

Workshop

DEVELOPING BIO-BASED ECONOMY – CONTRIBUTIONS AND NEEDS OF THE DANUBE REGION

October 18th, 2011, 9:00 – 17:45
Permanent Representation of Austria to the EU, Brussels

“[...] the EU Strategy for the Danube is an instrument to bring not only countries together but also all these institutions of great importance for our common future. The river Danube shall connect, not divide. Also is science doing by the common obligation for the humanities. For sure it is a political problem but I think it has to be done on several sides. Universities and science have a great importance and bio-based economy is the future - because it is life.” *Dr. Erhard Busek, former Austrian Minister of Science and Chairman of the Institute for the Danube and Central Europe (IDM), consultant to EU Commissioner Hahn*

EXECUTIVE SUMMARY

The **Danube Region**, the world’s most international river basin, fully deserves to be **developed in an integrated and coherent manner** to one of the most attractive regions in Europe.

The **Danube River provides people of the Region with key benefits**, such as water supply, food, hydropower, navigation, irrigation, ecosystem services and recreation. However, **the Danube is currently threatened by unsustainable overexploitation, increasing human pressure on its catchment and problems of increased floods and droughts - at least partly induced by climate change.**

Issues to be tackled in developing a bio-based economy within the macro-region Danube Region:

- **Integrated Danube River Basin & Water Resources Research and Management** taking into account long-term development to sustain and improve e.g. ecosystem services like habitats, renewable energy & flood protection, river-type specific hydrological & hydraulic conditions, the continuum of biota & sediment, enhanced e.g. by starting a Danube River Research and Management Project within the EU Danube Strategy.- **Biomass-production as a means of smart specialization holds chances and risks for the Danube Region.** Efficient biomass logistics that exploit economies of scale are key in making the bio-based economy economically competitive. The Danube may develop into an important transportation corridor for feedstock and commodities. Yet assessments that integrate technical, bio-physical and economic considerations are necessary to allow for design of good policies that foresee feedbacks in various parts of our economies.
- **Governance structures & funding schemes** meeting the Danube Region’s needs have to be implemented in the upcoming financing period (Structural Funds, Horizon 2020, etc.), e.g. **similar to the BONUS-Programme** in the Baltic Sea Region
- Strategies for **“smart specialisation” and transnational cooperation, meeting the Danube region’s demands, in higher education, research & innovation** as means to cope with the challenges of our day, e.g. demographic change, digital divide, knowledge & technology transfer, competitiveness as a macro-region in a global world
- **Synergetic effects within and between the Danube Region universities have to be strengthened** via an upgrading of networks such as “Danube Rectors’ Conference” for decision support. Specific thematic problems again have to be decided by networks of e.g. Life Science Universities in order to offer its power in decision supporting policy to boards like the European Commission.

ICA-CASEE, a macro-regional network of Life Science Universities in **Central and South Eastern Europe**, is prepared to address these important issues. The significant expertise of the CASEE universities in science and education as well as their profound knowledge of the Danube Region render them premier partners in the implementation of the EU Strategy for the Danube Region, Europe 2020 Strategy and the development of Horizon 2020.

WORKSHOP SYNTHESIS

Background

A rapidly changing world regarding economy, ecology, climate and societal development calls for innovative research and sustainable innovation, the input and the expertise of the Life Science Universities is of utmost importance. Feeding a steadily increasing human population of maybe more than 9 billion people is and will be a considerable challenge. The effects of said global challenges become manifest on (macro)regional levels. For the Danube Region, this holds true for:

- **Economic development of rural areas:** Rural areas in Europe - and specifically the Danube region - are facing constantly increasing pressure. Young people are moving to urban areas hoping for better employment opportunities. The demographic development shows that the rural population is ageing considerably; local infrastructure is on the downgrade. Rural areas urgently need new economic opportunities for development. The implementation of the bio-based economy presents one of these opportunities. Primary production needs diversification, specialization and new sources of income. The bioconversion of renewables promises to be one powerful way for development. The value of biomass is steadily increasing – not only food supply but energy and raw materials for industrial production are in high demand.
- **Feeding the world:** Agricultural areas worldwide are not increasing – on the contrary we are losing about 0.5 % of agricultural areas per year due to erosion, degradation, desertification and sealing. At the same time the world's population is steadily increasing, although the double exponential growth came to a standstill. To overcome a detrimental situation a doubling of the hectare yield until 2050 is needed. Yet in many countries of the Danube region fertile soils are partly fallowed due to the structural changes during the 90s of the last century. Therefore new concepts for the use of these important resources are in dire need.
- **Landscape development:** The severe competition of ecosystem services such as agriculture, forestry, infrastructure for living, industry, transport for the limited resources soil and landscape increases the pressure on areas used for primary production further. Here we need new concepts to cope with these diverging demands, especially in the densely inhabited areas; unfortunately the areas with rapidly increasing human density are those which are distinguished by highly fertile soils.

The Danube Region, the world's most international river basin, fully deserves to be developed in an integrated and coherent manner to one of the most attractive regions in Europe. The workshop "Developing Bio-based Economy – Contributions and Needs of the Danube Region" acted as a catalyst towards that aim by offering input via several key note speeches and room for discussion in three workshops.

Key messages from the Workgroup on "Integrated Danube River Basin Management"

The Danube River provides people of the Region with key benefits, such as water supply, food, hydropower, navigation, irrigation, ecosystem services and recreation. The Danube is fundamental to life and frequently possesses major cultural significance. However, **the Danube is currently threatened by unsustainable overexploitation, increasing human pressure on its catchment and problems of increased floods and droughts - at least partly induced by climate change.** This leads to changes in floodplain morphology, pollution, degradation of aquatic habitats, changes in fish communities, changes in whole agricultural production systems and population movements. All these changes impact dramatically on many benefits in the Danube region.

1. **The Integrated Danube River Basin Management has to maintain or restore/rehabilitate** (in a dynamic, spatial and temporal context) **the Danube River basic functions**, including biodiversity and ecosystem services, to avoid single-aim infrastructure development projects and

- strategies, to aim for win-win solutions combining ecological functionality (based on EIA) and economic use.
2. **There is a need to implement the Integrated Water Resources Management in a long-term context, taking account of the potential impact of climate change on the Danube, to integrate use, protection and restoration of the Danube** (including upstream-downstream interactions), to sustain or improve river type-specific hydrological and hydraulic conditions, to preserve or restore the continuum of biota and sediment and sustain or improve sediment transport and fluvial morphodynamics, to achieve (close to) natural conditions, to establish and fulfill water quality objectives and to collect and freely exchange data for transboundary rivers, based on common standards and accuracy.
 3. **The Integrated Danube River Basin Management Plan identifies four Significant Water Management Issues (SWMI) that can directly or indirectly affect the status of both surface water and transboundary groundwater:** Pollution by organic substances, Pollution by nutrients, Pollution by hazardous substances, Hydromorphological alterations.
 4. Due to the huge amounts of wastewater and the rising standards for wastewater effluent quality, **existing wastewater treatment plants have to be adapted** to perform the separation of the sludge from the clarified water more efficiently.
 5. **Basic and applied research on agricultural crop plants with emphasis on plant breeding, plant genetics, phytopathology and disease resistance** e.g. against Fusarium head blight **is needed**. Modern tools of functional genomics and metabolomics shall be applied to solve relevant problems in a plant breeding context to ensure food security and food safety in the Danube region.
 6. **To ensure the comparability of measurement results for organic and inorganic parameters in water analysis**, proficiency testing schemes as a means for external quality assurance shall be further developed and utilized within water measurement programs in the Danube region.
 7. **Concerning the Joint Programme of Measures in the Danube River Basin Management Plan several basin-wide vision are of importance:** For organic pollution the vision is zero emission of untreated wastewaters into all water bodies of the Danube River Basin District. For nutrient pollution the vision is the balanced management of nutrient emissions via point and diffuses sources in the entire Danube River Basin District, for hazardous substances pollution the vision is no risk or threat to human health and the aquatic ecosystem. For hydromorphological alterations the vision is the balanced management of structural changes of the riverine environment. Floodplains/wetlands in the entire DRBD should be reconnected and restored. For future infrastructure projects the vision is that they are conducted in a transparent way using best environmental practices and best available techniques in the entire DRBD – impacts on or deterioration of the good status and negative transboundary effects have to be fully prevented, mitigated or compensated.
 8. **To reach an Integrated Flood Risk Management**, fulfilling the EU Floods Directive, which regulates the Danube River Basin wide activities and aims to reduce the flood borne negative impacts on human health, environment, cultural heritage and economic activities, research is necessary to harmonize data, improve calculation procedures, derive inundation maps and design flood protection measures.
 9. **The Renewable Energy Directive and Climate Change discussion give raise to a future hydropower development in the Danube River Basin**, whereby scientific investigations are essential to lead to new types of hydropower plants, that e.g. can allow a sediment and biota continuum.

10. **The Development of Inland Navigation is another area of economic interest, being also an environmentally friendly transport mode.** Research is required e.g. to develop new types of river engineering measures that increase water depth and at the same time stop river bed degradation.
11. **In order to get from basic research to knowledge society and to reach a sustainable and integrated management (use and protection) of the Danube River, within the EU Danube Region Strategy the project Danube River Research and Management (DREAM) should be implemented.** DREAM consists of five activities, e.g. the construction of two large Responsible River Modeling Centers/hydraulic and environmental engineering laboratories (5000 l/s flow capacity),
12. **Synergisms within and between the Danube Region universities have to be strengthened via an upgrading of networks such as “Danube Rectors’ Conference” for decision support.** Specific thematic problems again have to be decided by networks of e.g. Life Science Universities in order to offer its power in decision supporting policy to boards like the European Commission.

Key messages from the Workgroups on “Future Bio-refinery Scenarios” and “CAP and Bio-based economy”

Bio-economy is imperative for a sustainable future and may demonstrate its potential with a more efficient and integrated pathway, along the supply chain but also across sectors and territories.

1. **Research on renewable resource utilization has to focus on current and future human needs by acknowledging an increasing scarcity in fossil resources.** Consequently, mankind must be able to substitute fossil resources by renewable resources, being the only alternative carbon source. This will also mean a restructuring of the complex pathways of chemical industries - from the use of fossil sources to the use of biomass. Today’s refineries will have to become bio-refineries.
2. **The chemical and material utilization of biomass will become more important, with the additional potential of energetic co-utilization.** In the long term, no alternatives exist to the use of renewable carbon sources for producing chemicals. However, there are several other possible options for the production of energy, such as wind, water, and solar energy. Nevertheless, many impact assessments of renewable energy targets (such as implied by climate change mitigation policies) show that bioenergy has to supply a substantial part of the energy demand by 2050. This implies that cascade utilization of biomass is imperative to lessen the pressures of competing biomass utilization pathways as well as on scarce natural resources.
3. **Research and funding strategies regarding efficient utilization of renewable resources should be goal-oriented and to acknowledge co-utilization potentials** (i.e. energetic, material and chemical uses). Energetic research must not appear as chemical research “in disguise”; the decisive factor is the end-use as a fuel or as a chemical / material. Fundamental chemical, biotechnological and analytical research, also addressing pulping, fractionation, bioconversion and concentration technologies, will be the key factor for a successful transition into a knowledge-based bio-economy.
4. **The multi-step, cascade utilization of biomass will grow more important to efficiently use all components of biomass as well as to reduce waste and environmentally harmful products.** Cascade processes will increasingly produce intermediate and final products for chemical and material, besides energetic utilization.

5. **The synthesis and structuring effort of nature will be more acknowledged in future bio-refinery R&D.** Today, several approaches employ the breakdown of highly specialized macromolecules, provided by nature's ingenuity, to simple molecules, which then feed the conventional pathways of chemical industries. In future, technologies and processes should be developed towards more direct uses of these complex substances.

..... but large scale use of biomass raises issues and challenges that should be properly addressed to minimize adverse effects on environment and societies.

6. **Biomass can be used for the production of food, feed, chemical, material, and energy commodities. There is competition between and within these sectors.** For example, conversion paths differ significantly between power, heat and biofuel production with respect to costs and the potential to substitute fossil fuels. Selecting single conversion paths, as in the EU mandatory biofuel targets, may decrease overall economic efficiency of greenhouse gas mitigation policies and may increase land use requirements significantly. Research on investigating promising technologies should be prioritized and policy makers should carefully balance market-based policies (such as carbon taxes and the emission trading scheme) and technology specific policies for still uncompetitive technologies that however could represent a good potential of economic and environmental performance.
7. **Biomass is mainly produced on fertile land using other scarce resources, such as water and fertilizers competing with alternative uses.** Selecting non-food crops as source for energetic or chemical utilization does therefore not decrease the competition with food and feed production.
8. **The biomass production potential of marginal lands that is currently not used for agriculture may be technically high. But experiences from current biomass utilizations, such as biogas plants, show that production costs are often prohibitive to an effective use.** Feedstock is therefore often produced on highly productive land, increasing the competition with other land uses. The integrated assessment of regional and global bio-physical and economic production potentials as well as of measures to reduce production costs and negative environmental impacts along the entire supply chain should be paramount in research.
9. **The competitiveness along the entire supply chain determines type, location, and size of bio-refineries including feedstock, process technology, logistics as well as intermediate and final products.** The effective use of surplus heat in refineries for district heating or industrial purposes can increase the energetic efficiency of bio-refineries. Therefore, optimal plant locations and sizes are also depending on the amount of regional heat demand. The Danube is an important transportation route for supplying bio-refineries, and proximity to harbors along the Danube River could be one crucial factor of plant locations.
10. **Increasing the production of biomass for either chemical, material or energetic uses may have negative consequences with respect to global food security, greenhouse gas emissions and ecosystem services.** Therefore, direct and indirect land use changes due to additional biomass production may lead to tropical deforestation and consequently to the release of carbon stocks and the destruction of important eco-systems services. Furthermore, increasing prices for agricultural commodities may negatively affect the urban poor, particularly in the global South. Regionalizing production of biomass for chemical or energetic uses by imposing trade barriers on biomass, biofuels or biochemical would not solve these problems as it would lead to displacement of food production to other world regions and thus also generate indirect land use changes. These leakages could significantly change the level of emissions savings, making some technologies ineligible. A focus on closing the yield gap between the global north and the south and planting crops that maximize the yields per hectare decreases indirect land use change.
11. **Therefore, sustainability criteria for biomass production and utilization have to be set to minimize "collateral damage" on climate, eco-systems, water resources as well as on**

food and energy security. Considering the large scope of phenomena, integrated assessment approaches appear most suitable to reveal the trade-offs between as well as the magnitudes of the different effects (e.g. food security, crop productivity, GHG emissions) and compare them with the full cost of the policy.

Key messages on governance and financing

1. **Higher education and research in the Danube region are facing three major issues:**
 - a. the challenges of demographic change
 - b. global competitiveness and cooperation
 - c. redefinition of the roles and responsibilities of the various actors in a system defining higher education and research as public good
2. **Policies and mechanisms to be promoted include:**
 - a. Dissemination mechanisms and targeted support for research infrastructure
 - b. Networking of centers of excellence and complementary partnerships
 - c. Smart specialization of and within the region
 - d. Braincirculation
3. **In order to promote policies mentioned above efforts should be taken**
 - a. establishment of a Danube Region Research and Innovation Fund promoting excellence in research in the Danube Region
 - b. strengthening university cooperation through a Danube Region Education, Research and Innovation Platform
 - c. promoting innovation and business success in new markets
4. **The development and implementation of a bio-based economy is crucial for the sustainable economic and social development of the Danube region, having immediate and visible benefits for the people of the region.**
 - a. Within Horizon 2020 programs for research, innovation and education should be developed specifically targeted to the Danube Region
 - b. The successful development of a knowledge-based bioeconomy needs integrated and coherent measures, among them key areas like
 - i. further development of the knowledge society by investing and collaborating in research and education at all levels
 - ii. sufficient and stable research funding at both national and European levels, including appropriate development of research infrastructure
 - iii. coherent strategies and activities are required all along the supply chain, across all sectors and territories
 - iv. framework conditions for innovation processes have to ensure that research results can efficiently be converted to the commercialization stage

Conclusion

On its way towards becoming truly a 21st century region the Danube Region is facing various grand challenges that can only be met through joint efforts of stakeholders in all areas, be it politics, academia, industry or society.

Universities - especially life science universities - have and will have a crucial role in seeking solutions for reducing poverty, improving human health – in developing as well as developed countries. The complexity of the systems calls for a collaborative, multidisciplinary approach and thus academic centers focusing on broad themes are key. **ICA-CASEE**, a macro-regional network of Life Science Universities in **C**entral and **S**outh **E**astern **E**urope, is prepared to address these important issues. The significant expertise of the CASEE universities in science and education as well as their profound knowledge of the Danube Region render them premier partners in the implementation of the EU Strategy for the Danube Region, Europe 2020 Strategy and the development of Horizon 2020.

CONTACT:

O. Univ. Prof. Dr. Josef GlöbL,
Vice Rector for Research & International Research Collaboration

University of Natural Resources and Life Sciences, Vienna
Gregor Mendel Straße 33, 1180 Vienna
Phone: +43 1 47654-1014; E-Mail: forschungsservice@boku.ac.at