

Focus: Water – Energy – Food Security Nexus

From Nexus Thinking to Nexus Action

Background

Water, energy and food are the basis for human livelihoods and economic activities; they are also closely interrelated: Agriculture, forestry and the energy sector simultaneously depend heavily on and affect water resources. Energy is essential for water management, but also for agricultural production, processing and marketing. Land is needed for the production of food, fodder and renewable energy as well as water resource protection. Demographic trends – such as population growth, progressive urbanisation and globalisation, changing lifestyles and consumer habits – are increasing pressure on already limited natural resources. In order to feed the global population in 2050, agricultural production needs to be increased by 70 per cent.¹ By 2030, the demand for freshwater is expected to exceed renewable water supply by 40 per cent² and by 2035 the world will need more than one third more energy³. Climate change will raise pressure on natural resources and make both people and ecosystems more vulnerable. Its impacts are already aggravating shortages in water supply and arable land. At the same time, changes in land use, agricultural and livestock practices, unsustainable forestry, acidification of waters and drainage of wetlands and many forms of energy production cause greenhouse gas emissions that contribute to climate change. Likewise, biodiversity is threatened by land use changes and/or the intensification of conventional agriculture. In contrast, intact natural ecosystems assure water security, prevent natural hazards, such as floods and landslides (or protect people from their impacts) and provide means of maintaining food security when harvests fail.

Why Nexus?

Access to clean drinking water and sanitation facilities, sufficient and high-quality food and adequate energy are essential for human well-being and depend largely on the sustained availability of natural resources. However, the world is approaching – and in some cases has already exceeded – the sustainable limit of natural resource availability: Sixty per cent of the world's major resources and ecosystems have already been degraded. This jeopardises the livelihood of the poor and vulnerable, who are highly dependent on natural resources, especially soil and water. The increasing depletion of resources will heighten the already keen competition for land, water and energy. This is why the nexus approach was developed and advocated during the Bonn Nexus Conference (2011) in preparation for the Rio+20 Conference on Sustainable Development (2012). Emphasis was placed on the need to devise a comprehensive and systemic approach for framing policy and its subsequent practical implementation that takes due account of the interlinkages and possible,

¹ FAO (2009): Global agriculture towards 2050

² WEF (2011a): Water Security: The Water-Energy-Food-Climate Nexus

³ IEA (2012): World Energy Outlook 2012

synergies and trade-offs among these thematic clusters. These complex relationships cannot be addressed from a single sectoral standpoint; they need to be considered together, with a focus on inclusive and sustainable human development combined with the responsible/sustainable use of limited natural resources.

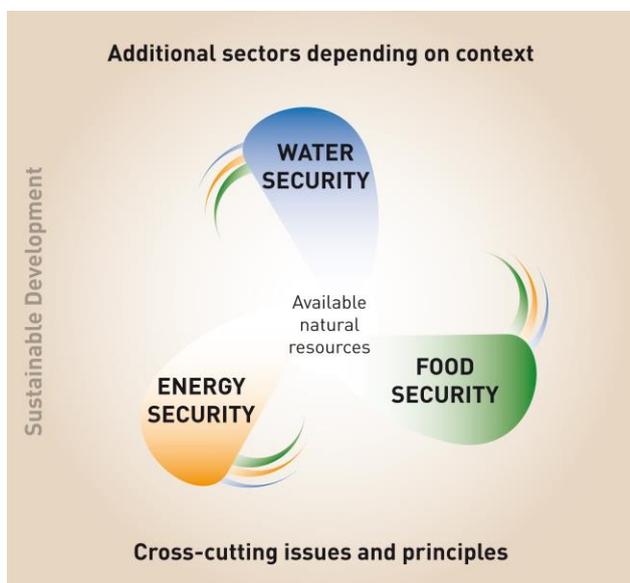
In its 6th report dealing with the most severe risks for global development, the World Economic Forum in 2011 rated the constellation of factors around the water-food-energy nexus as one of the three foremost risks:⁴

The “water-food-energy” nexus: A rapidly rising global population and growing prosperity are putting unsustainable pressures on resources. Demand for water, food and energy is expected to rise by 30-50 percent in the next two decades, while economic disparities incentivize short-term responses in production and consumption that undermine long-term sustainability. Shortages could cause social and political instability, geopolitical conflict and irreparable environmental damage. Any strategy that focuses on one part of the water-food-energy nexus without considering its interconnections risks serious unintended consequences.

ADC perspectives in adopting a nexus approach

After extensive internal discussions and consultations with various stakeholders and partners, ADC has adopted a specific vision of a nexus approach.⁵ To raise the overall impact of development efforts, future ADC development strategies, projects and programmes must focus on the interactions, synergies and possible trade-offs among sectoral interventions in water, energy and food security. In applying the nexus approach, ADC will support interventions with the greatest possible holistic development impact, key aspects being climate protection, adaptation to climate change and strengthening the resilience of households and communities to climate change impacts and other risks and crises.

ADC considers water supply security, energy security and food security as core nexus themes, which depend on renewable (such as soil, water and biomass) or non-renewable natural resources (such as fossil fuel and mineral its).⁶ Focusing on interactions, syn-



⁴ WEF (2011b): Global Risks 2011

⁵ This work was supported by the following institutions/companies contracted by ADA: Sustainable Europe Research Institute (SERI), Swiss Resource Centre and Consultancies for Development (SKAT) and HydroConseil

⁶ OECD (2008): Natural Resources and Pro-Poor Growth

ergies and possible trade-offs among nexus themes will support sustainable development efforts. Depending on the local context, other themes or sectors may complement the nexus perspective. In any case, all nexus interventions must take due account of cross-cutting issues, principles and good practices in development cooperation.

All strategies and interventions should comply with and contribute to the achievement of the proposed Sustainable Development Goals (SDGs). The following quality criteria are of special importance for ADC here and have to be taken into due account when designing programmes:

- Economic development has to be decoupled from the extensive use and/or depletion of natural resources and environmental damage. This is why promoting sustainable patterns of production, investment and consumption is important, along with enhanced resource efficiency and the reduction of waste, food losses and pollution.
- To improve livelihood conditions and social equality require inclusive participation of all population groups in planning and decision-making, especially the poor and vulnerable. Their equal access to land and other natural resources is crucial, as they are heavily dependent on the availability, accessibility and use of these for their survival.
- This calls for the empowerment of vulnerable and marginalised population groups, the elimination of current barriers and more balanced power relations to enable inclusive and equal participation in development processes. Since these groups are heavily dependent on natural resources and are also most severely affected by the impacts of climate change and other crises, it is of utmost importance to address their specific needs and interests by strengthening resilience at local household and community level.

Environmental sustainability requires the conservation of nature and natural resources and the maintenance of biodiversity and ecosystem services. The sustainable use and management of natural resources and ecosystem services is therefore crucial for ensuring food security, the supply of public goods and services and inclusive economic development.

In adherence to the alignment and harmonisation principles set out in the Paris Declaration on Aid Effectiveness, ADC will continue to engage in sectors of relevance to nexus themes and as defined by partner countries and organisations. However, interventions should be preceded by a comprehensive analysis to identify and then enhance prospective sectoral synergies and interlinkages, unveil possible trade-offs and define appropriate mitigation measures.

As with any other issue, the nexus approach entails developing the capacities of different stakeholders at all levels. This is not confined to specific technical assistance and training, but also includes especially efforts to strengthen analytical and systemic thinking and the ability to deal with complexity in project and programme implementation. These capacity development measures must address theoretical aspects of the nexus concept, but should primarily deal with the specific demands and requirements of the situation at hand and context. Sharing information and experience, documenting and disseminating good practices and taking initiatives for joint learning will help improve nexus thinking and working.

Sectoral entry points for relevant nexus themes

As ADC will continue to engage in and align its operations with the sectoral priorities and interventions of its partner countries, some specific entry points for this engagement with a bearing on nexus themes are proposed below.

There are various entry points for incorporating the nexus approach into the **water and sanitation sector**: Water is key for food and energy security and is itself a foodstuff. Only if it is safe to drink and combined with good sanitation and hygiene practices will it contribute to a healthy and balanced diet as the foundation for people's well-being and participation in economic life. Safe wastewater management is vital for a healthy environment: Wastewater needs to be prevented at source and unavoidable wastewater and faeces must be treated to enable the reuse of purified effluents for irrigation and solids as fertilizer in agriculture. Energy often accounts for more than half the operating costs of water and sanitation service providers in developing countries. Water losses in grids incur energy losses as the water discharged through leakages or illegal connections has to be pumped and treated with considerable energy input. Water losses (non-revenue water) and energy efficiency are therefore interdependent key factors that need to be addressed for the sustainable management of utilities.

Water resource management and governance often involves transboundary collaboration and is fundamental for peace and stability, as disputes over access to water often lead to severe conflicts and even wars. Integrated water resource management strikes a balance among the water requirements of various users and seeks to remedy critical sources of pollution. From a human rights perspective, human consumption of drinking water always takes precedence over other forms of use and usually accounts for small amounts of water, though with high quality requirements. Large quantities of water are in contrast often used for irrigation, livestock and industry (including power generation), although the quality standard is less important. Multiple-use systems need to meet all the different relevant requirements and match up user needs. The inclusive involvement of all stakeholders at all levels is key for resilient and sustainable water resource planning and management.

Water for agricultural production and food security in Burkina Faso

In Burkina Faso, ADC supported a project implemented by FAO to strengthen the resilience of the rural population to food crises in five affected regions. The project assisted in developing and constructing wells and boreholes for irrigation purposes and watering places for livestock, erecting shallow water retention basins (valley tanks) and developing adjoining irrigation areas. Several nexus challenges emerged during implementation.

In project design, the use of agricultural wells and boreholes was restricted to irrigation development and providing water for livestock, without fully considering the drinking water needs of the target population. It emerged that the beneficiary population's prime interest in several of the facilities provided by the project was to meet their drinking water needs, with secondary importance attached to irrigation and livestock watering. The facilities in these locations therefore needed adapting to ensure that water quality complied with drinking water standards and their structural layout allowed of easy use to fill jerry cans, etc.

Furthermore, the use of water retention basins for irrigation requires cost-effective and energy-efficient pumping facilities to make agricultural products competitive at local market prices. The intended development outcome of raising the resilience of the rural population to droughts can therefore only be achieved by addressing the need for domestic water supply together with water demand for agricultural and pastoral activities and choosing the appropriate energy source for pumping water.

In energy, there are several entry points for the water and sanitation sector as well as for food security issues: Water and energy are of growing importance as demand for both is increasing and water is needed to generate power.

Water is a key input in most energy production processes: Fossil fuel production requires water for extraction, transport and processing; thermoelectric power generation based on nuclear and fossil fuels requires large amounts of water for cooling; renewable energy resources, such as solar power, require water for cooling and cleaning panels or collectors for improving efficiency; hydropower can only be generated if water is readily available in rivers or reservoirs.

Moreover, the water supply chain – water extraction (pumping), raw water treatment, usage and warm water production, wastewater treatment and discharge into the environment or for reuse – depends heavily on energy; the global energy demand for this is estimated to be around 8 per cent.⁷

Depending on the degree of mechanisation, energy in the global food production chain is needed for production, processing, distribution, preparation and cooking. The food sector currently accounts for some 30 per cent of global energy consumption, met largely by fossil fuels.⁸ As world demand for food grows (by a projected 60 per cent by 2050), the bulk of additional demand for energy supply to the food production sector will come from emerging economies in Asia, Latin America and sub-Saharan Africa.⁹

Accountable for a significant energy footprint, a large amount of food ends up as waste. Approximately one third of all food produced is lost or wasted each year, resulting in the wastage of 1 to 1.5 per cent of total global energy use.¹⁰ In developing countries, 40 per cent of losses occur during post-harvest and in processing, whereas in industrialised countries more than 40 per cent of losses are incurred at retail and consumer level.¹¹

The type of energy supply for the agriculture sector can have a substantial influence on food security. Dependency on fossil fuels makes for more volatile food prices and affects the availability and distribution of and access to food.

Cooking and heating in households are generally energy-intensive activities. In bioenergy systems¹² (traditional firewood or modern biomass), the reliability of energy supply depends greatly on the quality and availability of biomass. Inefficient cooking and heating practices using biomass sources, whose production and collection are mostly unsustainable, such as low-quality fuelwood, crop residues and animal dung, are especially common in developing countries.

On the one hand, thick smoke produced by the inefficient combustion of low-quality fuelwood and other biomass together with inadequate ventilation in houses can be detrimental to health, primarily for children and women. Today, this is the cause of 4.3 million premature deaths per year.¹³ On the other, the overexploitation of biomass resources (often used in developing countries to produce charcoal) could lead to deforestation and forest degradation, minimise essential organic inputs for agricultural production and destroy potential

⁷ UN-Water (2014): Water and Energy

⁸ FAO (2011): Energy-Smart Food for People and Climate

⁹ *ibid.*

¹⁰ *ibid.*

¹¹ FAO (2011): Global food losses and food waste – Extent, causes and prevention.

¹² Bioenergy is energy derived from the conversion of biomass where biomass may be used directly as fuel, or processed into liquids and gases. IEA (2015): Bioenergy

¹³ Global Alliance for Clean Cookstove, 2014

watersheds . This can reduce the accessibility of biomass and further add to the drudgery of walking long distances to collect fuelwood for cooking and heating.

Electricity is a high-end, costly energy source that often places economic constraints on developing countries. Inefficiently used electricity in industrial processes and households can often easily be replaced by low-cost, efficient renewable energy supply, such as solar thermal collectors or biogas facilities, etc. Integrating these types of energy efficiency measures in national energy capacity planning would help to reduce overall electricity demand and diversify national energy strategies away from focusing on large scale, centralised power generators.

Seawater desalination in the Gaza Strip and in Cape Verde

In the aftermath of the 2014 Israel-Gaza conflict, the Gaza Strip can only meet a fifth of its total energy requirements. At the same time, there is a severe water shortage and ground-water pumping (about 150 million m³ per year) exceeds more than double natural ground-water recharge (about 50 million m³ per year). The desalination of sea water is therefore seen as a key pillar for future water supply security. Current annual installed desalination capacity amounts to about 1 million m³, far below 1 per cent of the water needs for households, industry and agriculture combined, let alone the environmental requirements. Yet, due to the shortage of energy, only one third of installed desalination capacity can be used. Therefore, any further investment to expand seawater desalination only makes sense if local energy security can be improved, which can be done most effectively by raising renewable energy capacity with solar and wind power as preferred options.

Similarly, the city of Praia, the capital of Cabo Verde, cannot supply enough water to meet the needs of its 130,000 inhabitants. Praia is a growing city due to rural migration and the resultant rapid population growth. Access to clean water supply is crucial to prevent diseases. A seawater desalination plant currently supplies part of Praia's water needs. However, less than 70% of the desalinated water actually reaches its destination due to pipe leakages. Over 30% of energy is consequently wasted due to the loss of nearly one-third of the water in the distribution system, so that any investment in leak reduction would help both improve water supply security and increase energy efficiency in the utility.

Access to natural resources, especially land and water, is of crucial importance **for food security**. Yet, due to their increasing scarcity, competition in access and conflict in utilisation are on the increase. A prominent example of this are large-scale land acquisitions (land grabbing) by private investors, for example, primarily for the purpose of exporting agricultural commodities to their own home countries or for agro-fuel production. As land grabbing has severe impacts on the livelihoods of the population, seriously threatening food security at local and national level and resulting in the forced eviction of local people, the Austrian Parliament passed a resolution against it in 2012.

Water-intensive monocultures and poorly managed and inefficient irrigation for agricultural production jeopardise the availability and accessibility of water supply for the population and often have adverse impacts on the environment and ecosystems. In the face of climate change and increasingly variable and unpredictable weather conditions, irrigation also plays a growing role in risk mitigation. However, any irrigation project should be based on proper planning (assessment of catchment based water potential), improved water-use efficiency and agricultural water management, further developing traditional and small-scale irrigation systems, supporting site-appropriate irrigation schemes (working with farmers indigenous

knowledge and experiences) as well as strengthening reuse of treated waste water in agriculture. Access and users' rights, different forms of land and natural resource use¹⁴ as well as possible conflicts and trade-offs have to be considered in land-use planning and management (e.g. at watershed level). Moreover, due account has to be taken of possible trade-offs in the use of agricultural products to provide food for people, fodder for livestock or the production of agro-fuel. Production of foodstuffs, fodder and agro-fuels, such as ethanol, depend on water for irrigation. Equally, the production of agro-fuels could compromise food security and have adverse impacts on human rights (i.e. forced eviction) or on the environment (i.e. changes in land use). ADC gives priority to food security over energy production. The use of agricultural products for the production of agro-fuels is therefore confined to meeting local energy needs (and not for export).

As 80 per cent of agricultural land in Africa and Asia is cultivated by smallholder farmers, assuring the survival and food security of this group is of utmost importance. Moreover, ADC takes account of the multi-functionality of land and thus emphasises the promotion of locally adapted and environmentally sustainable agricultural and forestry production. Resources for water usage in agricultural irrigation and energy use in the production, processing and marketing of agricultural products have to be allocated efficiently. For improved market access, issues that need to be addressed therefore include income generation by strengthening farmers' organisations, enhanced productivity, reduction of harvest losses (especially through storage and processing facilities) and greater access to financial and demand-driven extension services. Considering the specific role of women in agriculture, food supply and water and fuel collection, it is essential to involve them in local value added and ensure that they benefit from it.

Synergies between food security and environmental protection improve livelihoods in northern Ethiopia

In cooperation with the Amhara Regional Government in Ethiopia, ADC is supporting the project, Livelihood improvement through sustainable resource management in North Gondar. As this intervention takes place in an ecologically very sensitive and risk-prone region, it is crucial to promote the sustainable use of natural resources and landscape rehabilitation. The primary approach is participatory watershed management, that is, involving local communities in planning and implementing measures aimed at improving soil fertility, water availability and the biodiversity of degraded land. To avoid potential conflicts in land access and utilization, land management is supported, including amongst others the issuance of land certificates to rural farmers (men and women).

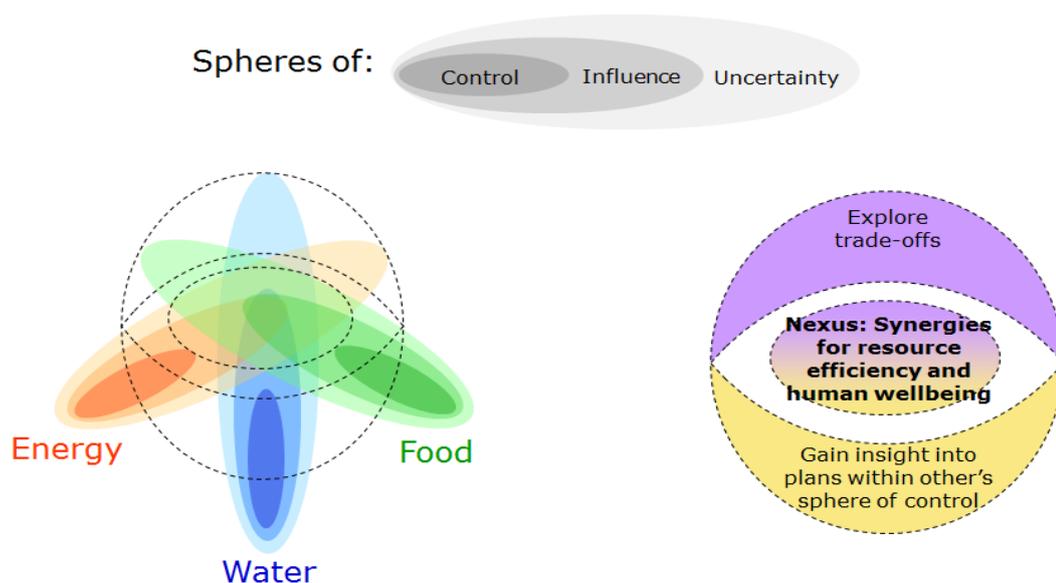
¹⁴ Land is an important natural capital that is needed for any type of agricultural production, including livestock keeping and forestry, but also the establishment of food processing units, market infrastructure and road construction. Moreover, human settlements require land as well as almost every type of energy production. Land is also indispensable for maintaining biodiversity (including nature parks or protected areas), protecting drinking water sources and sustaining water supply in general.

The social and economic situation of the local population is being improved through environmentally sustainable production (i.e. promotion of organic farming), the introduction of more profitable and resilient species, improved storage and processing of agricultural and livestock products (e.g. milk processing unit) and greater access to markets (local markets and the tourist industry). While the main focus of this project is on food security and environmental protection, it also addresses energy needs (e.g. promotion of re-afforestation, dissemination of improved cooking stoves, and credit for solar installations) and water supply (including the development of protected springs and hand-dug wells).

Nexus in project cycle management

Depending on the local context, synergies among the nexus themes of water, energy and food security can take different forms. A distinction can be drawn between projects/programmes with significant systemic interlinkages and those without any major inter-relations that retain a sectoral focus. A nexus approach does not necessarily mean that the themes water, energy and food security are all addressed together in the framework of one single intervention; more emphasis may be placed on the one or the other nexus theme, depending on the respective local and/or project context.

The holistic perspective requires development practitioners to take a 'blurred view' and to accept a certain level of uncertainty to be able to explore possible trade-offs among the nexus themes. The focused view aims at gaining insights into the spheres of control of the individual nexus themes water, energy and food security and to specify the design of the development intervention without necessarily addressing them altogether. Switching between the focused view for planning and design and the blurred view to gain a holistic insight into its development context makes the intervention (programme or project) nexus specific, while harnessing maximum synergies for increased resource efficiency and human well-being.



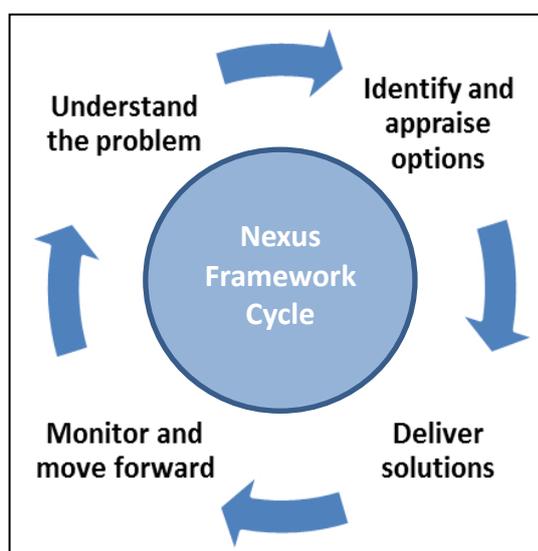
IIASA. ADA Annual Meeting 2013 (adapted)

“All development interventions are based on a theory of change; and it is most advisable to know on which premises we base our actions. The use of conceptual models (simplified representations of reality) enables us to encompass the wider context, the “bigger picture” of an intervention. The quality and usefulness of conceptual models depend on how closely they come to represent the essential relationships of the “real world”. Being mindful of the bigger picture will most probably help design better, which means: more relevant, more effective, more sustainable programmes and projects. However, we need to be clear about the fact that taking a wider perspective also means blurring the focus. You cannot have both, a holistic perspective and a clear view on the details of a complex system at the same time. However both perspectives are indispensable. Nexus is a matter of being able to switch between a ‘focused’ view in order to identify and specify the intervention and a ‘fuzzy’ view in order to take into account the overall development context and interlinkages.”
Statement by Robert Lukesch (ÖAR) during the Annual Meeting of ADA in 2013

ADC applies a project cycle management approach to design, plan, implement, monitor and evaluate the project and programme portfolio. In all phases of programme cycle management, nexus aspects come into play, take different forms, alternating between the holistic perspective to achieve the overall development impact and sustainability on the one hand and the focused view to make development interventions specific, effective and efficient on the other.

At the strategic (e.g. country strategies) and overall programming (annual work programmes) level, general fields of activity relevant for the application of a nexus approach should be identified and form part of the respective sector engagements in partner countries.

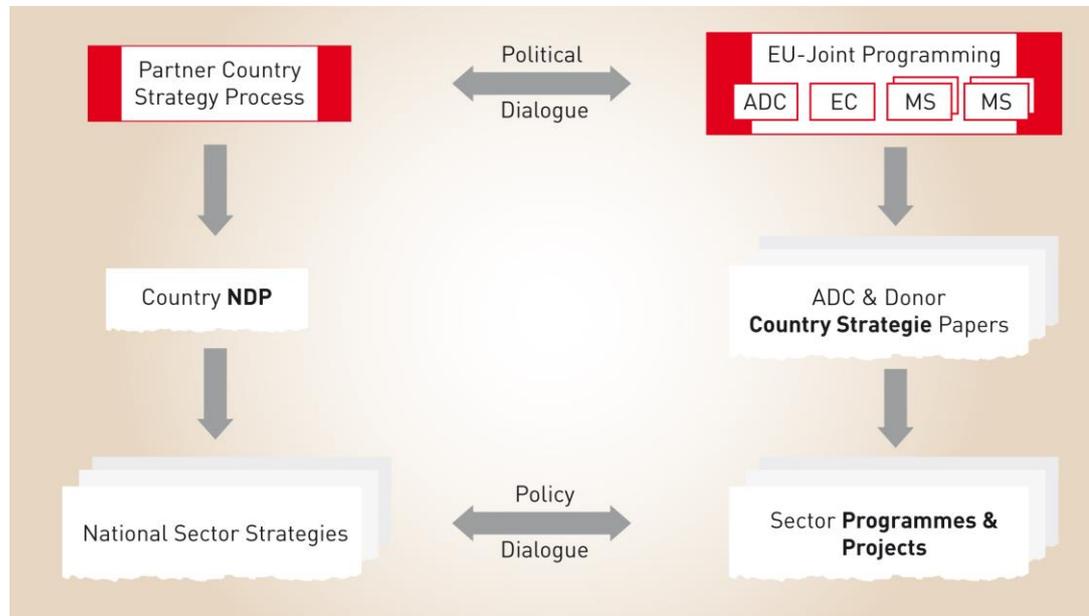
At project and programme level, the specific synergies and trade-offs when applying a nexus approach should be considered at all stages: **Understanding the problem** requires an initial assessment of interlinkages, vulnerabilities and impacts (blurred view) to be able to **identify and appraise options**, opportunities and entry points for incorporating the nexus perspective in projects and programmes (focused view). These opportunities and possible alternatives have to be tested for their practicability and robustness; support from relevant stakeholders has to be secured. **Delivering solutions** means mainstreaming the nexus approach into the planning process for defining outputs, outcomes and impacts. Identified solutions and lessons learnt are then adopted in **monitoring** and review frameworks. Interfaces among sectoral



institutions should be identified and used for joint learning and compiling lessons learnt from these nexus approaches, which could further contribute to their systemic integration into project cycle management.¹⁵

Nexus in policy and political dialogue

Policy and political dialogue is a key aspect of ADC's participation in the development efforts of its partner countries. Nexus can and should make up part of this, without necessarily using the explicit term 'nexus', as this can often confuse or overwhelm partners, who often view new concepts with a certain degree of scepticism. This also applies for political dialogue at a higher level (e.g. EU Joint Programming, activities in budget support operations, development partner engagement in national development planning) and policy dialogue at sectoral level (e.g. contributions to framing national sectoral strategies, local development planning and budgeting), where linkages to the other nexus themes can be extremely effective and improve overall development outcomes.



Besides the arguments and background information outlined above, some entry points for political and policy dialogue are:

Nexus in policy dialogue requires alliances (like-minded partners) and thorough communication of the advantages and value added (e.g. nexus for improved human well-being, use of ecosystem services, nexus for improved overall development outcomes, etc.).

Energy often plays a special role: As identified in case studies carried out in Ethiopia and Burkina Faso, the entry points for energy at local levels are often ill-defined and weak. In many countries, the energy agenda is limited to electricity issues, ignoring fuel for cooking and heating, often based on firewood. As energy issues are considered politically sensitive, they are mainly dealt with at top government levels.

¹⁵ *ibid*

While the energy situation is somewhat specific and the need to consider energy/resource efficiency has to be placed onto the policy agenda, it is necessary above all to scale-up integrated and systemic policies at national level and go beyond mono-sectoral working groups. Involving dedicated focal points from and in nexus-related sectoral working groups could be a way forward.

When planning and implementing nexus projects, bottom-up initiatives need to be aligned with top-down policies and strategies. Understanding nexus requires good examples with clear, evidence-based and documented results at grassroots level (bottom-up), which need to be flanked by an enabling framework set by central governments and/or global frameworks (top-down). ADC political and policy dialogue can play a major role in matching bottom-up with top-down nexus efforts.

Partners are often hesitant and reluctant to engage with new ideas. Many aspects of the nexus concept are not entirely new and borrow from existing approaches (e.g. integrated water resource management, integrated rural/regional development and integrated/sustainable natural resource management). It is often effective to point to good examples of unintended nexus work and gradually place it on the policy dialogue agenda to make it more intentional and planned.

Conclusion: Nexus thinking is more important than nexus wording.

In its Three-Year Programme for 2016 – 2018, ADC makes a clear commitment to engage in water and sanitation, sustainable energy and food security using a nexus approach. This requires a response that draws on all the financing instruments available and makes use of all intervention avenues, including project and programme work, capacity development, policy and political dialogue, and raising awareness among civil society actors and government officials. Apart from nexus approaches in specific projects and programmes, it is also necessary to link evidence-based results in the field with enabling policy frameworks at national, regional and global levels.

In doing so, Austria will adopt a pragmatic and flexible approach where nexus work is geared to a sustainable, inclusive overall improvement of development outcomes that do not deplete natural capital.

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