Systems Ecology as a Design Tool for Water Resources and its Environmental Education

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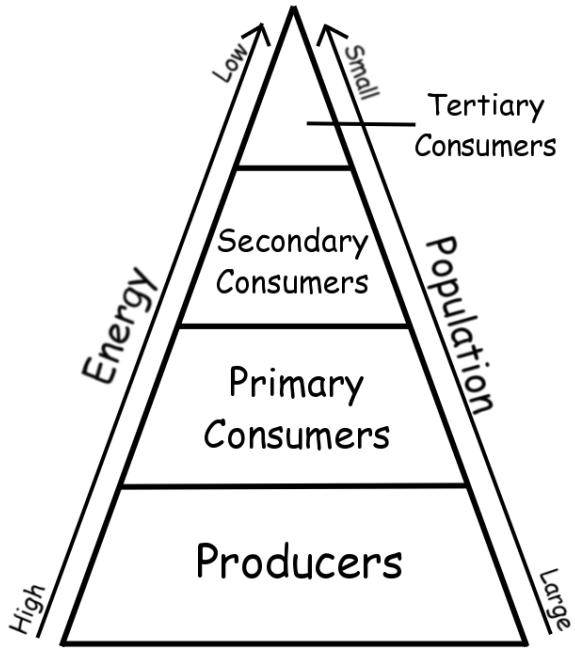
Concept of ecosystem

- Natural Ecosystem

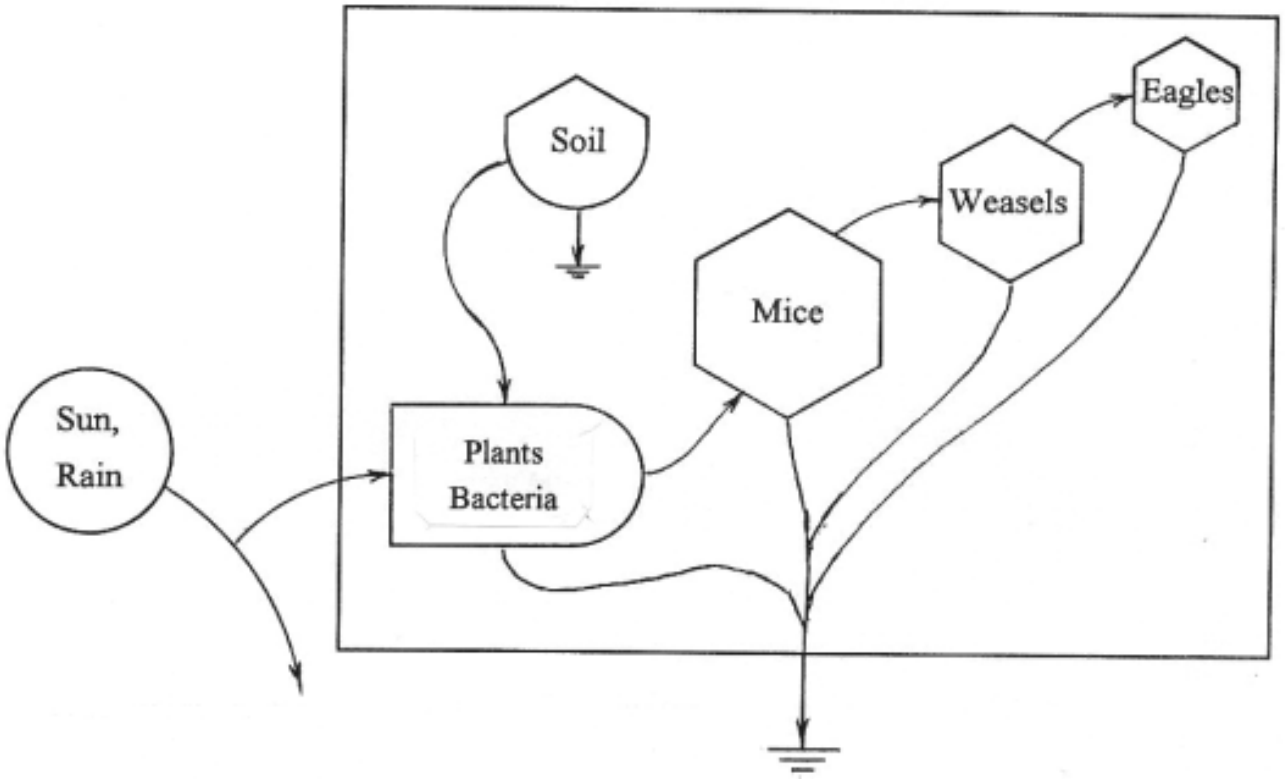
https://media.proprofs.com/images/QM/user_images/1452023/1430982767.jpg

- Conceptual model of ecosystem based on food web

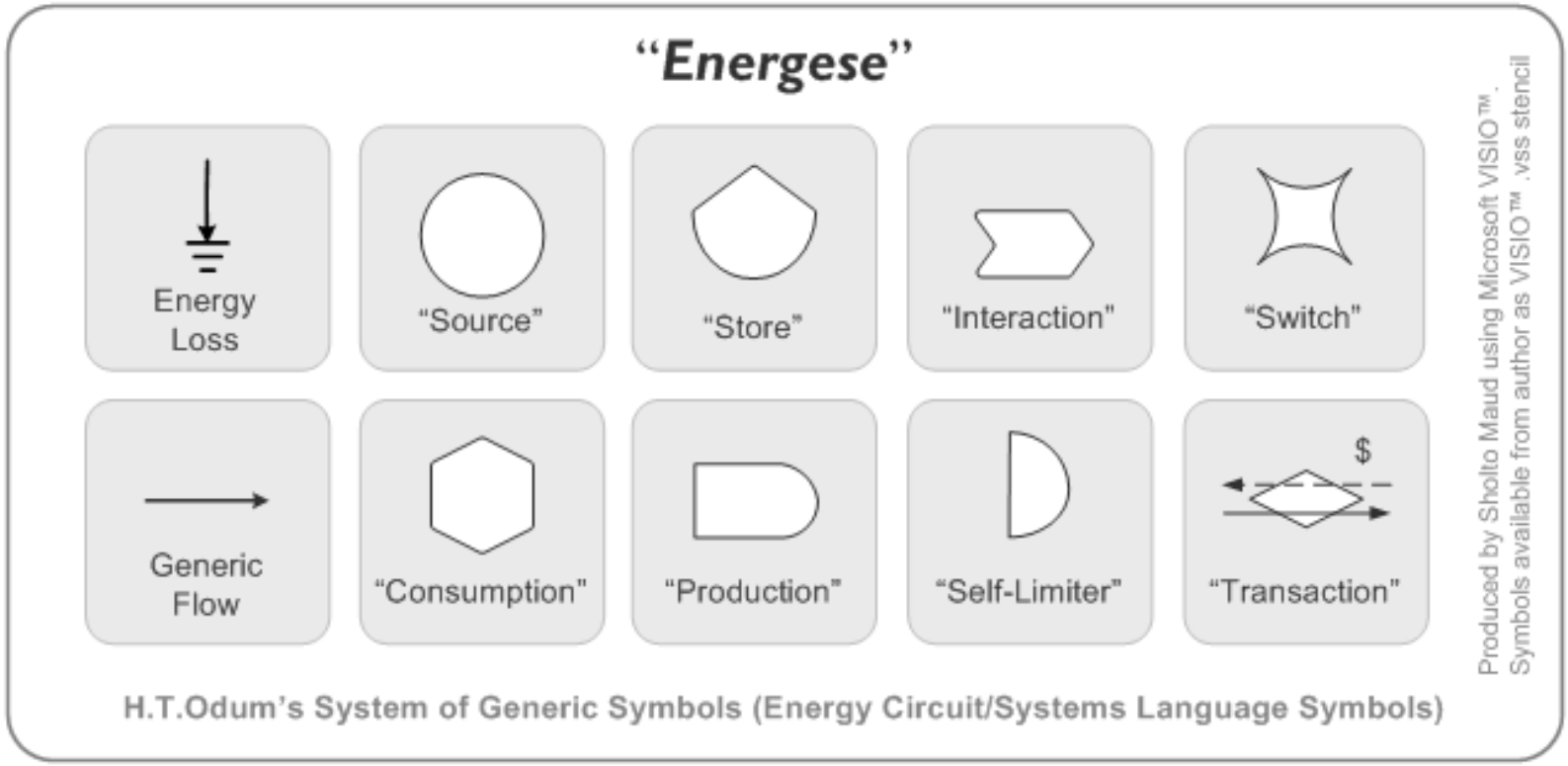


http://www.stephsnature.com/images/Websitelifescience/ecology/energypyramid.png

Ecosystem model in Systems Ecology



Energese of Systems Ecology

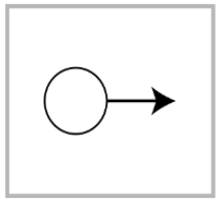


Objectives

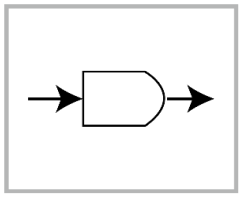
- Architects and school managers
  - difficult to integrate all aspects of sustainability
  - not able to apply sustainability on facilities in buildings and on campuses.
- Therefore,
  - illustrate a systematic method to assist designers or school managers
  - clarify all possible components of improving campus sustainability

Notations

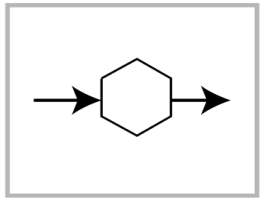
Application on built environment



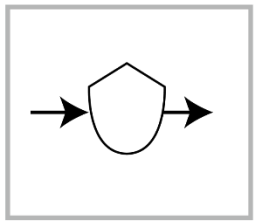
Source Element



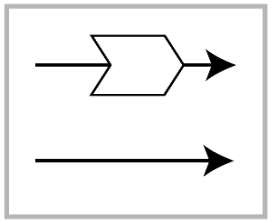
Producer Element



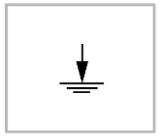
Consumer Element



Storage Element

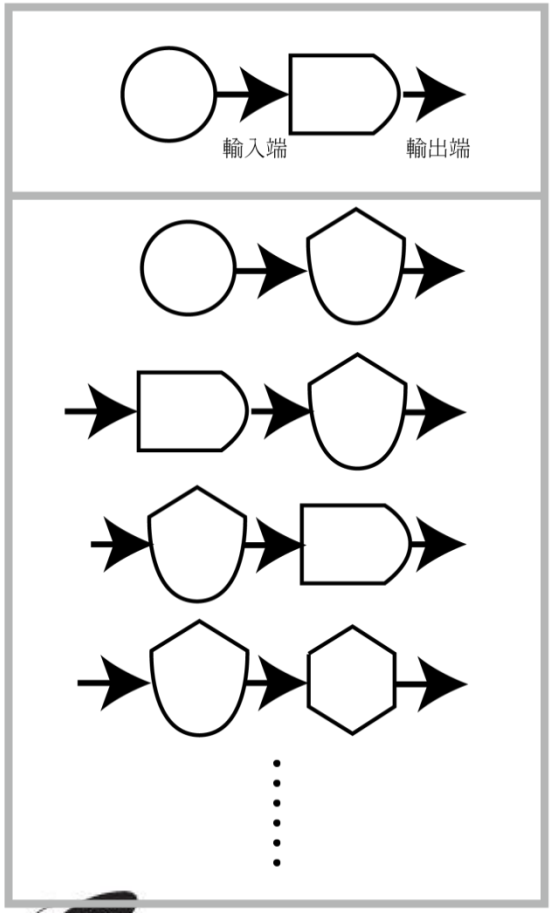


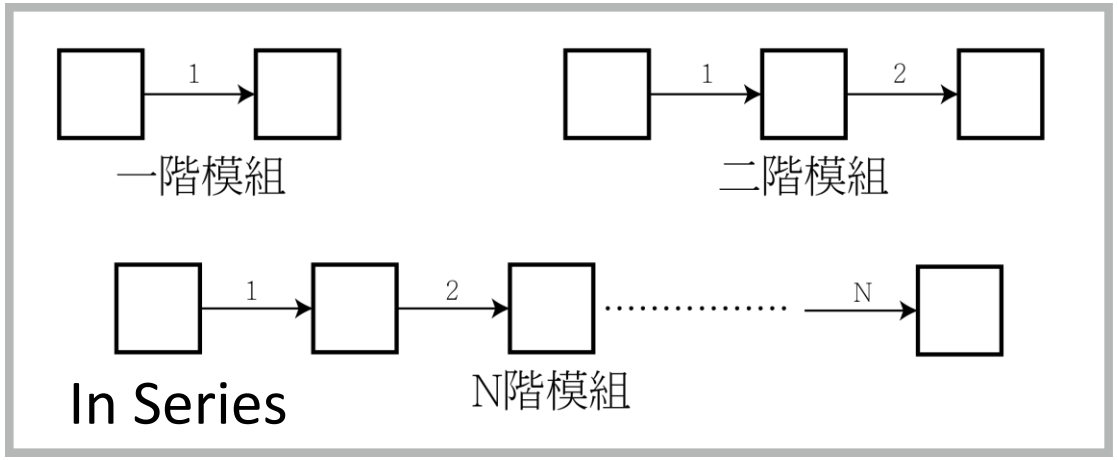
Processes

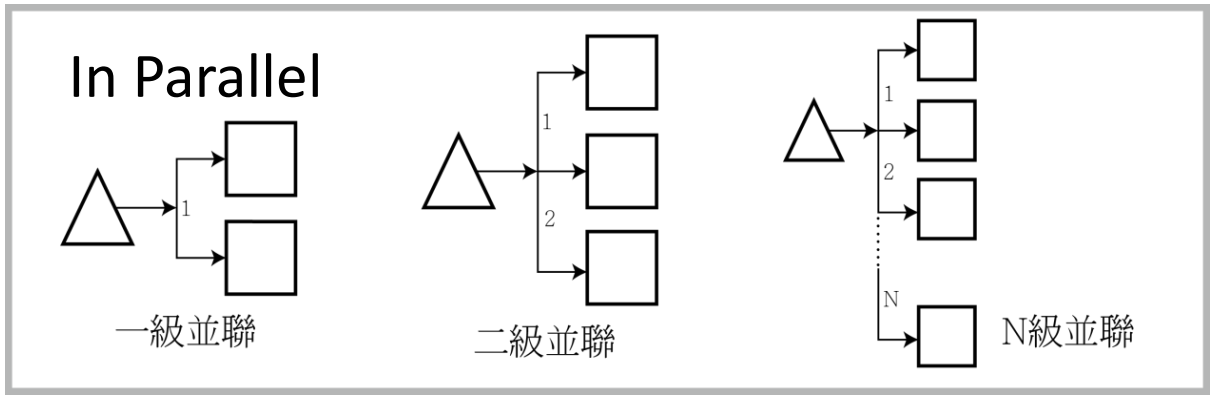


Outbound

Modules of System Models:
connecting elements with processes







System of Water Resources and its Environmental Education on Sustainable Campus (SWREESC)

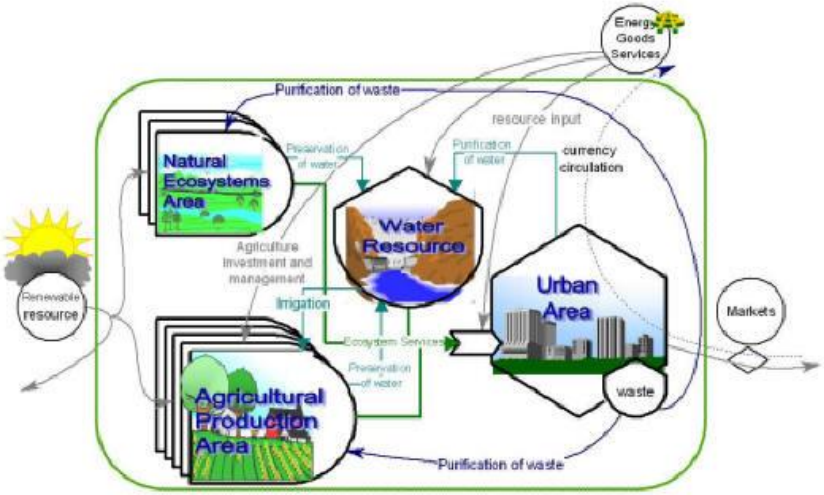
- Model boundary: Hardware and software sustainably related to water resources management on campus.
- Providing design whims for architecture, engineering, and teaching activities
- Monitoring, examining, and controlling pathways
- Utilizing notations from Systems Ecology to create the “System Model of SWREESC” (SMSWREESC)

Development of model application

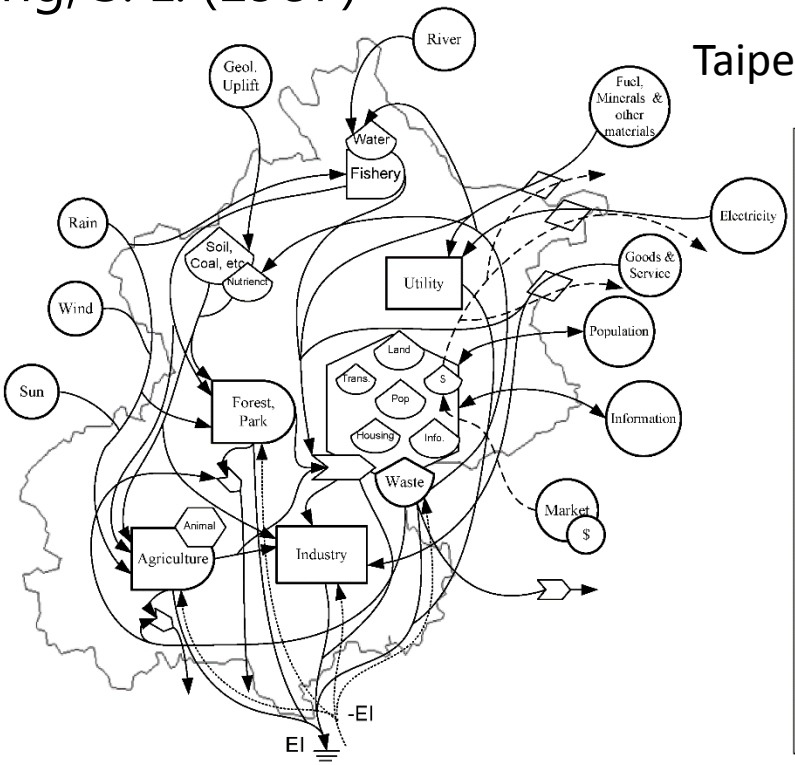
SWREESC

Model for Urban Odum(1983)

Urban Energy Model Huang, S. L. (1987)

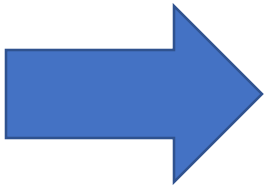


Taipei



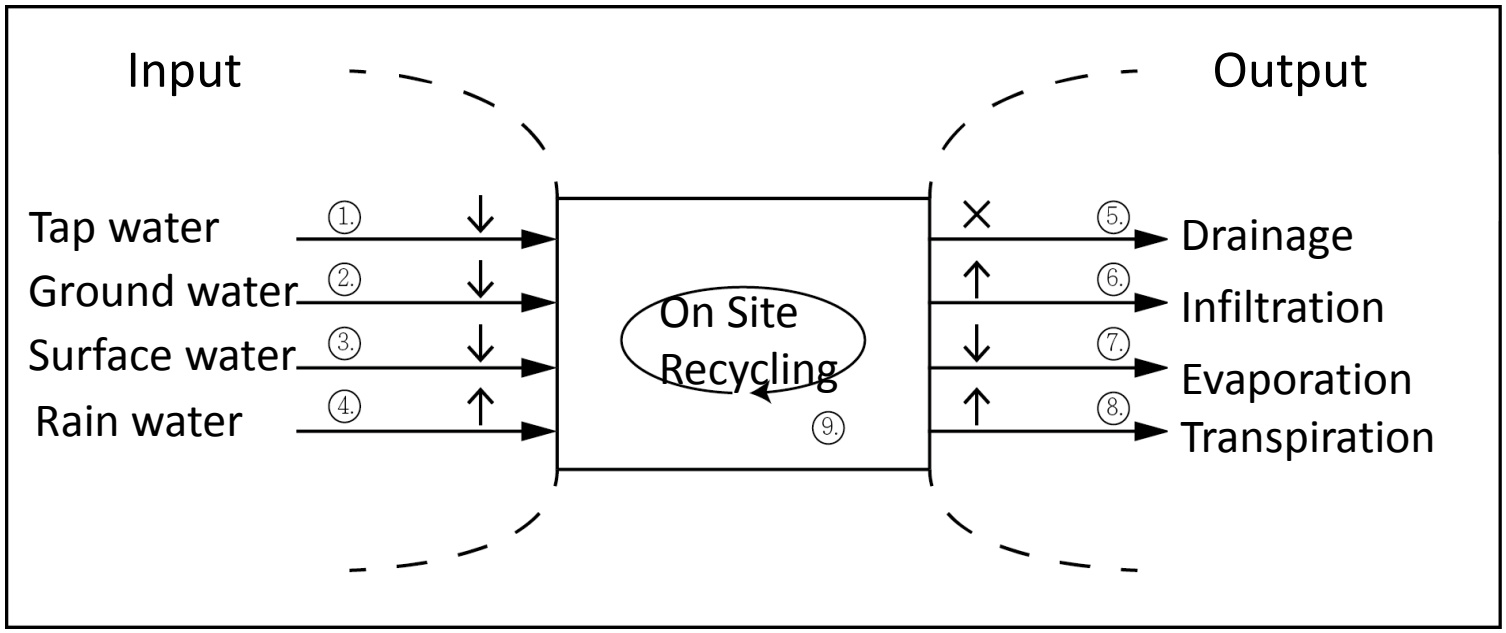
Model building and its 4 states

- Literature review
  - Sustainable development,
  - green campus,
  - green building,
  - water management,
  - systems ecology
- Special team program (STP) of experts
  - Focus and divergent discussion



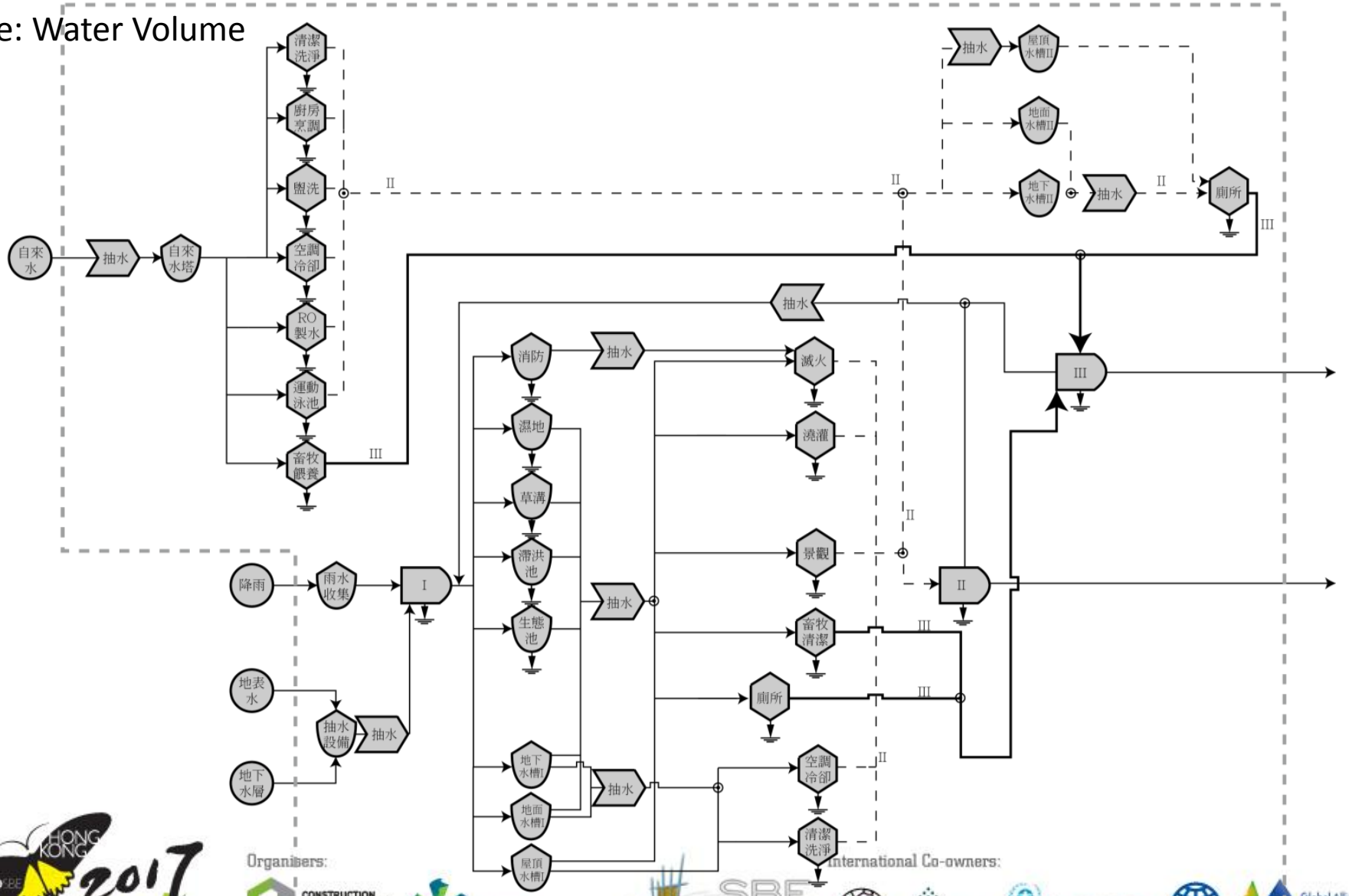
- SWREESC
  - Water Volume
  - Organic Matters
  - Energy
  - Knowledge of Environment Education

Hydrological Concept of Sustainable Water Management

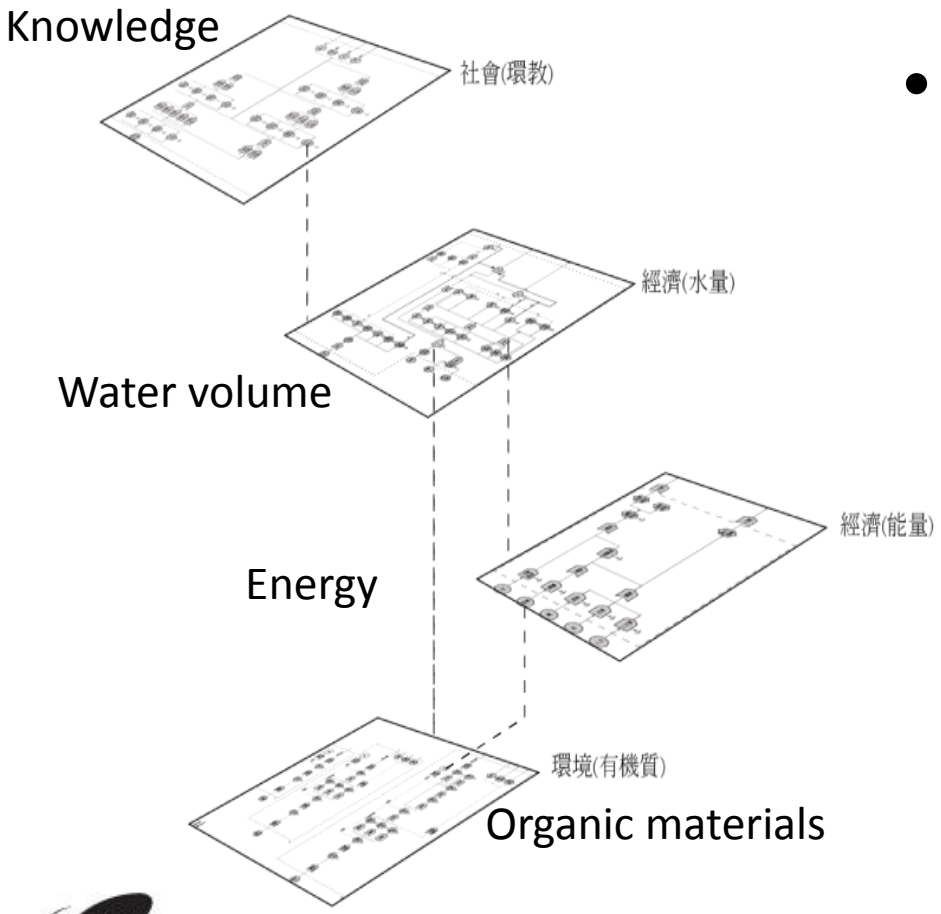


Ideal System of Water Volume

State: Water Volume



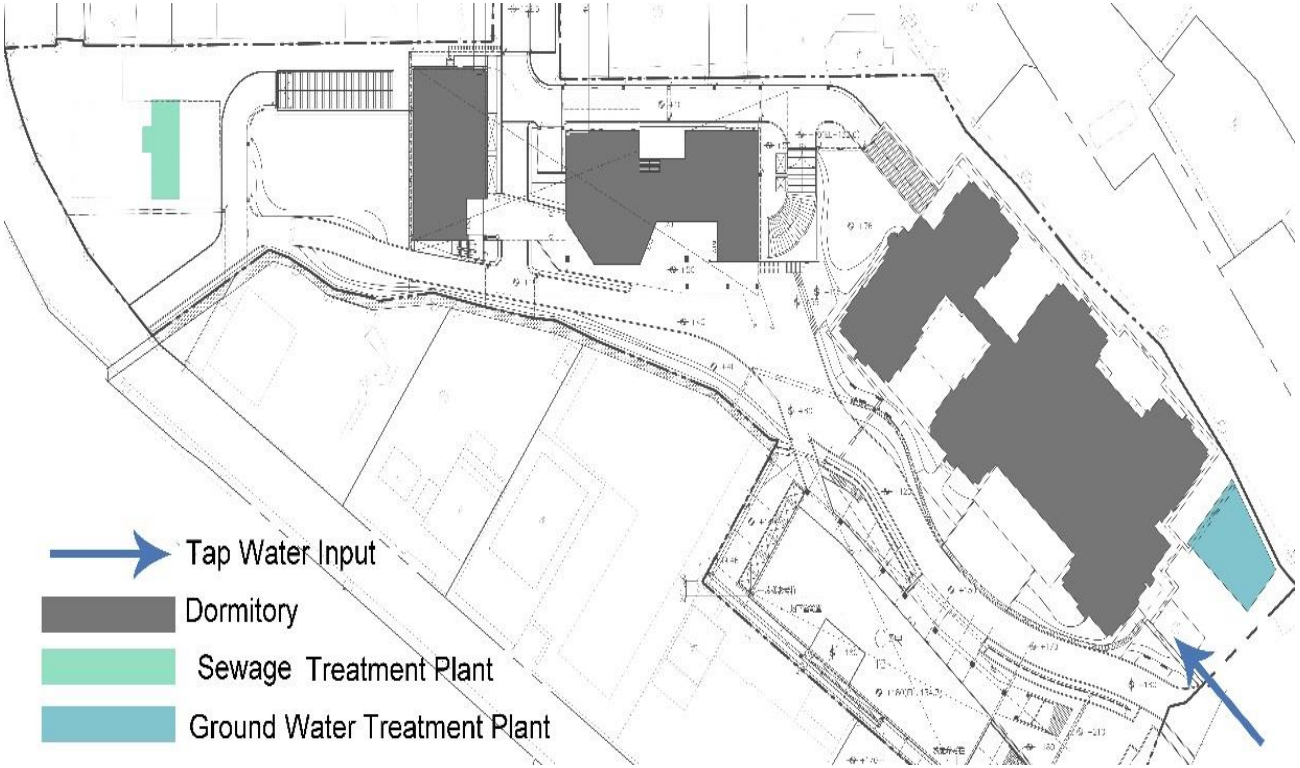
SWREESC connecting 4 states



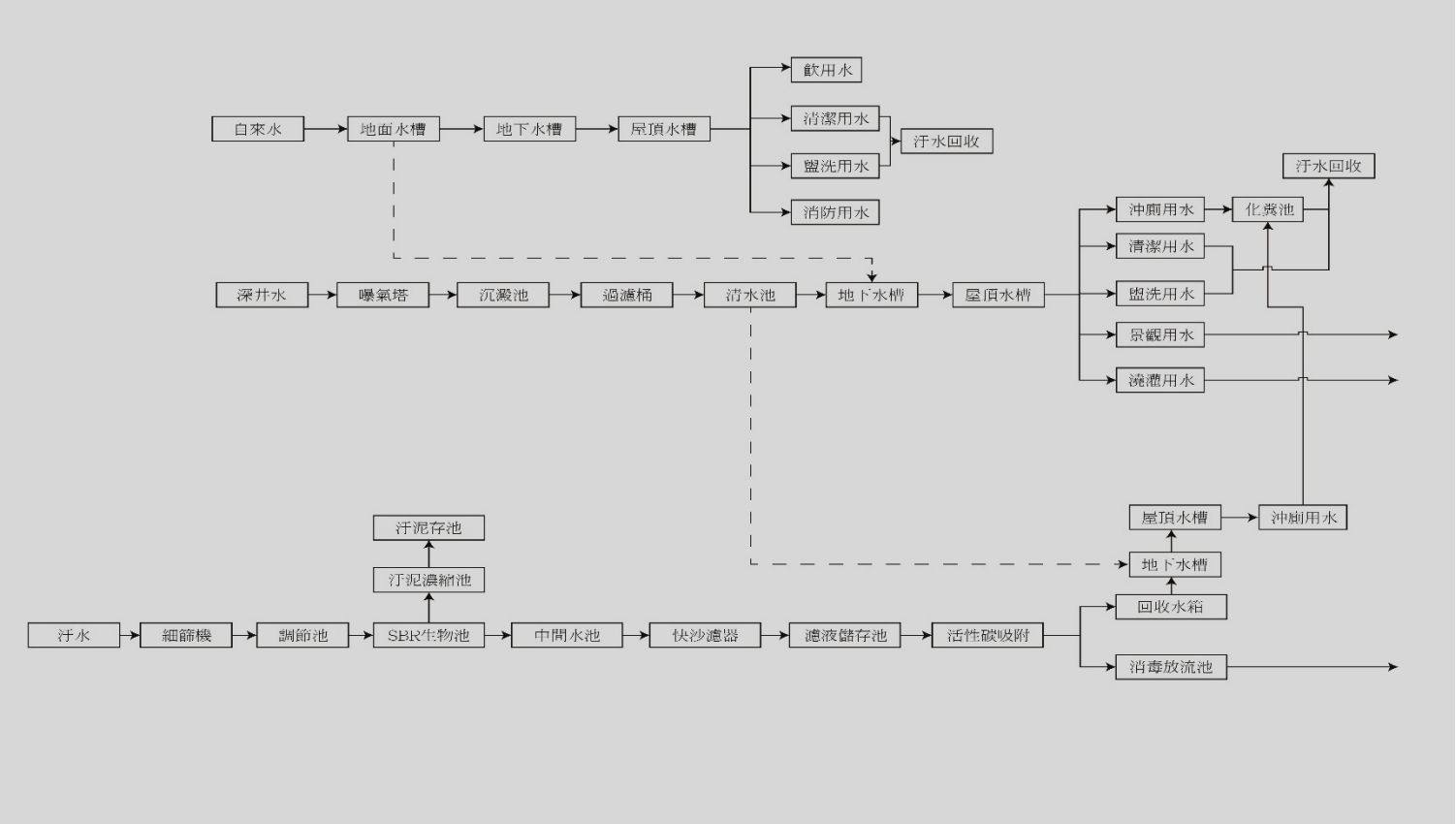
- Sustainability
  - ➢Environmental: Organic materials recycling
  - ➢Social: Environmental education
  - ➢Economic: Energy, water volume

Case application: Mr. Y. K. Wang

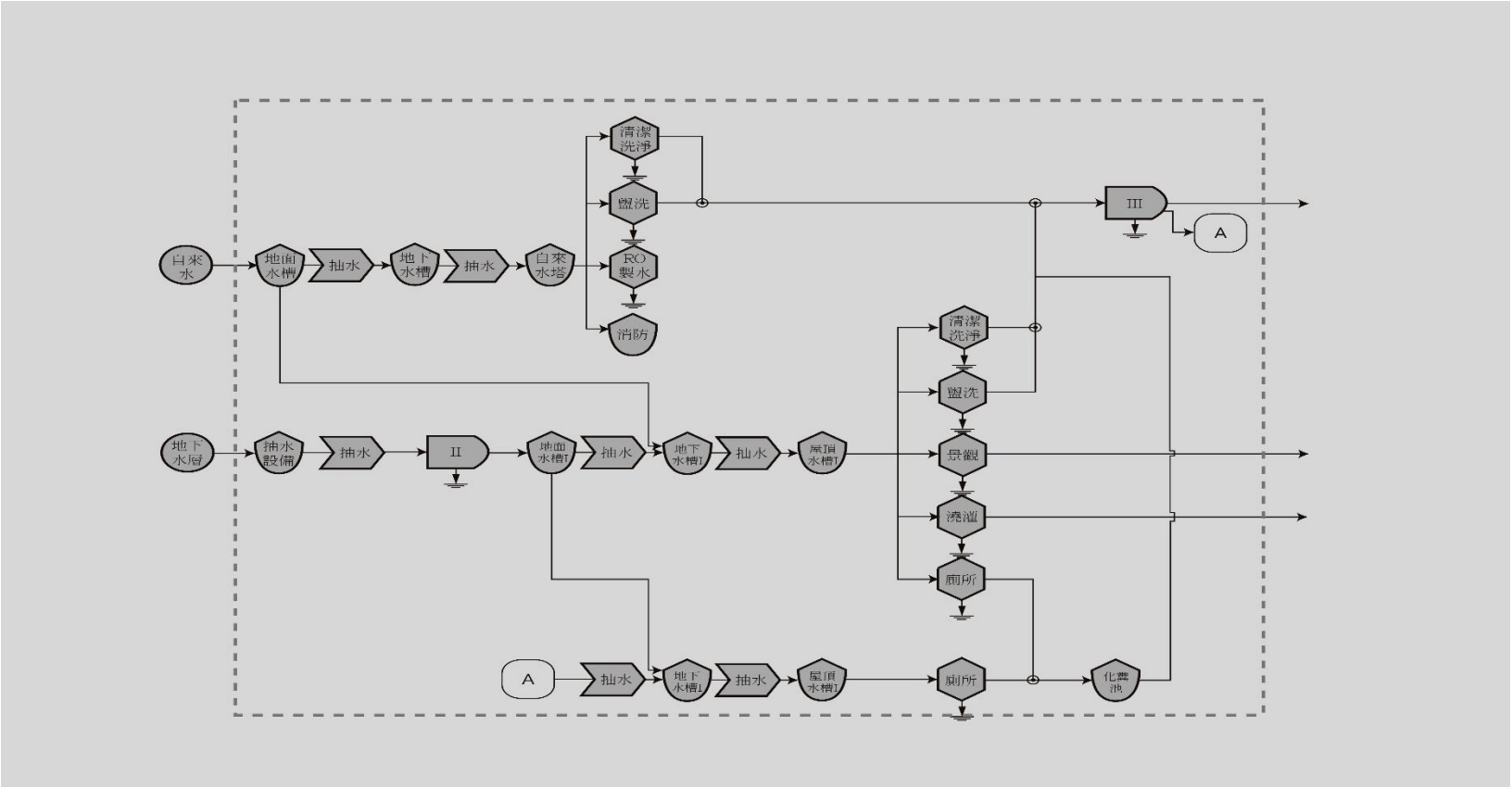
- Dormitory at Chung Yuan Christian University (CYCU)



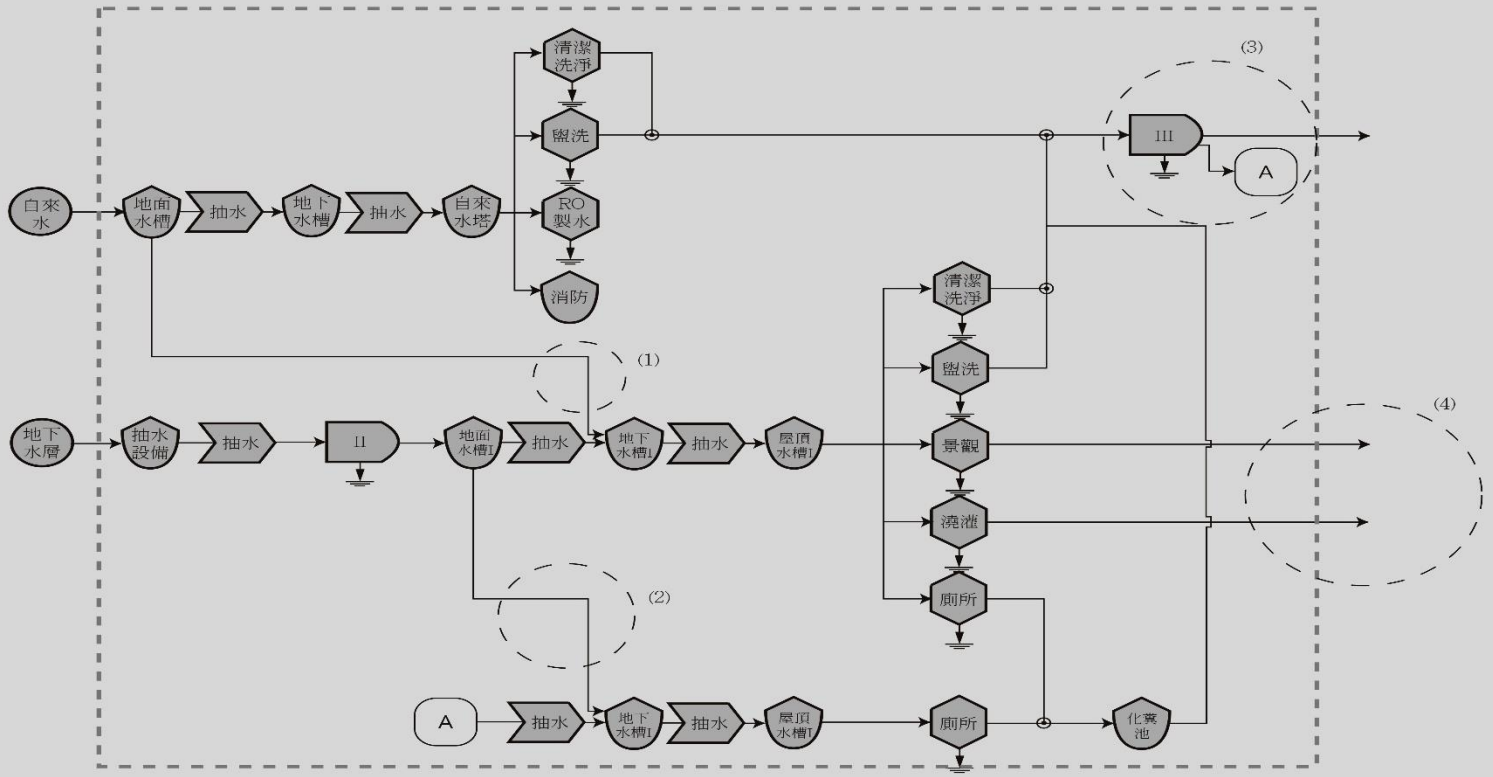
Flowchart of Current Water Usage and Drainage of CYCU Dormitory



System model of current usage and drainage of CYCU dormitory



Looking for missing elements and/or disconnections

- 

Design Whims

All equipment would be used for environmental education with posters and banners to illustrate the relevant sustainable knowledge

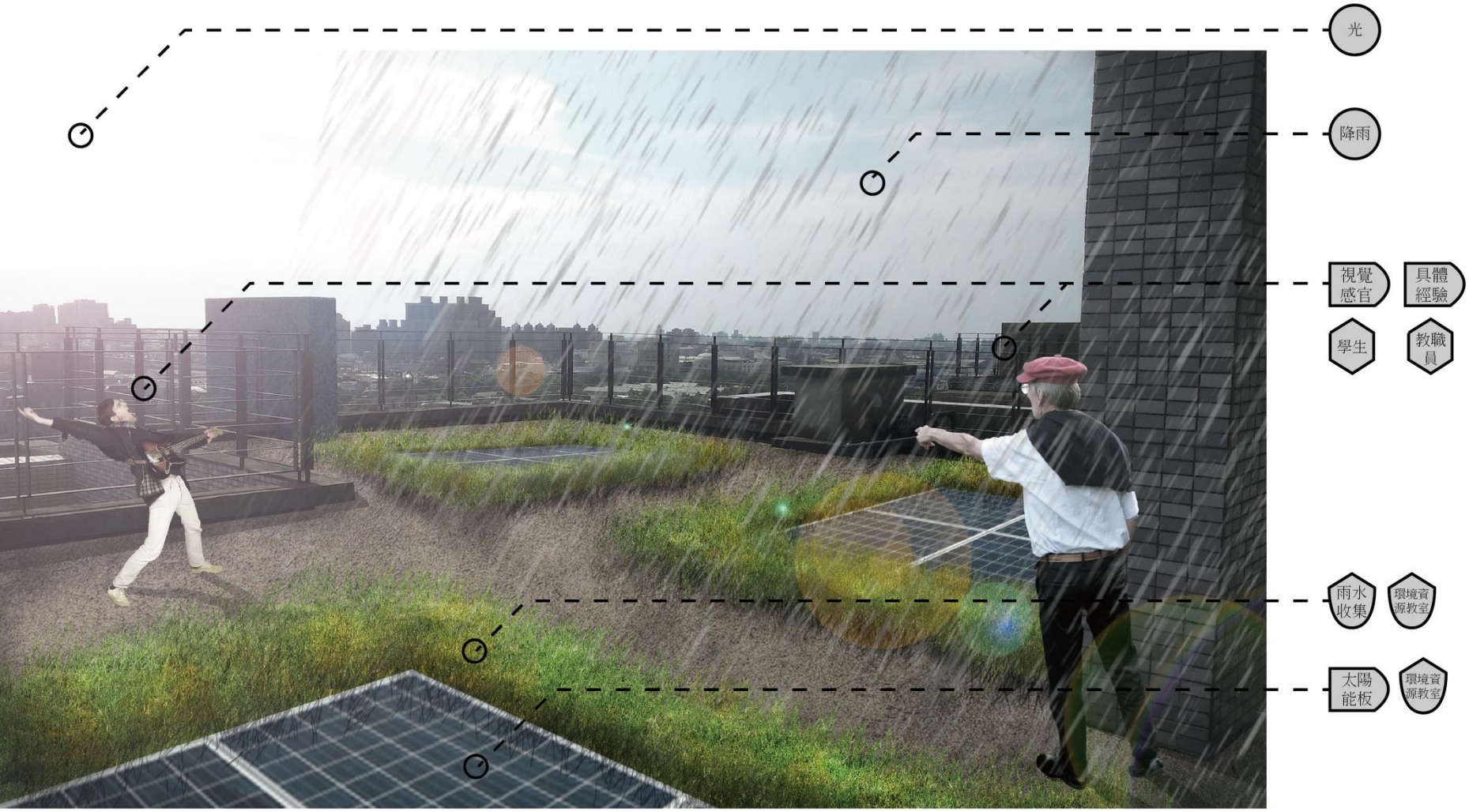
1)Roof rain-light garden: developed usage of solar energy and rain water;

2)Wind-light corridor: both solar and wind energy were induced;

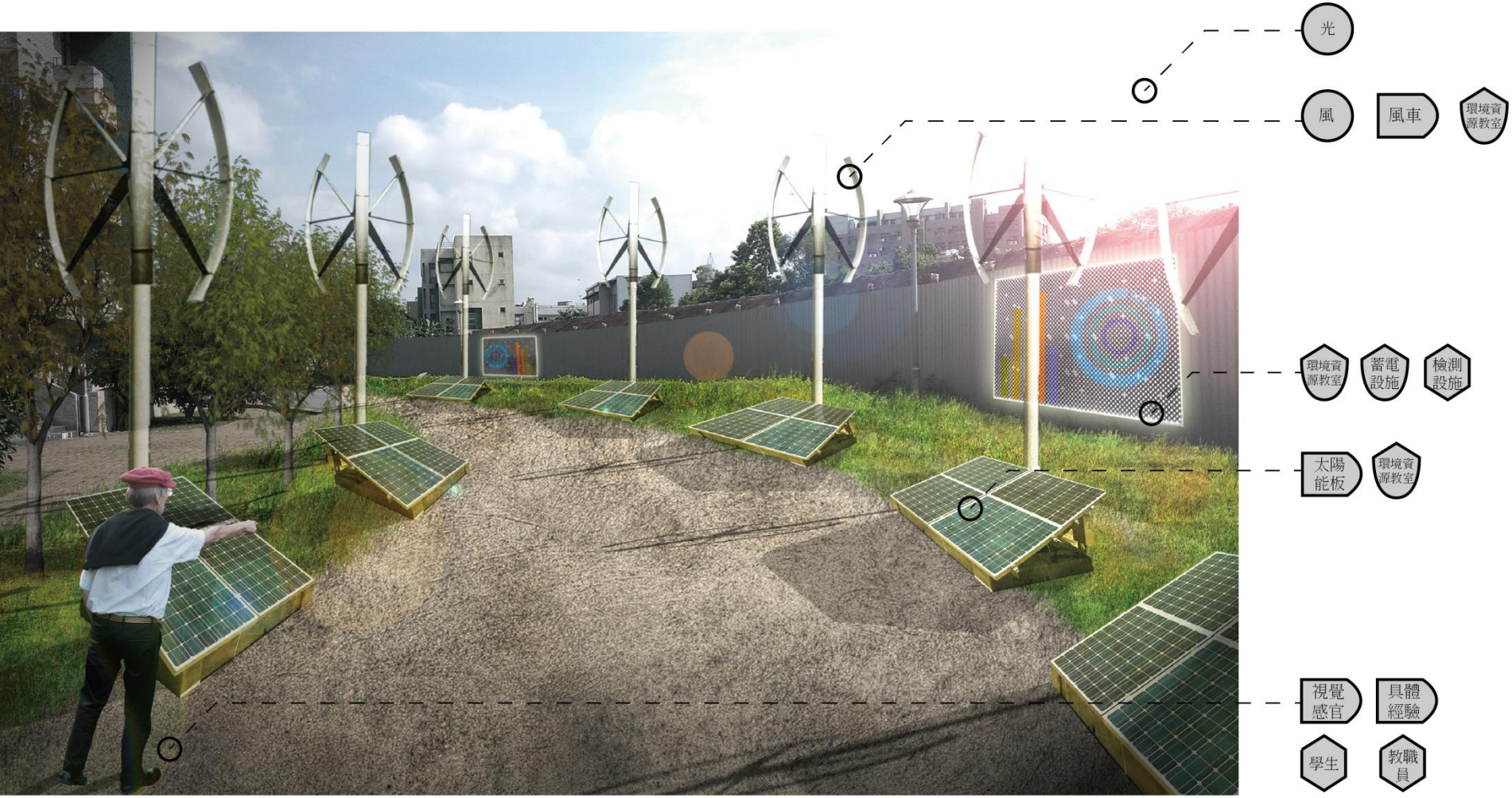
3)Water purified and ecological corridor: living sewage was purified with aquatic water in a stream-like channel, and flow into a pond.

4)Flywheel exercise area: Transforming manpower to generate electricity.

Roof Rain Light Garden



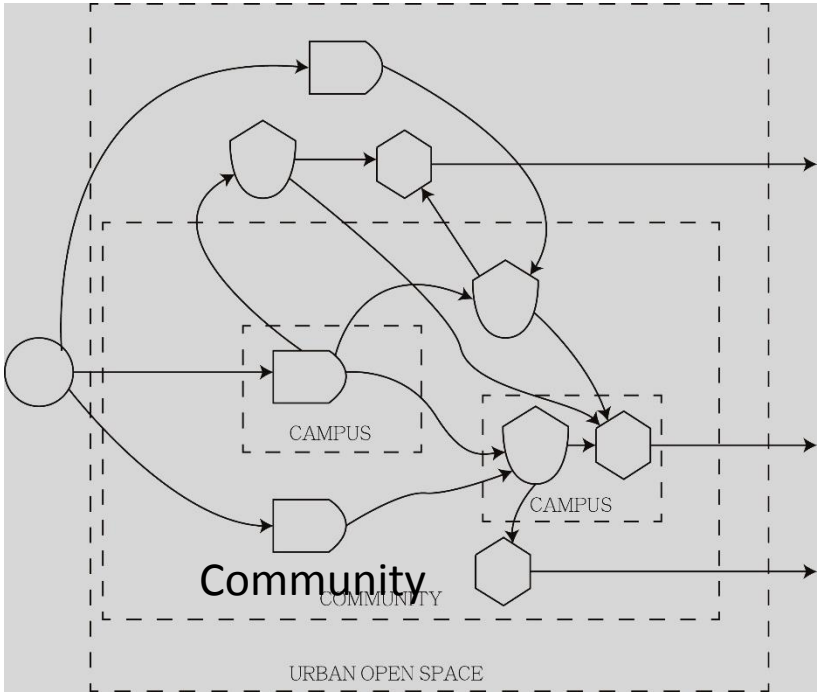
Wind Light Corridor



Water purification and ecological corridor

Flywheel exercise area

Expanding system boundary



Urban open space

1. Exchanging services: public education, farms, shops, factories, recreations.
2. Integrated infrastructure: water, materials, and energy.

Conclusion

- To create a learning space for sustainability
- To combine different states and elements of a campus in order to provide connections of all needs and disconnections.
- May apply to larger spatial areas, such as community and urban open space.

Contribution

- A design tool is necessary for architects to examine the water use and its related environmental education facilities and programs in a sustainable campus.
- Systems Ecology used the Odum's energy language to describe natural ecosystems.
- The water use and its environmental education facilities and programs, which contain water, materials, energy, and knowledge, are compared analogical to an ecosystem, so that the energy language was transformed into a design tools to describe the campus water management and education bionically and systematically.

Thank you