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Shared consensus: Starting point

1. There is a relentless drive of humanity for continued economic growth,
2. Energy and water are fundamental resources for growth,
3. We have failed as a society to strive for growth without polluting the environment.



This dichotomy can best be addressed by linking energy, water, and climate change as a unified research agenda.

PASI 2012: Conclusions and Recommendations

1. Formulate policies for climate change and sustainability in terms of **a balance between actions and expected damages, ... in terms of the induced damages** instead of mere change in temperature. This would improve the public understanding. There is a need for an alternative global metrics for measuring the extent and effects of global climate change.



PASI 2012: Conclusions and Recommendations

2. Geographic settings, cultural predispositions, regional economic growth in a globalized market, policy formulations, cross-border flow of resources, and migration of the impacts of industrialization, make the need for **transnational discussions** an essential component of agenda for a sustainable future. These cross-border socio-political conditions are superimposed as aggravating factors on complex and multi-disciplinary subjects affecting our relationship with the environment.



PASI 2012: Conclusions and Recommendations

3. It was concluded, that in order to provide a universally acceptable and valid sustainable use strategy for energy and water, steps must be taken to **improve efficiency, deploy a larger number of “clean” technologies, and design more creative ways to use finite and limited resources.**



PASI 2012: Conclusions and Recommendations

4. The need for advanced **tools and mechanisms to more accurately model and forecast climate change** instigated by human activities.

Current research on climate change uses long term temperature data as an input, and uses statistical approach ...
.. anthropogenic heat, traditionally ignored in climate modeling.

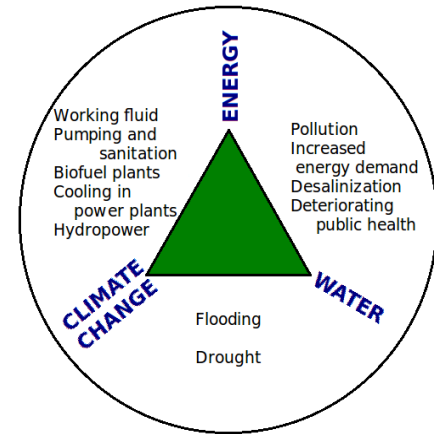


PASI 2012: Conclusions and Recommendations

5. Additional parameters to quantify climate change were proposed. ... to transform **the effect of human interactions and the environment into a set of simple numbers that quantify our impact on climate change.**

For example, energy, water, and climate with a conceptual map visualizing the couplings between the different areas of interest.

Use of **extended exergy** accounting to assess the state of the environment is proposed as a strategy that should receive more research attention.





6. There is a divide among developing and developed nations on handling the costs of global climate change. The United Nations Framework Convention on Climate Change adopts a principle of "common but differentiated responsibilities."

Objective responsibility and future emissions were discussed as a means for splitting the costs for climate change among nations. It is **unlikely that developed countries would be willing to sacrifice their current living standards to offset the pollution** induced by developing countries.

PASI 2012: Conclusions and Recommendations



7. Historically, economic trade has been one of the most successful forms of international collaboration. In the last decade, there have been discussions to **associate an economic price to environmental resources**. ... Define environmental capital with carbon credits, carbon footprint, etc.

Watersheds, aquifer recharges, etc. have no monetary value. If environmental capital value could be assigned to them in such a way that a resource capital can be saved, then the interest from this capital could be used to raise their cost. This increases river basin values, and the loss of its capital would be associated with its destruction.



8. The **creation of an information system mirroring ecosystems** was introduced, as it would allow for a feedback loop for an ecosystem spanning several regions or nations.

If the ecosystem is cross border, then the information and mitigation system too must freely flow between borders in the same way changes in the ecosystem flow. International scientific collaboration is one form of this type of information exchange, but the systems currently in place are sparse and not sufficient for informed policy making at the global level.

PASI 2012: Conclusions and Recommendations

9. Systems of validation and risk analysis of data and simulations allow for the (pseudo-) real time monitoring of the environmental state, and testing of the effects of policies. Networks **linking satellite data** from several countries has begun. Further development in the analysis and display of these data is necessary for the visualization of these complex systems for nontechnical people involved in policy making. An example of this type of system using UN data is found at **Gapminder**.



PASI 2012: Conclusions and Recommendations

10. Aquifer depletion and other water shortage data need to be combined with fuel and power generation to not cause new problems in one area with solutions in the other. The true **costs of power and water production technologies must be readily available to find locally viable solutions.** For example, ethanol production in Brazil and the USA do not have the same viability since corn and sugar cane based production have different yield and resource requirements.





11. Examples of information integration and validation are becoming more prevalent in web technologies with examples found in Wikipedia (www.wikipedia.org) where errors in open collaboration are mineralized through **crowd-sourcing** and other techniques. NASA and other scientific institutes have found how to use these technologies for the analysis of remote sensing, and show the power of these techniques which could be adopted in energy and water nexus, linked with climate change.

PASI 2012: Conclusions and Recommendations



12. Fossil fuel based power will continue to be used as major source of energy in the medium term until replaced by other clean sources of energy. It is therefore necessary to **manage the transition period to ensure maximum sustainability**. In this respect research on efficient carbon capture and storage systems Promising research opportunities on renewable energy: design of efficient solar power systems, wind mapping, hybrid solar, secondary cycles to boost cycle efficiencies of thermal plants, and other energy harvesting systems at the nano levels. The use of algae and cellulose for biofuel generation also offers an optimistic research topic.



13. Increased population continues to put stress on water, which has become a critical issue in many arid areas of the region and the globe. There is a need to **reduce the kW/liter of water treatment** to reduce the cost of treatment and desalination technologies.

14. **Water demand during power generation** processes also imposes research topics that include: reducing cooling water used in power production as well as in biofuel processing plants.

THANK YOU!



Questions ?



Thank you

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