U.S. Perspective on the Water-Energy-Food Nexus

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Executive Summary

Water, Energy, and Food: Mutual Security through a Nexus Approach

Water, energy, and food systems are interconnected in a nexus because they draw from common stocks of natural resources and require connected infrastructures to provide essential inputs to society. Their nexus is the shared set of spaces where they are interdependent and where management decisions cause cascading effects on security of these vital resources. Effective management is required to anticipate the interactions and feedbacks that occur across the water-energy-food nexus as it responds to drivers of growth, climate change, and natural disasters in a world of growing complexity.

The mutual security of these systems and lessons from U.S. experiences were studied at a June 23-24, 2014 workshop in Golden, Colorado. Colorado State University in partnership with the U.S. Army Corps of Engineers Institute for Water Resources and the U.S. Department of State convened the workshop. The main question to workshop participants was how to plan and manage jointly and effectively across the nexus for the range of contextual situations of resources and institutional capacities found in the U.S. The workshop built on outcomes of previous forums to contribute to the international dialog by studying lessons drawn from U.S. experiences during decades of development, discovery, and challenges.

In addition to lessons learned about management across the nexus in a nation with diverse climate and cultures, insights were sought about core international goals such as security, justice and equity, poverty alleviation, and sustainable development. The U.S. has experiences ranging across more than 50 states and territories and tens of thousands of local governments and special purpose organizations, as well as a dynamic private sector that includes both for-profit and not-for-profit organizations. On top of these, think tanks and thought leaders contribute substantially to the rich knowledge base that has been built about water management experiences.

To draw from this reservoir of knowledge, the workshop focused on case studies to frame specific lessons about governance, infrastructure and technology, financing, and public-private partnerships. It probed interconnected issues such as irrigated crops for biofuels, multi-purpose hydropower reservoirs, lease of agricultural water for electric power generation, and inland navigation.

While the number of cases reviewed was limited, common elements occurred across them, such as that water-energy-food nexus issues are complex and meaningful only when the scale and context are defined. No matter the level of complexity, there is a clear need to understand the nexus through study of the flows and stocks of resources and interdependencies among systems, but even more importantly, to find successful paths to shared governance to strengthen resilience of the linked systems.

Infrastructure management is a critical issue for security across the nexus, both in renewal of aging infrastructure with a triple bottom line approach and preparing for climate change and new thresholds of extreme events. As society modernizes, advanced planning before disasters is needed to provide the opportunity and blueprint for rebuilding more resilient and efficient infrastructure. This means that managers in the water, energy, and food sectors must coordinate their future infrastructure plans with the disaster preparedness sector, which has its own set of nexus issues. Competition for resources is another recurring theme. For example, agriculture faces competition for limited water and land resources from the growing urban, energy, and industry sectors. Joint governance of these sectors offers possibilities to develop shared uses and decisions about common property resources.

The clearest picture of nexus interactions is normally at the local level, where players and issues can be better defined than at higher systemic levels. The cases showed most potential for success through actions where stakeholders can forge cooperation directly, but scaling the lessons to higher policy levels is critical to provide a supportive enabling environment for them. However, no matter what happens at higher governance levels, success or failure in crosscutting problem areas is determined mainly at these local levels where multiple variables and mixtures of players and goals define the problems. As groups confront their issues locally, problem identification and solutions should be bottom-up and not top-down. It is especially important that flexibility of conflicting regulations and policies at higher levels is increased. For example, one grass-roots case showed negative consequences of on-farm regulation, but co-benefits occurred from a cooperative and flexible team approach. On the other hand, failure occurs in complex higher-level cases where there are tight regulations and weak incentives for parties to stay engaged. An important challenge to confront is to achieve cooperation across the nexus, especially considering the imbalance among...
water user needs, as for example the large water consumption for irrigation compared to the small consumptive use of energy production.

To motivate such local actions, the cases showed a clear need for a catalytic force such as a crisis or regulatory deadline to stimulate action to identify a convening authority, confer authority to make decisions, create a process to work within, and provide leadership to steer the process. In any of these situations, flexible processes are needed to provide for the highest and best use of shared resources and that stakeholders perceive a fair process so they are willing to share risks.

While nexus action mainly occurs at the local level, broad policy is determined at higher levels of governance. Given that water users may be suspicious of the motives of government, agencies without regulatory mandates can be involved with beneficial results to enable success. They make contributions to capacity building and serve as convening authorities to bring in models and other decision resources. For example, the U.S. Army Corps of Engineers and its involvement in river basin planning and management and management of the Inland Waterway System exhibit critical governmental roles across the nexus and show the role of the federal government in systems ownership and operation, as opposed to a purely regulatory role.

Policy barriers are formidable, especially the loss of flexibility and added constraints through regulatory controls and stovepipe approaches among the stakeholders. In confronting these, national-level water, energy, and food policy choices should identify tradeoffs between economic, social, and environmental strategies that work across the nexus and result in improved and shared security. To promote this, governments and policy scientists should encourage synergies and innovation among sectors by coordination, providing data and funding for technology development, and providing incentives and partnership forums when neither the market nor regulation achieve the desired goals. Governments and policy designers can encourage synergies among sectors and innovations that accelerate nexus security by policies that promote tradeoffs and co-benefits across economic, social, and environmental systems. In many cases, the most effective role for government is helping coordinate across sectors and with entities at regional and local levels, providing data and funding for technology development, and a combination of incentives and disincentives where market forces run counter to desired goals.

In many cases, the federal government must be careful to be policy informing but not policy-prescriptive, recognizing sovereignty of state, tribes, and allowing the right entity to make decisions and have enforcement authority when needed. Federal and state support programs can undermine incentives, but water users are also highly dependent on some federal water programs such as reservoir operations. Business and the non-governmental entities also play important roles in addressing the resource challenges faced by the world today.

The identification of strategies will vary with the context and determine the shades of governance needed, whether by regulation or enablement. A key to governance success is involvement of willing participants. Creating non-coercive incentives for participation can increase their willingness. These should be based on common regional goals. Parties should also trust each other and have an unbiased administrative or mediating entity. Governance should have appropriate and manageable scales and processes, and roles and responsibilities must be specified clearly with flexibility in the arrangements. It is also important to identify when the government should play a role at all. A structured mechanism for conflict resolution is required to facilitate groups, and it might increase the chance of collaboration if participants perceive that an external entity might make the decision in the absence of their consensus.

While shared governance processes are essential for the nexus, they add time and cost requirements, and it is important that stakeholders perceive the outcomes as being worth their investments in mutual planning and problem solving. Working on shared issues can involve multiple players who enter and leave the problem-solving process without consequences to themselves, and patience and persistence are required.

Given the extensive funding requirements of infrastructure, finance is a main driver of the nexus. Single-sector projects with limited partners may seem more accountable, but partnerships to build and operate infrastructure systems are needed to pool resources. New organizational structures to take advantage of the public and private sector approaches are needed. Again, local projects and partnerships will normally work better than large-scale programs.

Articulating a U.S. vision for water, energy, and food security that highlights the potential synergies of the nexus approach will help encourage policy initiatives at all levels of governance and is recommended as a next step. This vision may also help inform our outreach initiatives with international partners, with consideration of their unique contextual situations and realization that U.S. experiences have sometimes worked against integration. Aspects of this vision
include infrastructure development and management, disaster resilience, sustainable development, water and energy efficiency, public-private partnerships, and responsibilities for implementation.

The challenge to be confronted in formulating a vision applies in the U.S. as it does to other nations: how can non-coercive collective action for water resources management be marshaled to increase security across the water-energy-food nexus? Intergovernmental and public-private cooperation is required no matter the context, and across the globe many cultures and governance systems are at play. The conclusion of this point, and the starting point for the next step, would be to ask: What specific institutional changes should be made to take advantage of lessons learned about water resources management in the U.S. and to provide incentives to overcome barriers to success such as lack of cooperation, inflexible structures, and stovepipe decision-making? These questions apply directly to the water-energy-food nexus, but they also apply to broader questions of managing resources and infrastructure to serve the economy, society, and the environment better.