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Human-environmental security in the Asia-Pacific ring of fire: Water-energy-food nexus

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The purposes of the research are to understand the complexity of the water-energy-food (WEF) nexus system and to create policy options to reduce trade-offs among resources and to solve the conflicts of resource users under scientific evidence and uncertainty to maximize human-environmental security. We target surface and groundwater use for energy production including small-hydropower, geothermal, hot spring and shale gas. Conversely, we focus on energy use for pumping, and heating water. In addition, we address water use for fishery and agricultural productions, and water cycle is essential for the ecosystem. We are developing, and using various integrated methods to address the WEF nexus issues. We classified the integrated methods as qualitative and quantitative, and both contribute to both interdisciplinary and transdisciplinary researches. The Qualitative methods that we analysed consisted of Questionnaire Surveys, Ontology Engineering and Integrated Map. The quantitative methods included Physical Models, Benefit-cost analysis, Integrated Indices, and Optimization Management Models. As a result, we identified the pros and cons of each method. To address to temporal scale, we determined if we could use each method to address nexus during initial stage, developing stage and policy planning stage of the project to make future scenarios. We also challenged to design nexus systems to understand the complexities of nexus system, to visualize the linkages between events, to identify trade-offs and find efficiency of resource use, to define academic concepts of nexus, and to contribute to scenario planning, using otology methodology.

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