The Green Economy and the Water-Energy-Food Nexus: Best practices for the Danube Region

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The Green Economy

- The United Nations Environment Programme defines the green economy as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities
- Simply put, the green economy is a low-carbon, resource-efficient and socially inclusive economy
- In this type of economy, growth in income and employment is driven by both public and private investments that reduce carbon emissions, enhance resource efficiency and prevent loss of biodiversity and ecosystem services
- A key component of this economy is that economic development views natural capital as a key economic asset and as a source of public benefit

The Water-Energy-Food Nexus

- Water, energy, and food are inextricably linked with actions in one sector influencing the actions in other sectors
- For instance:
  - food production requires water
  - water extraction, treatment, and distribution require energy
  - energy production requires water
- As such, researchers and policymakers have increasingly emphasised the importance of managing the ‘water-energy-food nexus’ (WEF nexus)
- The nexus approach can support the development of the green economy, which aims to use resources efficiently while seeking greater policy coherence across the nexus sectors.
- However, the governance of WEF sectors remains separate with limited attention given to the interactions that exist between them.
- The result has been narrowly focused actions, investments, and policies that fail to reduce nexus pressures

The Green Economy Reducing WEF Nexus Pressures

- A green economy that reduces WEF nexus, which in turn promotes equitable and sustainable growth and ensures a resilient, productive environment can be realised by:
  - *Developing an enabling environment to enhance equity in resource access*: As resources become scarce, how resources are allocated, who will receive these resources will have an impact on social and economic development
  - *Abandoning silo thinking*: mechanisms need to be created to raise policymakers' awareness of these issues and promote greater collaboration among government agencies as well as communities, civil society, and the private sector in policy design and implementation

The Green Economy Reducing WEF Nexus Pressures cont.

- A green economy that reduces WEF nexus, which in turn promotes equitable and sustainable growth and ensures a resilient, productive environment can be realised by:
  - *Providing relevant, quantified information, and tools across the nexus*: The sharing and use of observations and information on water, energy, and food can shed light on areas where cooperation and resource sharing can result in synergies and more efficient management between the sectors
  - *Developing and disseminating resource-use efficient technologies for enhanced sustainability*: Incentives can be developed to enhance the implementation of new technologies that bring significant benefits to reducing nexus pressures
  - *Optimising market and trade solutions*: Market-based instruments can support resource-use efficiency by changing the behaviour of producers and consumers through market signals

The Green Economy and WEF Nexus Challenges in the Danube Region

The Green Economy and WEF Nexus Challenges in the Danube Region

- The development of the green economy in the Danube Region is challenged by a variety of WEF nexus pressures
- These pressures span the nexus and include:
  - Water-energy and energy-water nexus pressures
  - Energy-food and food-energy nexus pressures
  - Water-food and food-water nexus challenges

Challenges in the Danube Region: Water-Energy/Energy-Water

- Nearly all Danube countries depend on hydropower, with 59 dams having been built along the Danube's first 1,000 km.
- Around 60% of electricity in Austria originates from hydropower, 20% of which is produced along the Danube
- In Slovakia, hydropower accounts for 16% of the energy mix
- The Djerdap Gorge has two dams operated by Serbia and Romania producing around 37% of the total energy used in Serbia and 27% in Romania
- However, dams – existing and planned – can cause hydromorphological alterations including river and habitat disruptions, and disconnection of wetlands and floodplains
- Climate change is likely to lead to more droughts with water scarcity becoming longer, more intense and more frequent, potentially impacting availability of water for hydropower stations

Challenges in the Danube Region: Energy-Food/Food-Energy

- Bioenergy is expected to be the main component of renewable energy in Danube countries.
- In 2020, bioenergy is projected to account for 57.8% of the total energy provided by renewable energy sources in EU-Danube countries
- Similarly, in non-EU Danube countries, bioenergy is expected to be a significant component of renewable energy by 2020
- This will place pressures on land used for agricultural production
- In Montenegro, potential biomass resources could provide up to 26% of the country's total primary energy supply, with energy crops able to generate:
  - 362 GWh of electricity and 517 GWh of heat for industrial and medium-scale use and an additional 827 GWh of heat for households if around 10% of pasture land is used for crop production

Challenges in the Danube Region: Water-Food/Food-Water

- The main source of nitrogen emission in the Danube River Basin is agriculture (49%)
- Agricultural land use contributes 26% of phosphorus emissions in the Danube River Basin
- This contributes to eutrophication of waterways and of the Black Sea, with the Danube River accounting for over half of the nutrient input of the Black Sea
- The density of livestock per hectare on farms in lower Danube countries is below the Danube average
- It can be expected that the number of livestock will increase over time, leading to an increase in nutrient emissions
- Meanwhile, climate change is likely to lead to scarce water supplies for agricultural production with a potential 60% increase in the maximum number of consecutive dry days

WEF Nexus Best Practices

Uzbekistan's Energy Efficiency Labelling Scheme

- In Central Asia, despite the region having abundant supplies of water and energy the resources are highly unbalanced across the region and access to them is uneven
- Hydropower resources are concentrated in the Kyrgyz Republic and Tajikistan while thermal resources are concentrated in Uzbekistan, Turkmenistan, and Kazakhstan
- To reduce energy-water nexus pressures, Uzbekistan is aiming to reduce energy use per unit of GDP in half by 2030
- To achieve this, the country in 2015 initiated the development of an energy labelling scheme that forbids from 1 January 2016 the importation of electric appliances that do not contain information on energy efficiency class, which ranges from most efficient 'A' to least efficient 'G'
- Additional energy efficiency classes of A+ and A++ will be used for appliances that have even higher efficiency than appliances marked as 'A'
- It is planned that Uzbekistan will establish a step-by-step ban on importing/manufacturing household electric devices with 'G' class energy efficiency from 1 January 2018, 'F' from 1 January 2019 and 'E' from 1 January 2020.

Abu Dhabi's More Crop Per Drop Initiative

- In the Middle East, demand for food is expected to increase by 50 percent over the next two decades due to the region's population growing by 40 percent between 2010 and 2030
- With water use in agriculture already accounting for 85 percent of total water use in the region, and climate change likely to reduce agricultural yields by 27-55 percent by the end of this century, the Middle East will likely experience acute food-water nexus pressures
- To ensure more crop per drop, and enhance food security, Abu Dhabi has launched its Agricultural Investment Fund Project to support the development of hydroponics in the Emirate with two options available to farmers:
  - *Option 1 (Farms with existing greenhouses)*: The Fund will provide an interest-free loan of 50 percent of the costs of installing a hydroponic system in an existing greenhouse with payback set at five years.
  - *Option 2 (Farms without greenhouses)*: The Fund will provide an interest-free loan of 50 percent of the costs of investing in new greenhouses with the installation of a hydroponic system.

Maryland's Animal Waste-to-Energy Program

- In the United States, the agricultural sector uses nearly 800 trillion British thermal units of energy in 2012, the equivalent to Utah's entire energy consumption
- To help reduce energy consumption in the sector, as well as promote affordable, reliable clean energy and achieve energy independence, the Maryland Energy Administration has announced the FY2017 Animal Waste to Energy Grant Program for agricultural grantees
- The grant funds the installation of animal waste to energy projects while reducing the environmental impacts that animal wastes can have on the state's natural resources including reducing the amount of nutrients entering waterways
- With up to $2 million available, applicants will receive a grant that covers 50 percent of the project's expenses. The grant is competitive with each project evaluated on criteria including:
  - The capacity and efficiency of producing electricity
  - Economic impact of the project on the host site and local and regional economies
  - Whether any contracts have been secured for electricity generated from the project.

Conclusions

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- The Green Economy is a low-carbon, resource-efficient and socially inclusive economy where growth is driven by both public and private investments that
  - reduce carbon emissions;
  - enhance resource efficiency; and
  - prevent loss of biodiversity and ecosystem services
- Water, energy, and food are inextricably linked with actions in one sector influencing the actions in other sectors
- A green economy that reduces WEF nexus pressures can be realised by:
  - *Developing an enabling environment to enhance equity in resource access*
  - *Abandoning silo thinking*
  - *Providing relevant, quantified information, and tools across the nexus*
  - *Developing and disseminating resource-use efficient technologies for enhanced sustainability*
  - *Optimising market and trade solutions*

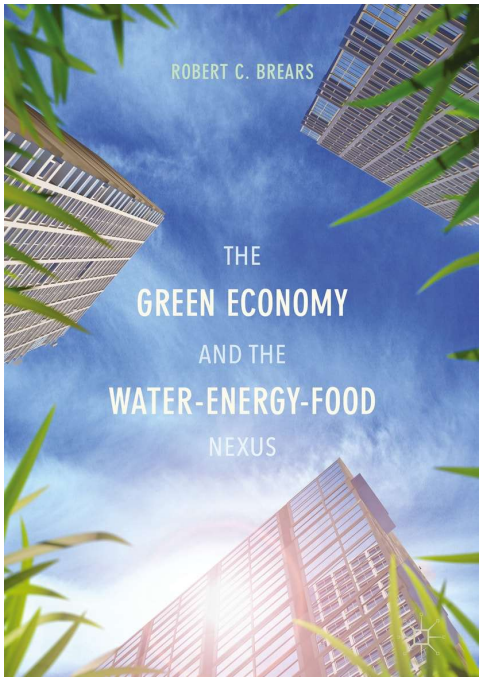
Conclusions

- In the Danube Region, the development of the green economy is challenged by a variety of WEF nexus pressures including:
- Nearly all Danube countries depend on hydropower. However, dams – existing and planned – can impact waterway health, while climate change will impact the availability of water for hydropower stations.
- Bioenergy is expected to be the main component of renewable energy in Danube countries, however, this will place pressures on land used for agricultural production
- Agricultural production is already the main source of nitrogen and phosphorus emissions in the Danube River Basin. It can be expected that the number of livestock will increase over time, leading to an increase in nutrient emissions

Conclusions

- To reduce WEF nexus pressures in the Danube Region, governments at all levels, including cities, states and nations, can implement a range of innovative policies to reduce WEF nexus pressures in the development of a green economy
- Examples of policies include:
  - interest-free loans and grants to reduce food-water- and food-energy-related nexus pressures
  - use of energy efficiency labelling to reduce transboundary energy-water-related nexus pressures

Thank you!



- The Green Economy and the Water-Energy-Food Nexus
- 400 pages with case studies on:
  - New York City and Singapore
  - Massachusetts and Ontario
  - Denmark and Korea
  - Colorado River Basin, Murray-Darling River Basin and the Rhine River Basin
- Published with Palgrave Macmillan
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