



Energy, water and food: A systems approach

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Energy relates to water and food in many ways. Energy enables access to water, through water pumping, distribution and treatment. Energy is needed in modern agriculture systems, from irrigation to use of fertilisers and machinery, to food preservation, processing, transport and cooking. At the same time, energy production has an impact on natural resources such as land and water, which are equally input to the agricultural sector. Land is actually the fourth dimension that needs to be taken into account in the Nexus debate.

Water is used for extraction, mining, processing, refining, and residue disposal of fossil fuels; for growing feedstock for biofuels and electricity; and as source of energy in the case of hydropower. Any water demand from the energy sector comes on top of over 70 per cent of freshwater being

used in the agricultural sector already. But not only water availability is an issue. Many forms of energy production through fossil fuels can pollute water, especially extraction from tar sands and shale. And return flows from power plants to rivers are warmer than the water that was taken in, and if polluted can consequently compromise other downstream usage as well as ecosystems. The production of biomass for bioenergy can lead to important run-off from fertiliser and pesticide use, as is the case for any agricultural production.

Many countries are already facing a triple energy-water-food crisis, and combined pressures threaten to drive ecological and social systems beyond critical thresholds:

- About 900 million people lack access to safe drinking water and an ever-increasing number of people are affected by water shortages. If we continue with business as usual we will have – in less than two decades – globally 40 per cent less freshwater resources available than we need for ensuring water, energy, and food security for all.
- 1.3 billion people lack access to electricity and 2.7 billion have no access to modern and healthy forms of cooking; energy demand is projected to grow by one-third by 2035. If present patterns of energy production and use are pursued, the climate target of keeping global temperature increases below 2 degrees will not be met.
- Close to 1 billion people are undernourished, and food price rises globally are of great concern, particularly to poorer segments of society who already spend a significant amount of their budget on food. If current consumption patterns, such as dietary changes to more protein-rich diets, and food waste continue, agriculture will have to produce 70 per cent more food by 2050, which may result in a 20 per cent increase in use of water and 10 per cent increase in land use change.

Addressing sectors in isolation will not get us to access to clean energy, water and food for all within the planetary boundaries. We must move towards greater integration of these key sectors, looking at them as a system. This approach needs to be reflected in assessments, planning and policy processes, as well as new business models and investment decisions.

Integrated planning processes, engaging relevant stakeholders

To identify system efficiencies and manage resources sustainably, integrated assessments need to consider

Global Bio-energy Partnership

24 indicators, 3 pillars

Economic

- Price and supply of a national food basket
- Access to land, water and other natural resources
- Labour conditions
- Rural and social development
- Access to energy
- Human health and safety

Environmental

- Lifecycle GHG emissions
- Productive capacity of land and ecosystems: soil quality, wood harvest levels
- Air quality: non-GHG air pollutant emissions
- Water availability, use efficiency and quality
- Biological diversity in the landscape
- Land-use change, including indirect effects

Social

- Resource availability & use efficiencies in bioenergy production, conversion, distribution and end-use
- Economic development
- Economic viability & competitiveness of bioenergy
- Access to technology and technological capabilities
- Energy security

multiple impacts across the full life cycle, and not only sector by sector or even technology by technology, but for entire systems. The International Resource Panel, for which UNEP hosts the Secretariat, is preparing a series of reports that further elucidate the issues at stake; the upcoming land report, for example, homes in on competition for land for multiple uses, including energy and food production.

Although the issue is bigger than bioenergy, it is worth looking at the literature and tools produced and used to address the Energy-Water-Food Nexus, as soaring bioenergy demand triggered the Energy-Water-Food Nexus debate. Under the framework of UN Energy, UNEP and FAO have developed step-wise guidance to ground bioenergy decision-making in science, and put it into a broader systems perspective. A 'decision tree' describes an integrated strategic planning process, analysing domestic energy and food needs, and assessing the status of critical resources such as water and land, and factoring in projected trends and impacts from major global threats such as climate change. The process implies multiple feedback loops to identify and study conflicting objectives and trade-offs as well as synergies and co-benefits. Tools comprise Integrated Water Resource Assessment as well as Agro-Ecological Zoning. The latter uses a combination of GIS data and ground-truthing, and involves among other parameters assessment of carbon storage value, biodiversity value beyond simple reference to Protected Areas designated under the Convention on Biological Diversity, state of food production and security, and land tenure rights.

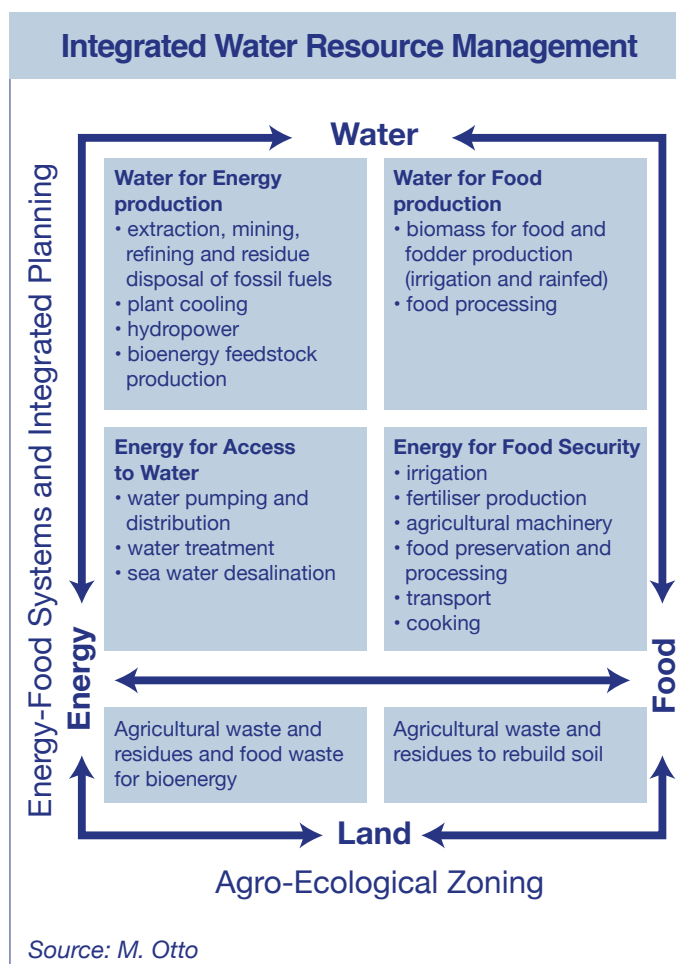
Planning processes need to engage relevant stakeholders. To facilitate the consultation both across national, regional and local government, and with the private sector and civil society, the Decision Support Tool suggests the creation of a Stakeholder Forum in which all interested parties can participate, and an Inter-ministerial Group, which facilitates the decision-making and acts as the executive organ. Such a process would facilitate the mutual understanding and cooperation needed to develop new integrated business models.

Integrated strategies and policies

As was stated in the 2011 Bonn Conference on the Nexus, water, energy and food strategies and policies need to articulate a plan for security of supply and sustainable access to basic services taking into account the implications on other sectors.

- Develop innovative, synergistic environmental policy measures and instruments which concurrently respond to several environmental challenges and minimise trade-offs.
- Create more with less by increasing resource productivity, establishing mechanisms to identify the optimal allocation of scarce resources for productive purposes, and sustainably intensifying the use of land and water to achieve equitable social, economic and environmentally sound development.

The Agricultural and the Energy sectors are particularly subsidy-heavy. Created to support poorer segments of society and other vulnerable groups to gain access to food and energy, or smallholder farmers in the case of agricultural subsidies, these subsidies often do not only benefit the target groups. At times they even promote waste. In addition, as in the case of fossil fuel subsidies,



they can distort the competitiveness of alternatives.

- Reformulate or remove those subsidies that are harmful to resource use and climate while implementing better targeted support mechanisms for vulnerable groups that are decoupled from resource use.
- Market instruments that encourage more efficient and equitable resource allocation and use, leaving business to find the best technological solutions and new business concepts.

In the work on Bioenergy it was found that securing land tenure rights and water rights for vulnerable groups are critical in achieving social goals and helping address over-exploitation of these resources.

- Review / develop land tenure and water rights benefitting vulnerable people.

To ensure policy effectiveness, it is important to monitor progress towards or away from policy objectives, and help to identify impacts and trade-offs on related sectors

The Global Bioenergy Partnership developed a set of 24 sustainability indicators to address sustainability in the bioenergy area, with 8 economic, 8 social and 8 environmental criteria, speaking to land and water, as well as access to energy and food security. This set can serve as inspiration for monitoring effectiveness of Nexus policies.

- Develop solid measures to monitor and evaluate the added value of integrated nexus planning and mutual beneficial outcomes.

Investments in business models taking a systems approach

Energy, Water and Agriculture were three of the 10 sectors highlighted in UNEP's Green Economy report as critical. The report had found that investment of 2 per cent of global GDP invested in 10 key sectors could kick-start a transition towards a low-carbon, resource-efficient economy. The integration of the three sectors requires new business models and redirecting investments. This opens up new opportunities, but initial barriers need to be overcome.

- Work with the investor communities and the financial sector to increase confidence in these new business models.
- Promote integrated Food-Energy Systems and good agricultural practices through agricultural extension services.

End waste

The most cost-effective way to reduce pressures on natural resources and reduce the carbon footprint is to end waste

and minimise losses along supply chains. As is often said, the cleanest and cheapest energy is the energy that is not consumed. Another example stems from the agriculture sector where one-third of the food we produce is lost and wasted, using critical resources such as water and emitting a certain amount of CO₂, while at the same time 12 per cent of the world population is estimated to be undernourished. To manage waste and loss down, UNEP with the Food and Agricultural Organisation of the UN has launched a global campaign called "Think. Eat. Save: Reduce Your Foodprint." Consumer choices are critical to end waste and reduce water, energy, food and other resource footprints.

- Promote sustainable consumption patterns.

Investments in sustaining ecosystems

Not least since the Millennium Ecosystems Assessment, the value of natural infrastructure has been recognised. Biodiversity and ecosystems deliver provisioning services for water, food and energy, and support nutrient cycles that maintain the conditions for life on Earth. Investments to secure, improve and restore ecosystem services are needed.

- Promote investments into ecosystems through regulation and market-based instruments.

What next?

The interrelation between Energy, Water and Food will be an important topic also in the decades to come. In the ongoing consultations on the post-2015 development agenda all three areas are being considered, and were subject to respective specific thematic consultations. It is important now to bring these elements together. As we move towards formulating Sustainable Development Goals (SDGs), a number of suggestions have been made already, for example by the High-level Panel of Eminent Persons on the Post-2015 Development Agenda set up by the UN Secretary General and the Sustainable Development Solutions Network. All capture the importance of energy, water and food security. In the formulation of the SDGs and their related targets and indicators we now need to establish the cross-references between the sectors.

Under the secretary-general's initiative for a Sustainable Energy for All, partners will be able to coordinate and scale up their activities. Realising long-term water, energy and food security for all within our planet's boundaries is certainly part of the future we aspire to. It can become reality, if we put our collective means to it. 