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IEA Bioenergy

THE BIOENERGY AND WATER NEXUS

KEY MESSAGES

The bioenergy and water nexus is complex

Bioenergy production[1] and use have both positive and negative environmental and socio-economic consequences, including those pertaining to water. Water is already a scarce resource in many parts of the world. The expansion and intensification of bioenergy production could add to existing pressures. Therefore, water resources management and adequate policies and strategies are needed to help ensure sustainability and balance different types of use in the short and longer term.

Water use for bioenergy needs to be evaluated at different scales

Different bioenergy products are not created equal, and this is also true for their use of water. Inventorying the water requirements of a bioenergy product can serve as a basis for water resources management and planning. Inventories can be created using water use indicators, which allow estimating the volumes per type of water abstracted, consumed and altered throughout the entire production cycle. The relevance of each indicator is determined by local or regional conditions, and planning needs to consider historic as well as alternative future land use in an area.

Impact assessments are the basis for decision-making

Given the complexity of the interlinkages between bioenergy and water, an assessment framework is critical if operators and policymakers are to be able to evaluate the positive and negative effects of bioenergy development on water resources.
The assessment framework needs to take into account the water intensity of proposed activities, the state of water resources, and impacts at a specific location.

Water quality concerns need to be addressed: point source and cumulative effects

Bioenergy systems can influence the quality of water nearby and over long distances, with resulting consequences for biodiversity and human needs. Impacts on water quality need to be considered at the project level (point source) and watershed level (non-point source or cumulative effects). There are ways to avoid or mitigate negative impacts, and in some circumstances bioenergy development may help improve the water situation.

Policy instruments are needed to address the water implications of bioenergy production

Policy instruments can directly or indirectly influence how bioenergy production affects water availability and quality. They should be designed to help avoid long-term adverse consequences while maximizing potential benefits, e.g. new rural jobs and new options for sustainable land and water use. Bioenergy-related water policy instruments need to be designed to be coherent with regard to instruments in related policy sectors and with existing water policy instruments, including those concerned with irrigation and other agricultural practices and industrial water use.

Use of voluntary certification schemes is one way to respond to water-related concerns on a project level

Many voluntary certification schemes for sustainable bioenergy production have identified water as a core issue, and have developed related criteria and indicators. Ambitious schemes exist covering excessive water consumption, water scarcity, and protection of water quality.
Certification is a tool with which decision makers on a project level can respond to environmental and social concerns. The practicability of certification schemes, as well as their effectiveness in preventing harmful impacts, need to be monitored and evaluated in the coming years.

[1] The term 'bioenergy production' is used here to capture the various ways of producing biomass and converting it to solid, liquid and gaseous fuels, and to electricity. However, it is recognized that this term is not doing justice to the first law of thermodynamics (energy can be neither created nor destroyed, but only change forms).

RECOMMENDATIONS

Take a holistic approach and a long-term perspective, cooperate on a watershed level

- Address competition for water resources for different uses though integrated water planning and management.
- Consider the context – regional, national and local conditions – to identify the best use of a drop of water. There is no “one size fits all”.
- Apply a life cycle perspective, as water use and related impacts can occur along the entire production chain, from feedstock production to conversion and final use of a bioenergy product.
- Take into account possible beneficial effects/synergies, e.g. for food and fuel production through combined systems.
- Consider inter-relationships with other resource needs, as there are potential tradeoffs between land and water use, biodiversity, GHG emission reduction, soil, etc.
- Reflect global trends, particularly climate change adaptation needs, in development strategies.
- Take action on appropriate levels (local, national and regional), taking into account the entire watershed.

Base decisions on impact assessments to ensure sustainable water management

- Analyze bioenergy systems from a comprehensive socio-ecological perspective, with consideration given to underlying ecological functions in agricultural and natural landscapes and broader livelihood and development implications.
- Promote sustainable land and water use, including understanding the outcomes of different land and water management systems and the options available to sustain critical ecological functions where land use change occurs.

Design and implement effective water-related policy instruments

Addressing the impacts of bioenergy production on water availability and quality will require the implementation of judicious water policy instruments and legislation for both feedstock production and energy conversion, together with effective monitoring of the competition between sectoral uses of water.

Establish/support appropriate institutions and processes, For example:

- inter-ministerial task forces to co-ordinate different policy objectives;
- stakeholder engagement from the planning through implementation phases; and
- ground-truthing on the watershed level, to verify information gathered through remote sensing by collecting information “on location”.

Disseminate best practices, For example:

- through upgrading of extension services; and
- through promotion of special training through certification schemes.

Promote technology development

- New technologies may help mitigate pressure on water resources, but they need to undergo a due diligence check prior to widespread deployment.

Intensify dialogue on the topic and on capacity building

This report is an important first step towards improving knowledge and exchanges concerning the bioenergy and water nexus in the global community. It provides a basis for:

- intensifying dialogue with groups and organizations working on the issue, including the editors of this report, the International Energy Agency (IEA) Bioenergy Task 43, the Oeko-Institut and UNEP, as well as processes referred to in this report, such as the Global Bioenergy Partnership and the different certification schemes; and
- building the capacity of the different groups concerned by this report. This is especially valid for decision makers in emerging and developing countries.

Conduct further research, fill data gaps, and develop regionalized tools

- Support international co-operation in research on bioenergy-related water quantity and quality impacts as compared to reference scenarios, including other energy sources (oil, nuclear, etc.).
- Address emerging and largely unexplored issues such as the potential and risks of coastal zones/macroalgae, land-based microalgae and genetically modified organisms (GMOs).
- Fill data gaps. Especially in developing countries, one of the main constraints on water management is lack of updated data. Some monitoring needs to be conducted on a regular basis to comply with regulations and with sustainable production.
- Develop regionalized tools further. Life cycle impact assessment (LCIA) and water footprint (WF) are inadequate without the differentiation of localized impacts.

A summary and the full report can be downloaded at:
www.unep.fr

For further information, please contact:
Martina Otto, Head of Policy Unit, Energy Branch, UNEP
at: martina.otto@unep.org