Climate Impacts on Energy Systems

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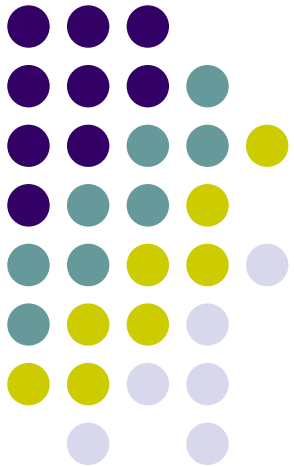
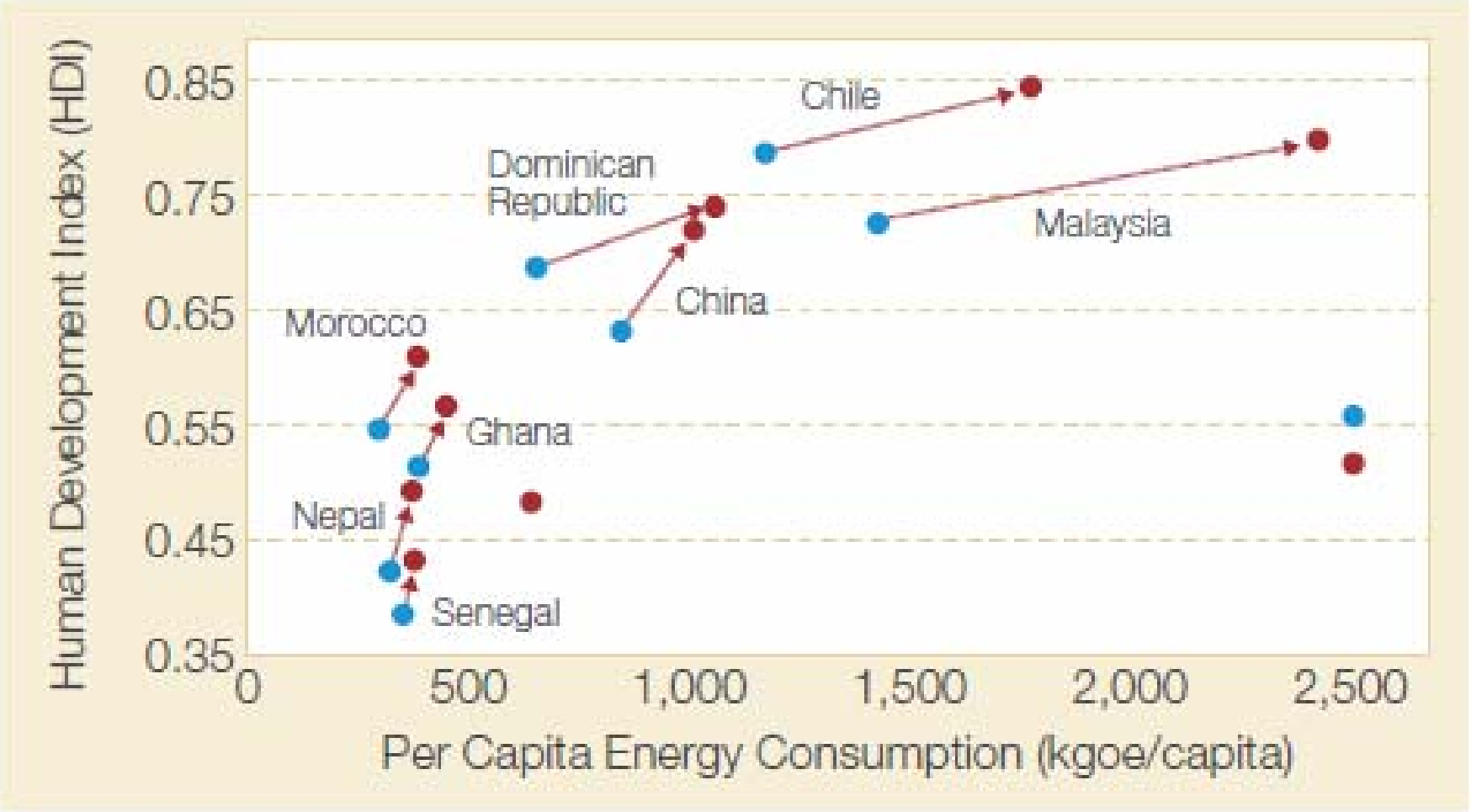
Seventh Africa Development Forum | October 12, 2010



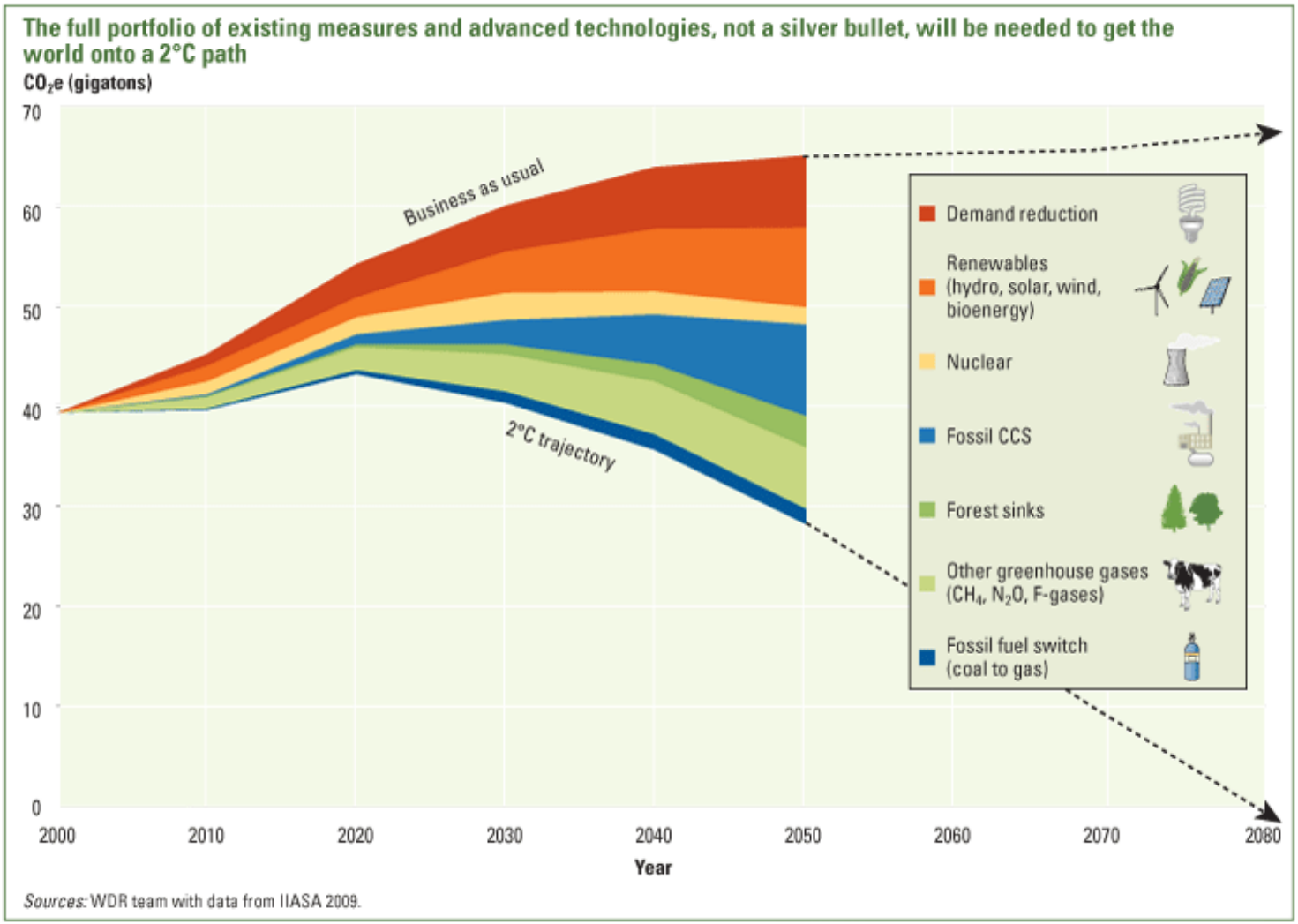
Energy…Rising Demand

Without action tripling of GHG emissions by 2050

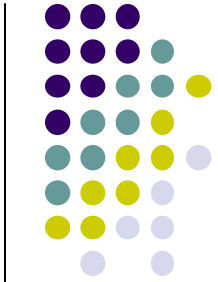


Source: World Bank, Infrastructure Brief

...Changing Development Pathway



…Changing Climate Parameters

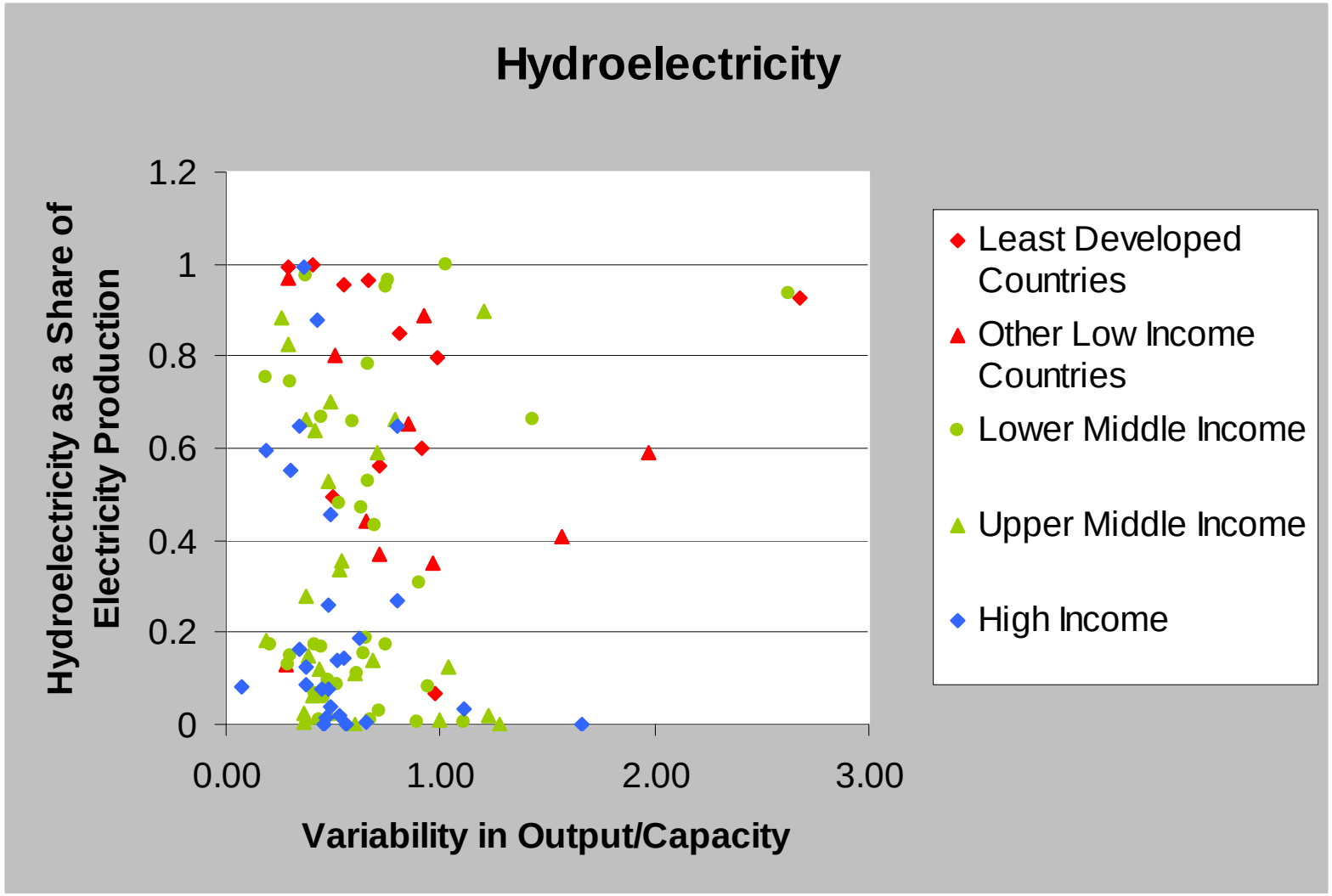


- Increasing temperatures over land & more variability in some areas (e.g. W Africa)
- Increased risk of heat waves
- Rising sea levels
- Permafrost degradation
- Changing precipitation patterns – more intense rainfall, longer periods of drought
- Variations in peak solar production (e.g. decrease E Africa)
- Decreasing mean mid-latitude wind speeds
- Possible increasing storm intensities

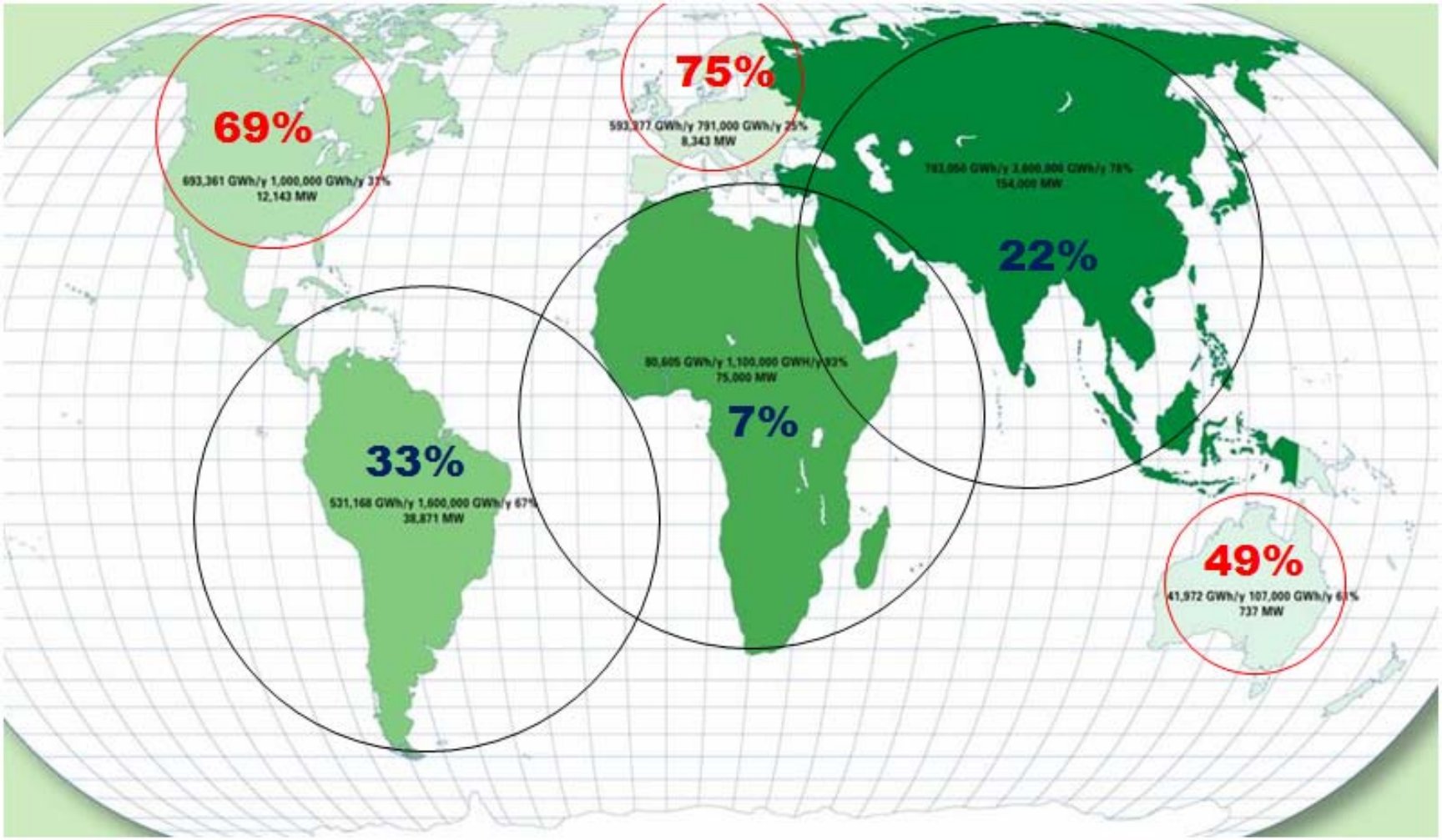
In 2005 alone climate extremes accounted for a 13% variation in energy productivity in developing countries (WDR, 2009)

ENERGY SERVICES WILL BE INCREASINGLY AFFECTED

Year-to-Year Variability in Hydropower Output (1990-2006)

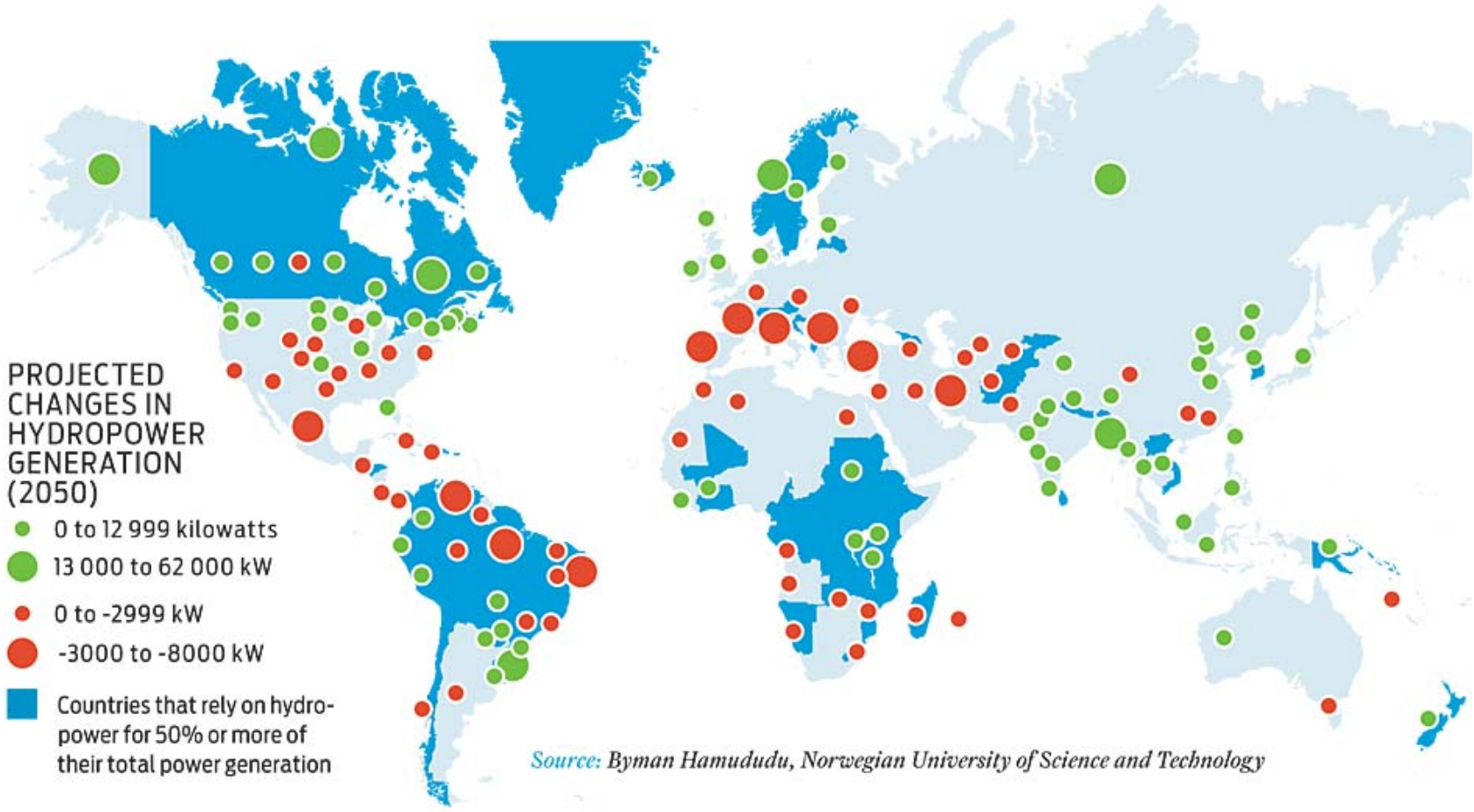


Significant Hydropower Development Expected



Source: O Dione, World Bank

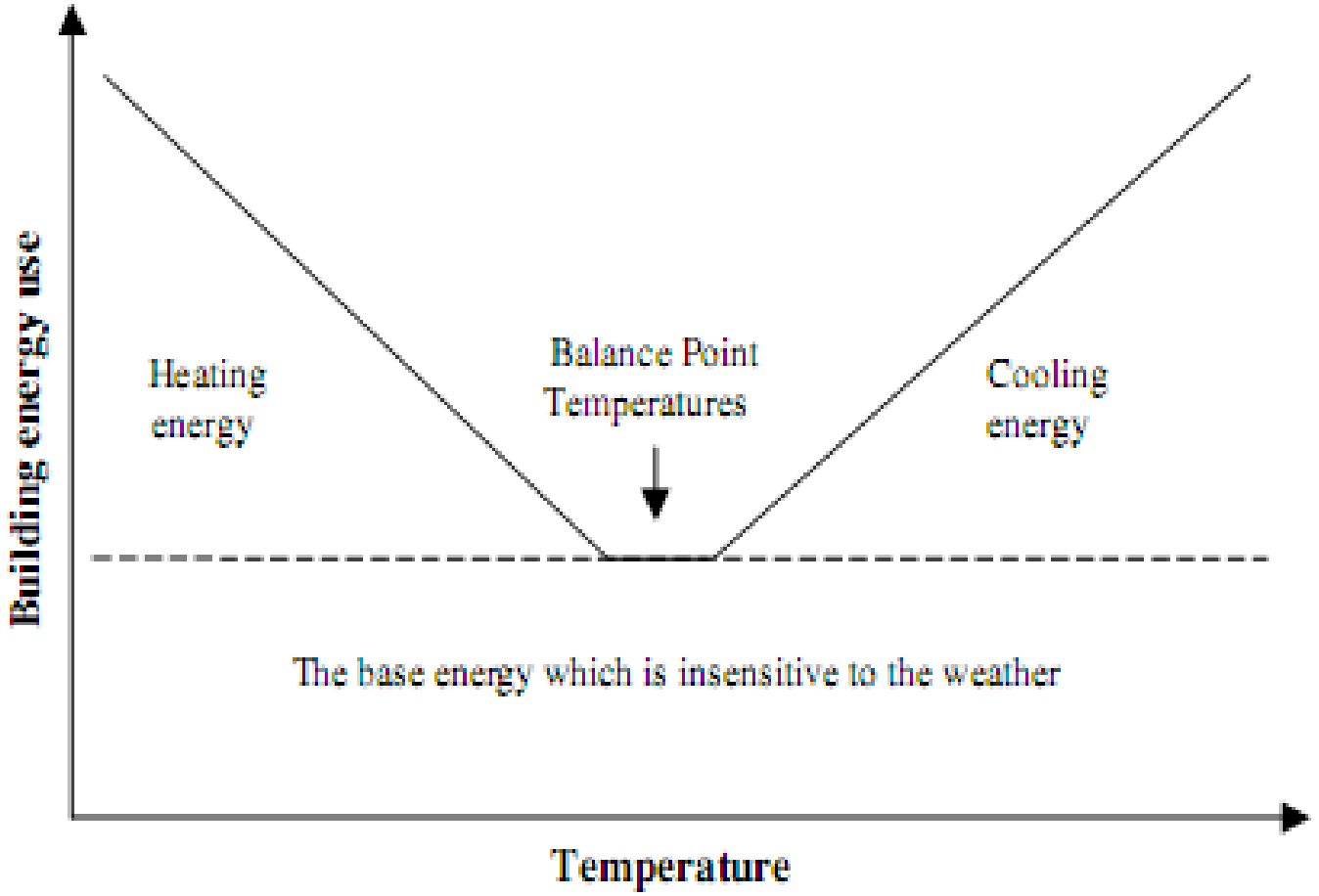
But …Hydropower Generation May Benefit or Suffer (or both) by 2050



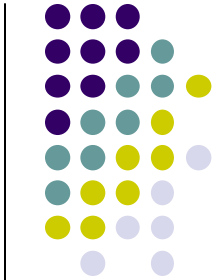
Source: http://spectrum.ieee.org/energy/renewables/future-of-hydropower

…heating will reduce but cooling demand will rise

- ✓Inter-annual variability and cold periods will remain
- ✓Seasonal demand profiles will shift for buildings, infrastructure, agriculture
- ✓Temperature tolerance of infrastructure will be tested



… and other wide ranging impacts

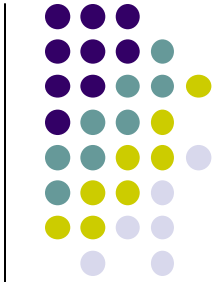


ENERGY IMPACT	CLIMATE CHANGE
Renewable energy resources	Changes in runoff, wind, crop response, ocean climate, atmospheric transmissivity
Energy supply	Hydro – water availability and seasonality Wind – variable wind regime Bio-fuels – reduced transformation efficiency Solar – reduced solar cell efficiency Thermal - Generation efficiency and cooling water availability Oil & Gas – extreme events
Transport/ Transmission & Distribution	Extreme event frequency, sea level rise
Design, Operations & Maintenance	Location – sea level rise, extreme events Downtime/ trade – extreme events
Demand	Temperature rise, inter-annual variations
Cross sector	Water resource management/ competition & locations

“Guarantee the supply of energy, and balance production and consumption throughout time and space” – an ongoing process

ADAPTATION IS NOT AN OPTIONAL ADD ON

Prevent Effects or Reduce Risks

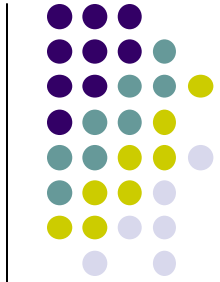


- Technological responses
  - Physical protection (e.g. targeted refurbishing)
  - Design standards (e.g. pipelines in discontinuous permafrost zones)

- Behavioral responses
  - Reconsider location (e.g. coastal infrastructure)
  - Anticipate arrival (e.g. better forecasting, contingency plans)
  - Change O&M (e.g. adapt to river flow patterns)

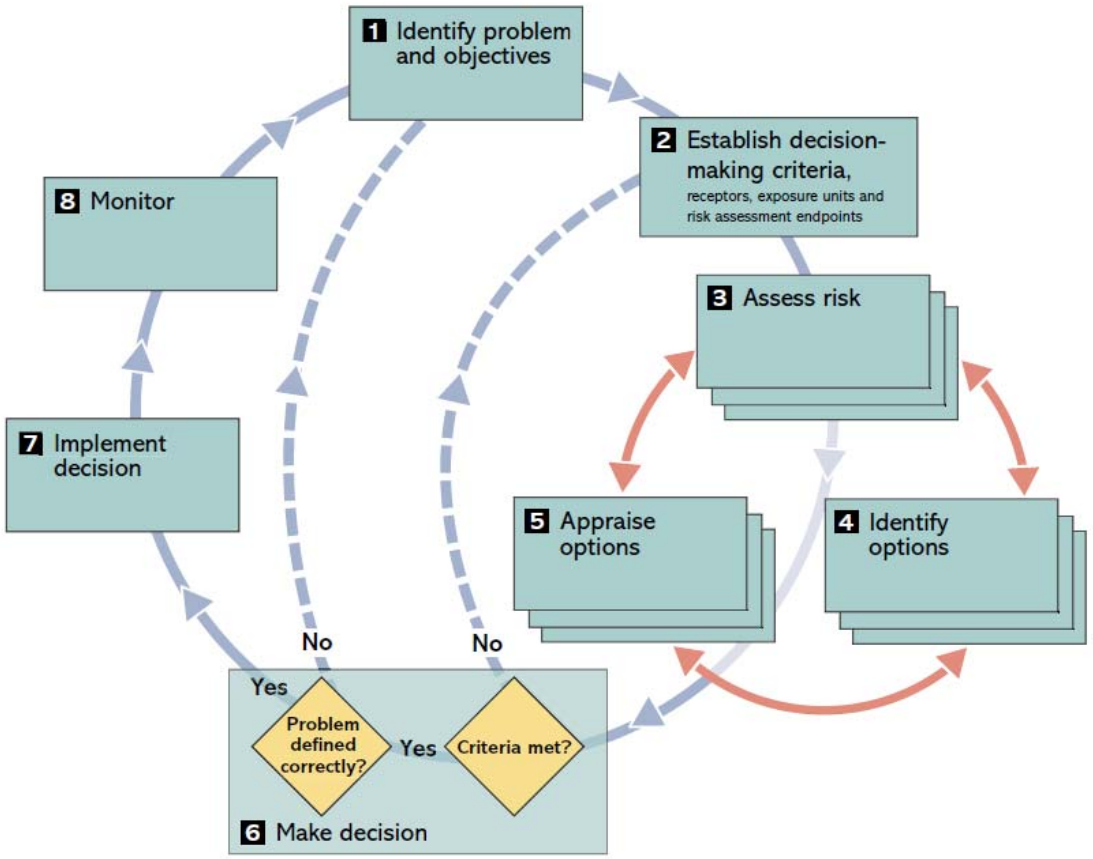
Share Responsibilities… Exploit Opportunities

- Financial instruments (e.g. weather derivatives, insurance)
- Diversify the energy system
- Energy/ water saving and demand side management
- Decentralized energy structures
- Urban policy & land use planning



INTEGRATED RISK BASED PLANNING WILL BE CRITICAL

Climate Risk Management



*"Responding to climate involves an **iterative risk management process** that includes both mitigation and adaptation, taking account of actual and avoided climate change damages, co-benefits, sustainability, equity and attitudes to risk" (IPCC 2007)*

Source: Willows and Connell (2003)

Integrated Planning is Highly Important

- Integrate plans
  - Within the sector
  - Between sectors (e.g. water/ energy/ agriculture)
  - Across stakeholders (e.g. national/ local, public/ private etc)
  - Mitigation and adaptation (e.g. RE)

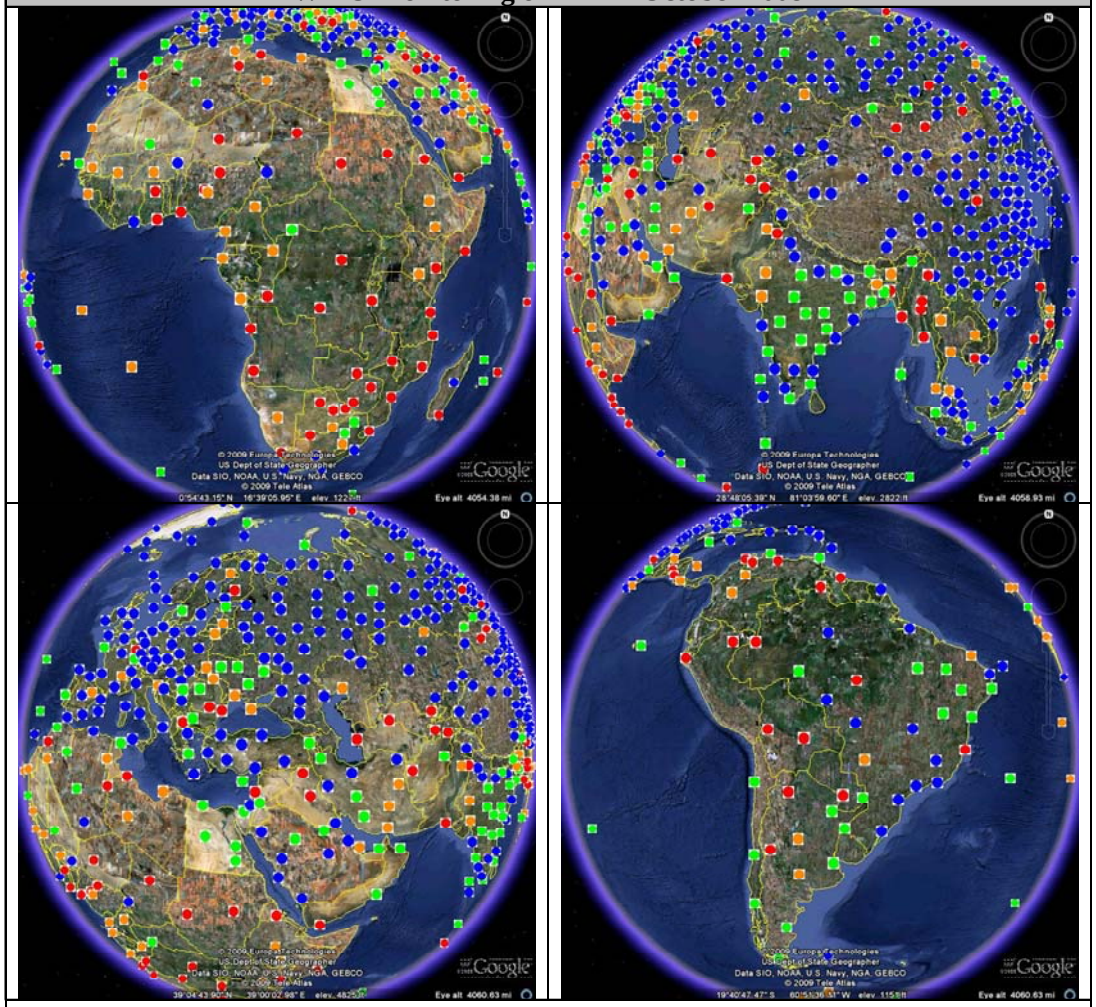
“The formal knowledge base is still at an early stage of development” (Willbanks et al., 2007)

AWARENESS, KNOWLEDGE AND CAPACITY ISSUES

Weather & Climate Services
…gaps in capacity

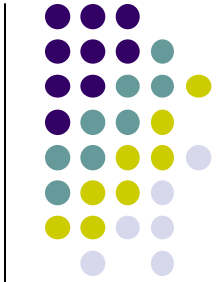
- Many services below WMO standards
- Historic records lacking or inaccessible
- Lack local skills and capacity for climate modeling
- Lack of tailored information and dialogue (cross sector)

WMO Monitoring of TEMP October 2008



BLUE: stations for which more than 90 percent of the reports were received
GREEN: stations for which 45 to 90 percent of the reports were received
ORANGE: stations for which less than 45 percent of the reports were received
RED: silent stations

Near-term Actions



- Climate Information
  - Nature and timing of climate change
  - How climate parameters affect energy systems
  - Assessment of climate information needs for energy
  - Tailored and timely flow of climate information to the energy sector
- Decision Making
  - Practical tools tools and guidance for CRM
  - Emerging adaptation practices and new standards
  - Expanded knowledge base (e.g. water/ energy, mitigation/ adaptation interactions, research on technologies/ modeling, economic assessment)
- Implementation
  - Policy instruments to support action
  - Awareness and exchange knowledge
  - Capacity building

Thank You!

For more information:

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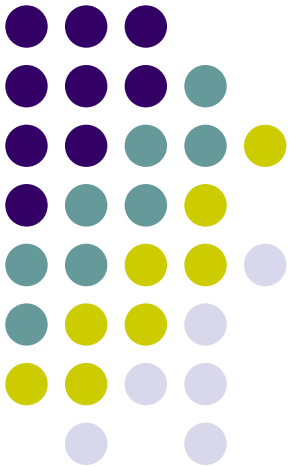

Study completed with representatives from: Basque Climate Change Center, ClimDevAfrica, CSIRO Australia, Danish Meteorological Institute, ESMAP, Federal University of Rio de Janeiro, Oxford University, UNEP Risoe, World Bank