Draft for the final stock-taking report of the nexus assessment under the UNECE Water Convention, version 23 April 2015

# Matrix of Nexus tools [[1]](#footnote-1)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TOOL** | **Category** | **Developed by** | **Scale[[2]](#footnote-2)** | **Purposes and user groups** | **Data intensity/ data requirements[[3]](#footnote-3)** | **Nexus interlinkages considered** | **Modeling intensity** | **Software availability** | **Stakeholder inclusion** | **Case studies/ application** |
| **CLEWs (Climate, Land-use, Energy and Water Strategies)** | QN | Alfstad, 2013, Howells, 2013 Sweden | * National
* Global
 | Trade-offs between conflicting uses of natural resources and highlight potential synergic solutions to overcome them. provision of policy relevant information[[4]](#footnote-4) | • Extensive data requirements• Technical and economic parameters of power plants, farming machinery, water supply chain, desalination terminals, irrigation technologies, fertiliser production | (W↔E↔L)+C | OSEMOSYS | Open source software available at energycommunity.org | Identification and quantification of resources interlinkages requires expert involvement[[5]](#footnote-5)Results could help stakeholder and policy maker to produce better resource management | Modelling the energy system and its interdependencies for Mauritius[[6]](#footnote-6) |
| **The Water, Energy,Food Nexus Tool 2.0** | QN | Mohtar and Daher, 2013 A&M Texas and QUEERI Quatar | National | * Decision-maker
* Technical expert [[7]](#footnote-7)
 | • Data and local characteristics of food, water and energy systems• Local production of food, water and energy • Context-specific policy inputs | W↔E, F↔W, F↔E | WEFnexustool 2.0 | Publicly available and can be accessed, free of charge, at WEF nexustool.org.[[8]](#footnote-8) | Stakeholders sharing their experiences with past drivers, by providing their views on preferred future landscapes and measures to reach them, and by expressing acceptable trade-offs and synergies[[9]](#footnote-9) | Dow Chemical’s site in the Netherlands; Adapting design to climate change, EDF group |
| **WEAP – LEAP** | QN | SEI, 2013 | * Global
* National
 | decision-makers at all levels[[10]](#footnote-10) | • Techno-economic details ofenergy technologies and stocks• Extensive data requirement | W↔E; W↔F;W↔En;E↔F; E↔L; E↔En; F↔E ; L↔F; L↔En [[11]](#footnote-11) | Integration of WEAP LEAP software | free for users in developing countries. (Affordably priced licenses available to all others) [[12]](#footnote-12) | Stakeholders covering public and civil society are interviewed to elicit information pertaining to their specific expertise to substantiate the initial scenario narratives [[13]](#footnote-13) | Tackling Complexity: Understanding the Food-Energy-Environment Nexus in Ethiopia’s Lake Tana Sub-basin[[14]](#footnote-14) |
| **Water, Energy, Food/Feed/Fibre/Fuel tool Nexus tool** |  | World, Business, Council for Sustainable Development (WBCSD) | * Global
* National
* Subnational/ regional[[15]](#footnote-15)
 | * Business
* Policy-maker
* Think-thanks[[16]](#footnote-16)
 | •Characterization of the energy sector• GIS maps and information•Characterisation of water for food and for energy• Information on labour force and availability of machinery[[17]](#footnote-17) | W↔C, W↔E, W↔F, C↔E, E↔F, F↔C | In the next future a user interface will enable tweaking of variable to generate instant results [[18]](#footnote-18) | ? already exist a specific tool/software? | ??? | Dow Chemical’s site in the Netherlands; Adapting design to climate change, EDF group |
| **CropWat**  | QN | FAO | Project or local level[[19]](#footnote-19) | Project developers: to inform about selection of suitable crops for particular water availability, or water use requirements of planned agricultural developments (?) | Data on water availability and monthly rainfall, cropping pattern, soil characteristic, scheduling criteria for irrigation and crops water requirements[[20]](#footnote-20) | L↔W | CROPWAT 8.0  | Available, after registration, at fao.org |  |  |
| **Aquacrop** | QN | FAO | Extension services, governmentalagencies, NGOs and farmers’ association[[21]](#footnote-21) | Project level[[22]](#footnote-22) | requires data on irrigation management practices, schedule and requirement, rainfall; moreover field management practices which influences water balance[[23]](#footnote-23) | L↔W | Aquacrop Version 4.0 | Available, after registration, at fao.org |  |  |
| **Foreseer tool**  | QN | University of Cambridge | National (but also global), transboundary river basin[[24]](#footnote-24) | experts/technician use | * set of policy
* environmental and climate change scenarios
* resources (land, water and energy) are traced from their source to the services they provide
 | E↔W, E↔F, L↔E, L↔F, E↔GHGF↔GHG | Foreseer Beta version | Available, after registration, at foreseer.group.cam.ac.uk | Stakeholder, users and partners are involved since the begging of the analysis in order to underline representative scenarios and policy options , policy questions; then also local experts are involved in order to refine methodology and data [[25]](#footnote-25) | National model for California, UK, China[[26]](#footnote-26) The Foreseer tool: Understanding the trade-offs between the services provided by water, energy and land resources in transboundary basins[[27]](#footnote-27) |
| **MuSIASEM Multi-Scale Integrated Assessment of Society and Ecosystem Metabolism** | SQ[[28]](#footnote-28) | FAO and LiphE4 | National | used by expert in order to produce user friendly results for understanding feasibility viability and desirability of different scenarios to help decision makers | •Extensive data requirements• Socio-economic indicators, includingwork force evolution•Availability of land•Climate change impacts•Characterisation of all flows | (W↔E↔F)+(PD,GHG, L) [[29]](#footnote-29) | analytical approach | Methodology and case study are available, free of charge, on the web | Involvement of local actors and experts is required in the pre-analytical choices of issue definition, Input of local expertise is essential for:(i) problem structuring  (ii) pertinent modelling (iii) data quality[[30]](#footnote-30) | The Republic of Mauritius; The Indian State of Punjab[[31]](#footnote-31) |
| **UNECE methodology for river basin** | SQ | UNECE | transboundary basins | Helps decision maker and basin authorities  | Data on basin indicator and national indicators available on global, national basin database or to be asked to local institution  | C+En↔(E-W-L/F-ES) having W as entry point | A set of indicators and the questionnaires to be submitted to stakeholders and experts | Any software exists but the indicators needed and the questions are available on UNECE web pages | Stakeholder and local experts are involved since the beginning of the study, through the use of anonymous questionnaires sectors and also their involvement, as well to collect useful and reliable data and to propose effective and shared solution and policy  | Alazani, Sava, Syrdarya River Basins |
| **FAO Methodology** | SQ | FAO | * National
* Regional
 | * Stakeholder,
* Government (minister..)
 | Data on water energy, land capital and labour and their interlinkages are need to build up the interlinkages matrix  | W↔E↔F+ES | Data on water energy, land capital and labour and their interlinkages are need to build up the interlinkages matrix. | Any software exists but the quantitative analysis can be performed  | Stakeholder and decision-making are involved in each phase of the analysis to guarantee the best consideration of the nexus issues and to produce solution which are shared, applicable and effective | Solar steam irrigation in Kenya, Ethanol production in South Africa[[32]](#footnote-32) |

Table 1 : Classification of main nexus tool

*References*

FAO (2014): Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative

Karlberg et al. (2014): The food-energy-environment nexus: a case study in Ethiopia’s Lake Tana sub-basin, submitted to Water Alternatives

<http://www.fao.org/nr/water/docs/FAO_nexus_concept.pdf>

<http://www.irena.org/documentdownloads/publications/irena_water_energy_food_nexus_2015.pdf>

1. QN=Quantitative, QL=Qualitative, SQ= Semi-qualitative

 E: Energy, W=Water, L=Land, C=Climate, En=Environment, GHG= Greenhouse gases, PD= Population Dynamics [↑](#footnote-ref-1)
2. <http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=496> [↑](#footnote-ref-2)
3. <http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=496> [↑](#footnote-ref-3)
4. <https://www.kth.se/en/itm/inst/energiteknik/forskning/desa/researchareas/clews-climate-land-energy-and-water-strategies-to-navigate-the-nexus-1.432255> [↑](#footnote-ref-4)
5. M. Welsch, S. Hermann, M. Howells, H.H. Rogner, C. Young, I. Ramma, M. Bazilian, G. Fischer, T. Alfstad, D. Gielen, D. Le Blanc, A. Röhrl, P. Steduto, A. Müller, (2013): "Adding Value with CLEWS - Modelling the Energy System and Its Interdependencies for Mauritius” [↑](#footnote-ref-5)
6. M. Welsch, S. Hermann, M. Howells, H.H. Rogner, C. Young, I. Ramma, M. Bazilian, G. Fischer, T. Alfstad, D. Gielen, D. Le Blanc, A. Röhrl, P. Steduto, A. Müller, (2013): "Adding Value with CLEWS - Modelling the Energy System and Its Interdependencies for Mauritius”” [↑](#footnote-ref-6)
7. FAO(2014): "Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative,” [↑](#footnote-ref-7)
8. Rabi H. Mohtar and Bassel Daher (2014) “The Water-Energy-Food Nexus Tool and its Application to Qatar’s Food Security,” [↑](#footnote-ref-8)
9. Livia Bizikova, Dimple Roy, Henry David Venema, and Matthew McCandless, Darren Swanson, Avet Khachtryan, Carter Borden and Karla Zubrycki, (2014): “Water-Energy-Food Nexus and Agricultural Investment: A Sustainable Development Guidebook” [↑](#footnote-ref-9)
10. SEI (2012): “Integrating the WEAP and LEAP systems to support planning and analysis at the water-energy nexus,” [↑](#footnote-ref-10)
11. Eric Kemp-Benedict (Asia Centre Director, 2014): “ Robust Approaches to Managing Nexus Issues: Experiences from Around the World,” [↑](#footnote-ref-11)
12. SEI (2012): “Integrating the WEAP and LEAP systems to support planning and analysis at the water-energy nexus” [↑](#footnote-ref-12)
13. Karlberg, Hoff, Amsalu, Andersson, Binnington, Flores-López, de Bruin, Gebrehiwot, Gedif, zur Heide, Johnson, Osbeck and Young (2015): “Tackling Complexity: Understanding the Food-Energy-Environment Nexus in Ethiopia’s Lake Tana Sub-basin” [↑](#footnote-ref-13)
14. Karlberg, Hoff, Amsalu, Andersson, Binnington, Flores-López, de Bruin, Gebrehiwot, Gedif, zur Heide, Johnson, Osbeck and Young (2015): “Tackling Complexity: Understanding the Food-Energy-Environment Nexus in Ethiopia’s Lake Tana Sub-basin” [↑](#footnote-ref-14)
15. FAO (2014): “Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative” [↑](#footnote-ref-15)
16. FAO (2014): “Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative” [↑](#footnote-ref-16)
17. FAO (2014): “Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative” [↑](#footnote-ref-17)
18. FAO (2014): “Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative” [↑](#footnote-ref-18)
19. FAO (2014): “Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative” [↑](#footnote-ref-19)
20. FAO (2014): “Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative” [↑](#footnote-ref-20)
21. FAO (2014): “Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative” [↑](#footnote-ref-21)
22. FAO (2014): “Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative” [↑](#footnote-ref-22)
23. FAO (2014): “Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative” [↑](#footnote-ref-23)
24. University of Cambridge (2013): “ The Foreseer tool: Understanding the trade-offs between the services provided bywater, energy and land resources in transboundary basins” [↑](#footnote-ref-24)
25. University of Cambridge (2013): “ The Foreseer tool: Understanding the trade-offs between the services provided bywater, energy and land resources in transboundary basins” [↑](#footnote-ref-25)
26. https://www.foreseer.group.cam.ac.uk/ [↑](#footnote-ref-26)
27. University of Cambridge (2013): “ The Foreseer tool: Understanding the trade-offs between the services provided bywater, energy and land resources in transboundary basins” [↑](#footnote-ref-27)
28. Mario Giampietro, Richard J. Aspinall, Sandra G.F. Bukkens, Juan Cadillo Benalcazar, François Diaz-Maurin, Alessandro Flammini, Tiziano Gomiero, Zora Kovacic, Cristina Madrid, Jesús Ramos-Martín, Tarik Serrano-Tovar (FAO, 2013): “An Innovative Accounting Framework for the Food-Energy-Water Nexus” [↑](#footnote-ref-28)
29. Mario Giampietro, Richard J. Aspinall, Sandra G.F. Bukkens, Juan Cadillo Benalcazar, François Diaz-Maurin, Alessandro Flammini, Tiziano Gomiero, Zora Kovacic, Cristina Madrid, Jesús Ramos-Martín, Tarik Serrano-Tovar (FAO, 2013): “An Innovative Accounting Framework for the Food-Energy-Water Nexus”. [↑](#footnote-ref-29)
30. Mario Giampietro, Richard J. Aspinall, Sandra G.F. Bukkens, Juan Cadillo Benalcazar, François Diaz-Maurin, Alessandro Flammini, Tiziano Gomiero, Zora Kovacic, Cristina Madrid, Jesús Ramos-Martín, Tarik Serrano-Tovar (FAO, 2013): “An Innovative Accounting Framework for the Food-Energy-Water Nexus” [↑](#footnote-ref-30)
31. Ibid. [↑](#footnote-ref-31)
32. FAO (2014): “Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative” [↑](#footnote-ref-32)