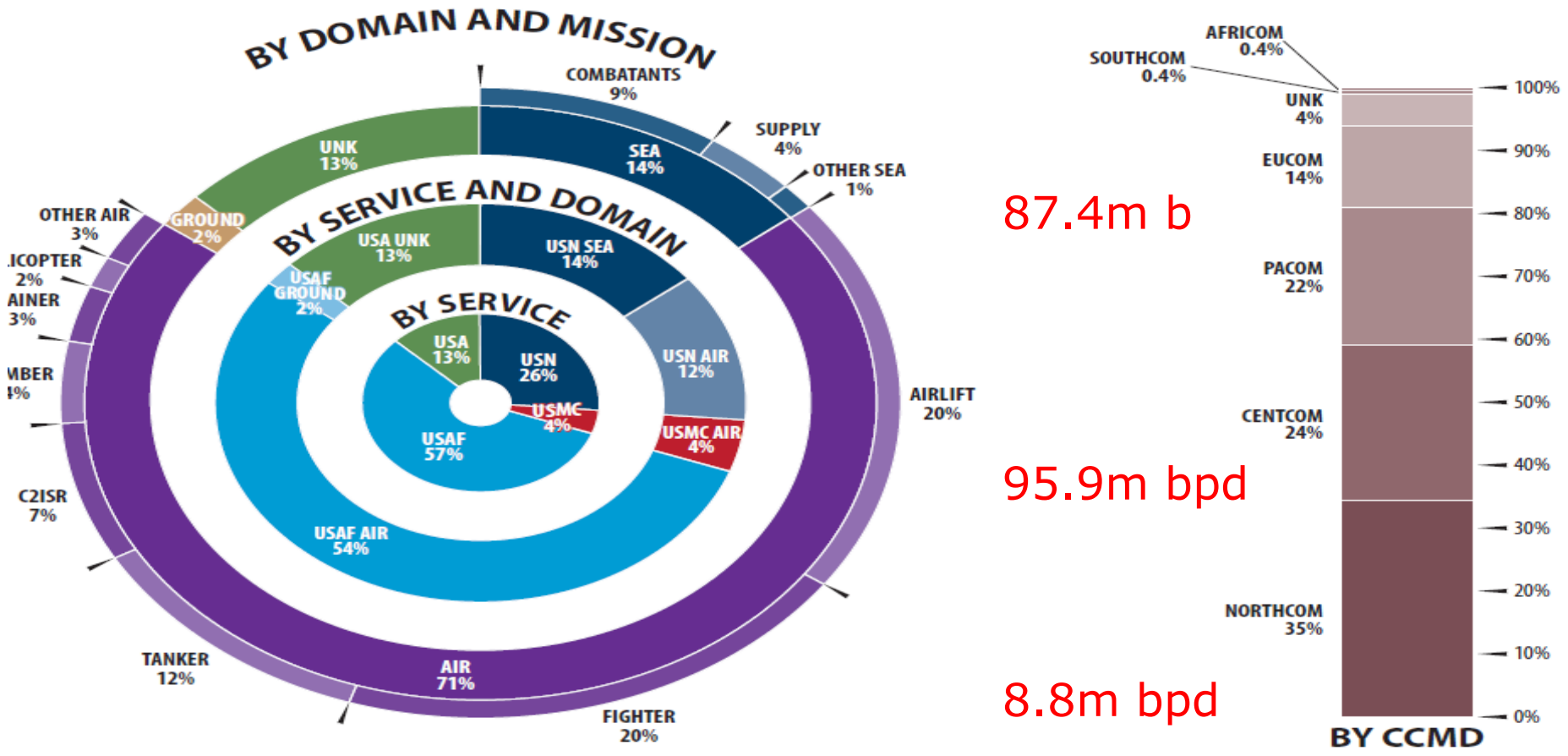
Price of
Oil
1950-
2015

Proven Oil Reserves

	<u>2011</u>	<u>2015</u>	
• Saud Arabia	262B	268B	
• Venezuela	211B	298B	
• Canada	175B	172B	
• Iran	137B	158B	
• Iraq	115B	144B	
• Kuwait		104B	104B
• UAE	98B	98B	
• Russia		60B	80B
• Libya	46B	48B	
• Nigeria		37B	37B
• US	21B	<u>40B</u>	
		+ 174B (+14%)	

Unconventional Resources ??
 E.G. GAO estimates up to 1.5T barrels of oil shale in CO/UT/WY – viable at \$70-95/barrel in 2005 dollars

[Source Energy Information Agency](#)



87.4m b

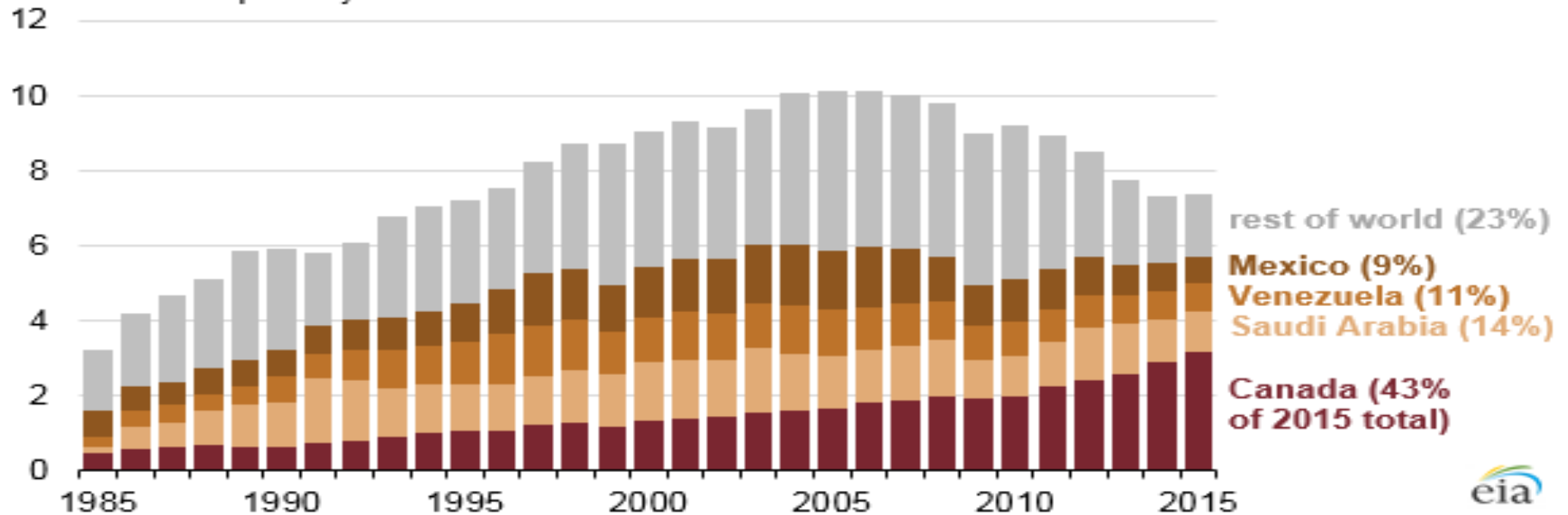
95.9m bpd

8.8m bpd

Figure 1: Operational Energy Use, FY 2014

Foreign Oil Sources

Gross imports of crude oil to the United States by country, 1985-2015
million barrels per day

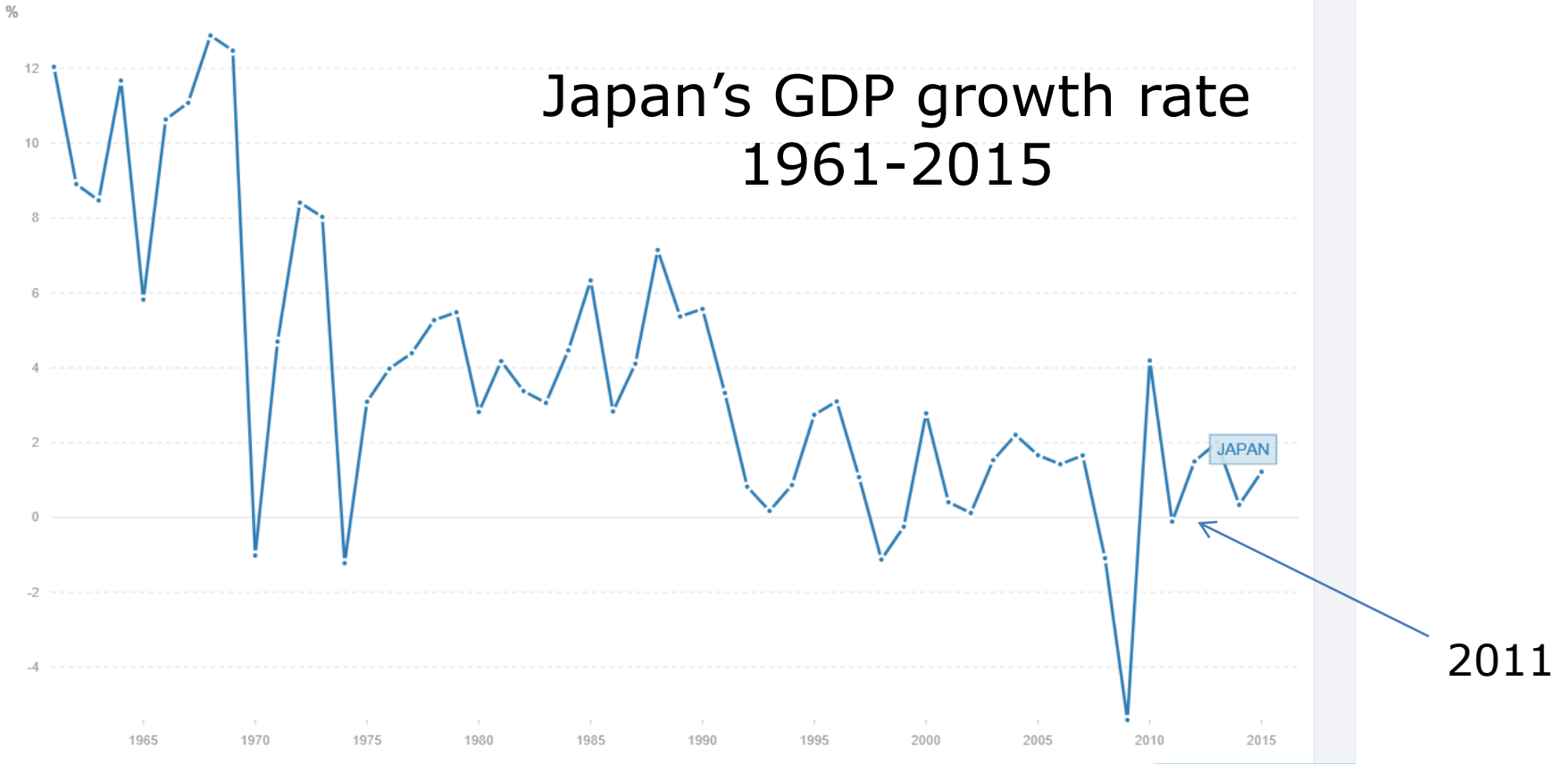


“The only oil reserve worth defending is that which can be held with a minimum of defensive military commitments”

Bernard Brodie - 1947

Fukushima March 11, 2011

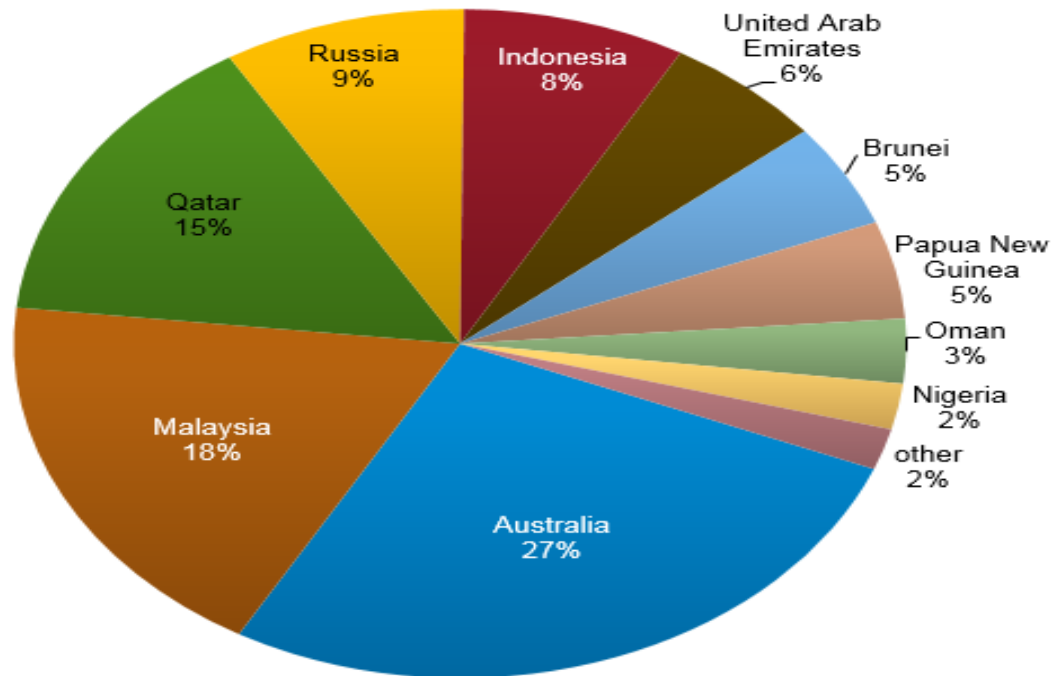




Source: World Bank

Resilience

Figure 6. Japan's LNG imports by source, 2016

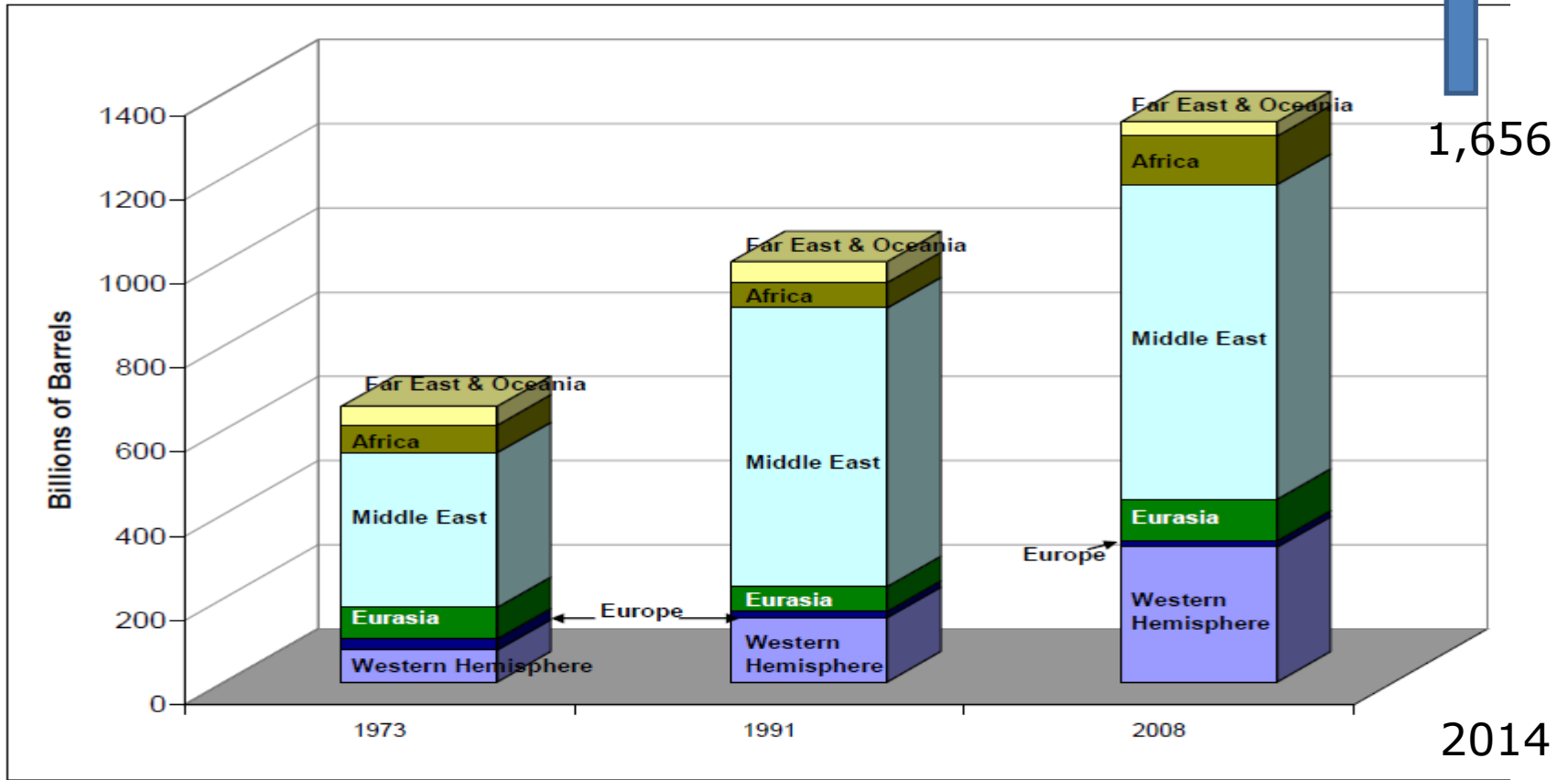


other: Algeria, Egypt, Norway, Equatorial Guinea, Trinidad, Yemen, Norway, Peru, U.S., and re-exported amounts



Source: IHS Energy

Figure 4. World Crude Oil Reserves, 1973, 1991, and 2008



Source: EIA, *International Energy Annual (IEA) 1990*, Table 32 and *IEA 2007 Table 8.1 Table of World Proved Oil and Natural Gas Reserves, Most Recent Estimates*. (data is from *Oil and Gas Journal* and is not certified by EIA, except for the data for the United States in the Western Hemisphere category).

S China Sea

South China Sea estimated proved and probable reserves

Country name	Crude oil and liquids reserves (billion barrels)	Natural gas reserves (trillion cubic feet)
Brunei	1.5	15
China	1.3	15
Indonesia	0.3	55
Malaysia	5.0	80
Philippines	0.2	4
Taiwan	-	-
Thailand	-	1
Vietnam	3.0	20
Total	11.2	190

Note: Reserve totals do not include Gulf of Thailand or onshore reserves.

Reserve estimates are based on field ownership status.

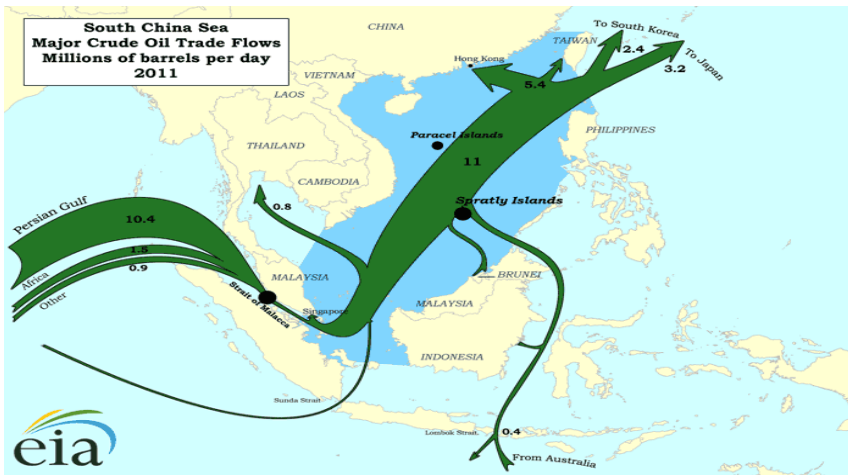
Sources: U.S. Energy Information Administration, Oil & Gas

Under-explored areas may contain...

USGS estimate of
5-22 bb oil
70 - 290 tcf gas

CNOOC estimate of
125 bb oil
500 tcf gas

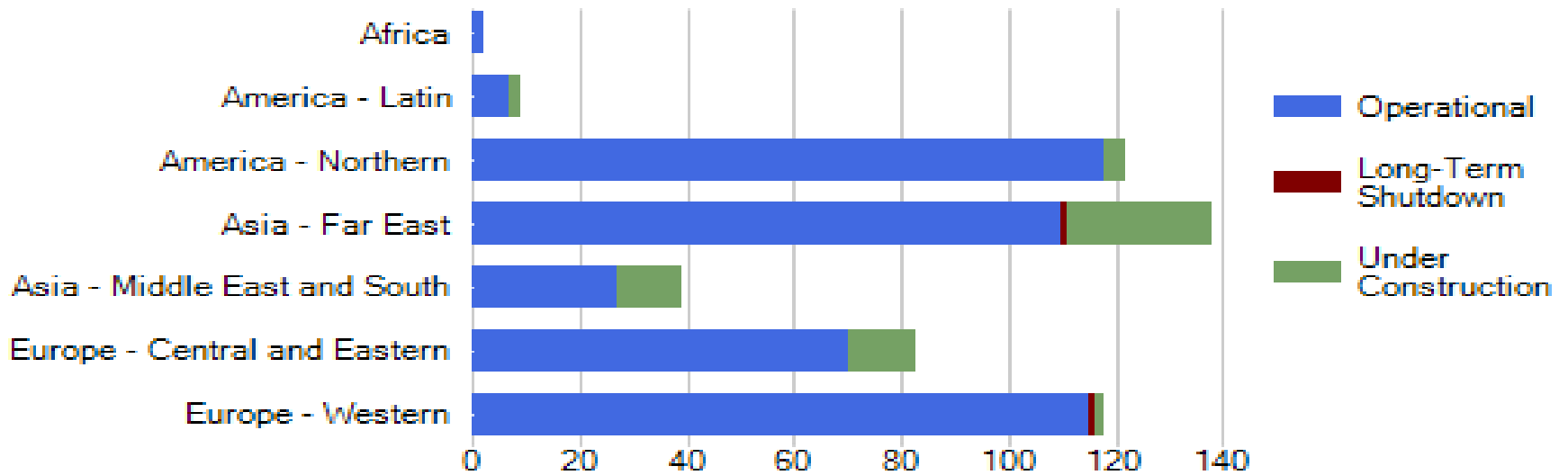
South China Sea and SLOC



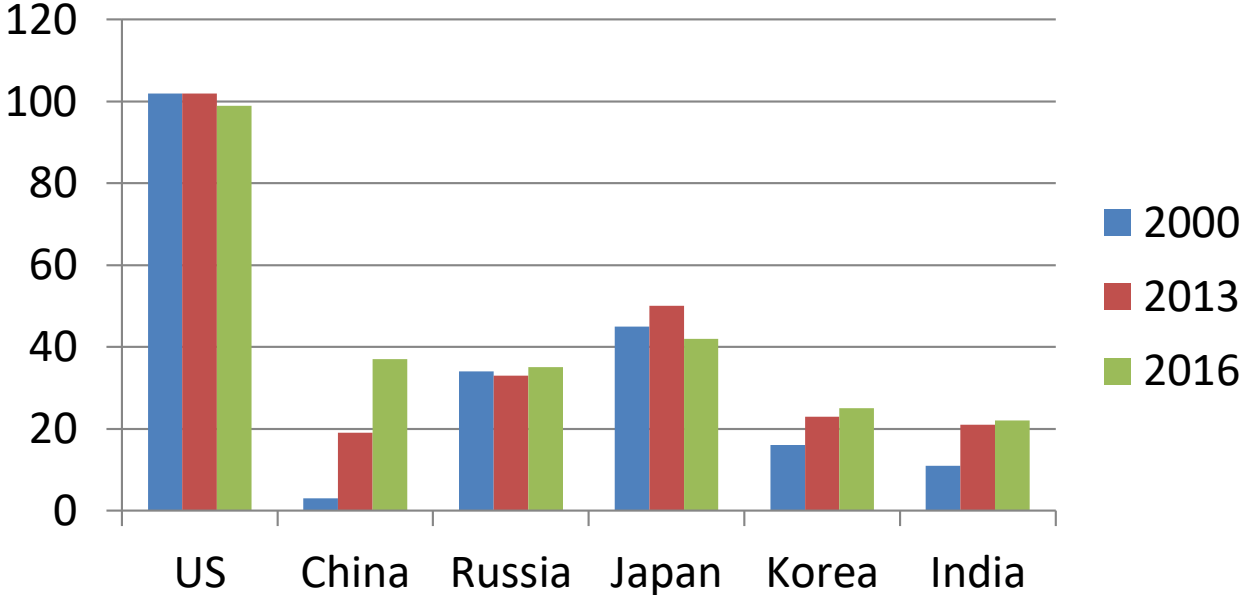
- 14 mbpd of oil transit
- 1/3 global oil movement
- 1/2 global LNG

The Growth of Nuclear... in Asia

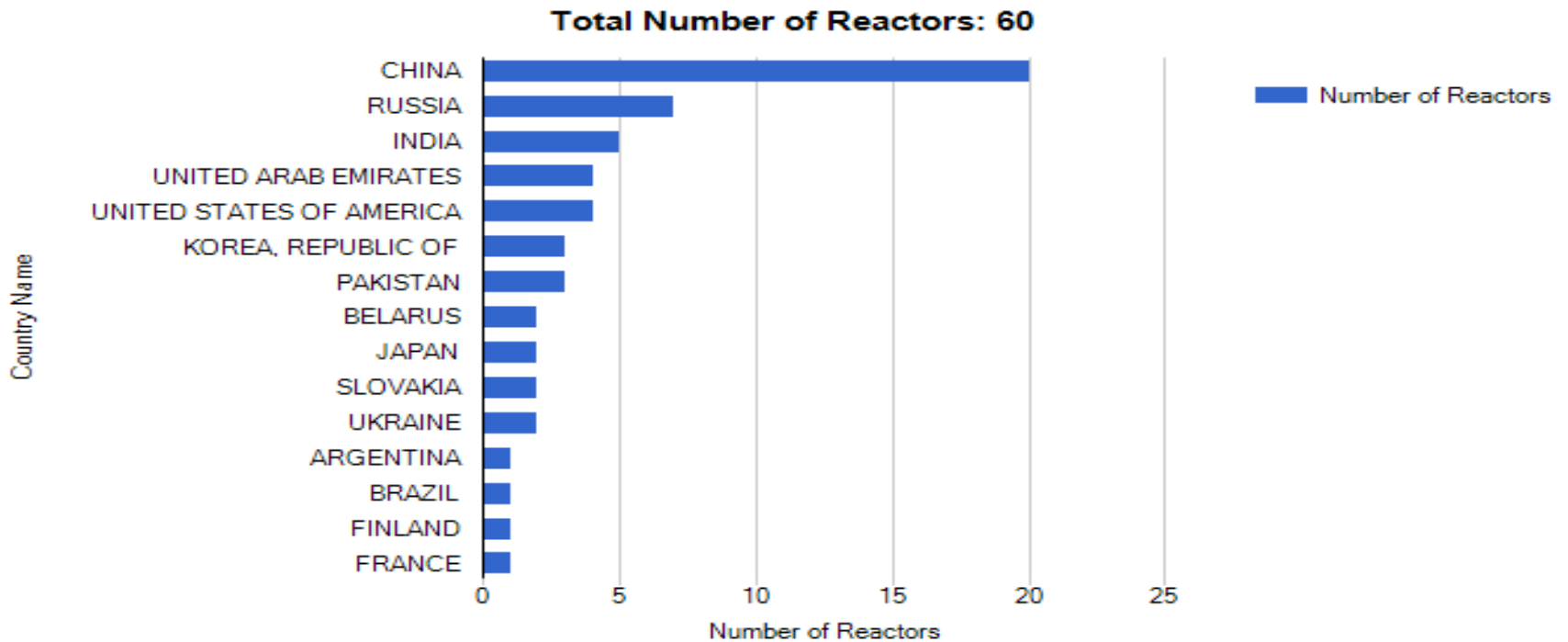
Nuclear Power Reactors Around Globe



Nuclear Reactors in A-P 2000-2016



Reactors Under Construction a/o Jan 2017



Source: International Atomic Energy Agency

Accidents

- 3 Major Accidents in 17,042 reactor-years of operation
 - 3 Mile Island
 - Chernobyl
 - Fukushima
- Possible lower accident rate....



Bringing it home

Your Part in Energy Security

- Beat the average fuel economy in the US...



Your Part in Energy Security

- Beat the average fuel economy in the US (22.6 mpg) by 5

27.6 mpg



Conclusions

- ONE, complex, energy system
- Prices go up and down
- Nuclear Growth in A-P will bring some risks

“Safety and certainty in oil energy lie in variety, variety, and variety alone”

Winston Churchill July, 1913



Mahalo!

Educate

Connect



Empower

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