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Urban water security – Water-energy-food nexus
城市水资源安全 – 水-能源-食品关系

A China Europe Water Platform Co-lead partnership partnership led by
The Ministry of Environment, Sweden
Foreign and Commonwealth Office, United Kingdom
and
Nanjing Hydraulic Research Institute, China

中欧水资源交流平台工作领域
由瑞典环境部、英国外交和联邦事务部
中国南京水利科学研究院联合牵头

Josh Weinberg, Stockholm International Water Institute

Urban Water Security: Water-Energy-Food Nexus
确保城市水资源安全：水-能源-食品关系

Objectives:

•Exchange between Chinese and European authorities on state of the art approaches and technologies

•Improve methods for analyzing synergies and conflicts between the major water uses of domestic, industrial, agricultural and energy production in urban areas

•Improve policy coherence between water and energy in China and the EU

Key activities:

•Taihu Basin Region Urban Water Security Programme

•Managing water risks in China's energy sector

•Managing energy risks in China's Urban Water Sector

•Sustainable and intensive agriculture for urban areas

目标：

•中国和欧洲当局之间在先进方法和技术方面的交流

•改进对城市地区居民、工业、农业和能源生产主要用水之间合成效应和冲突的分析方法

•提高中国和欧盟在水资源和能源之间的政策一致性

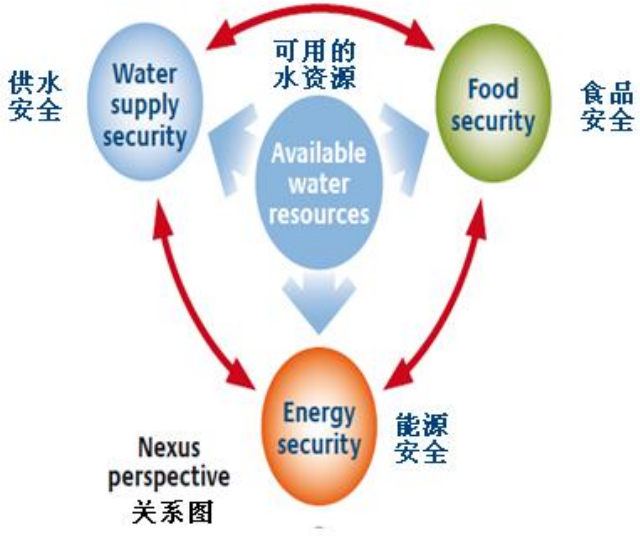
主要活动：

•太湖流域地区城市水资源安全项目

•管理中国能源领域的水资源风险

•管理中国城市水资源领域的能源风险

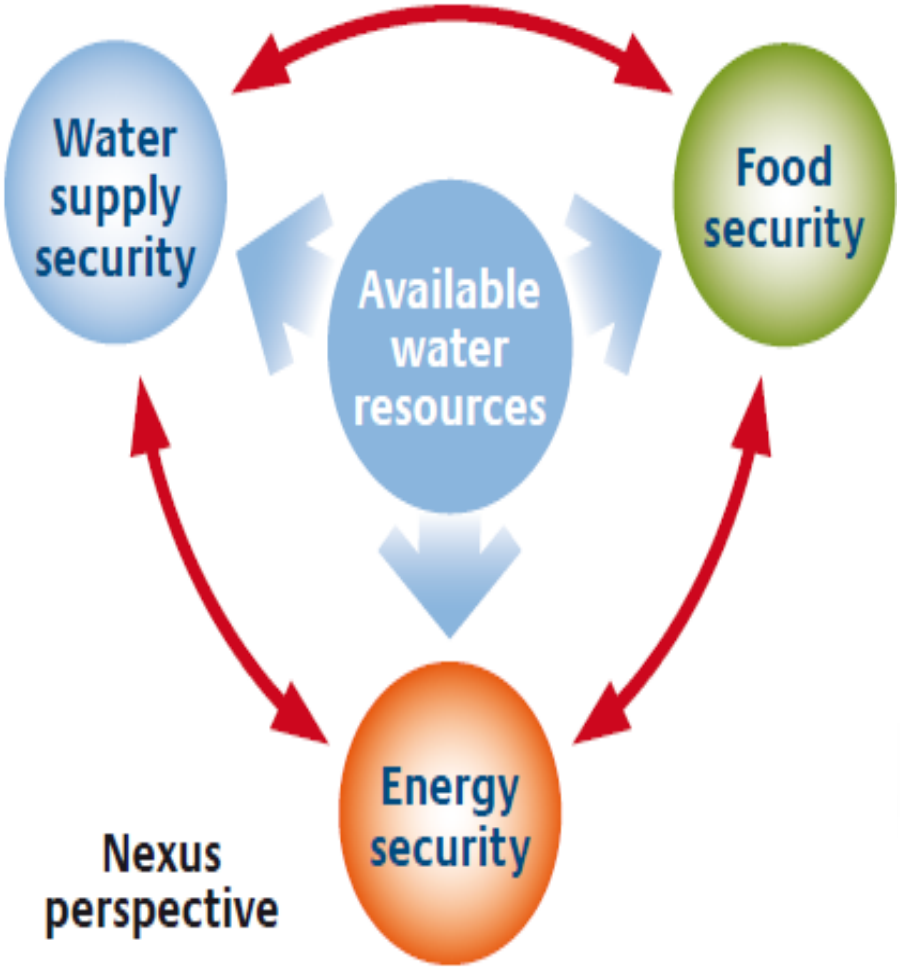
•城市地区的可持续和集约型农业



Water-Energy-Food Nexus

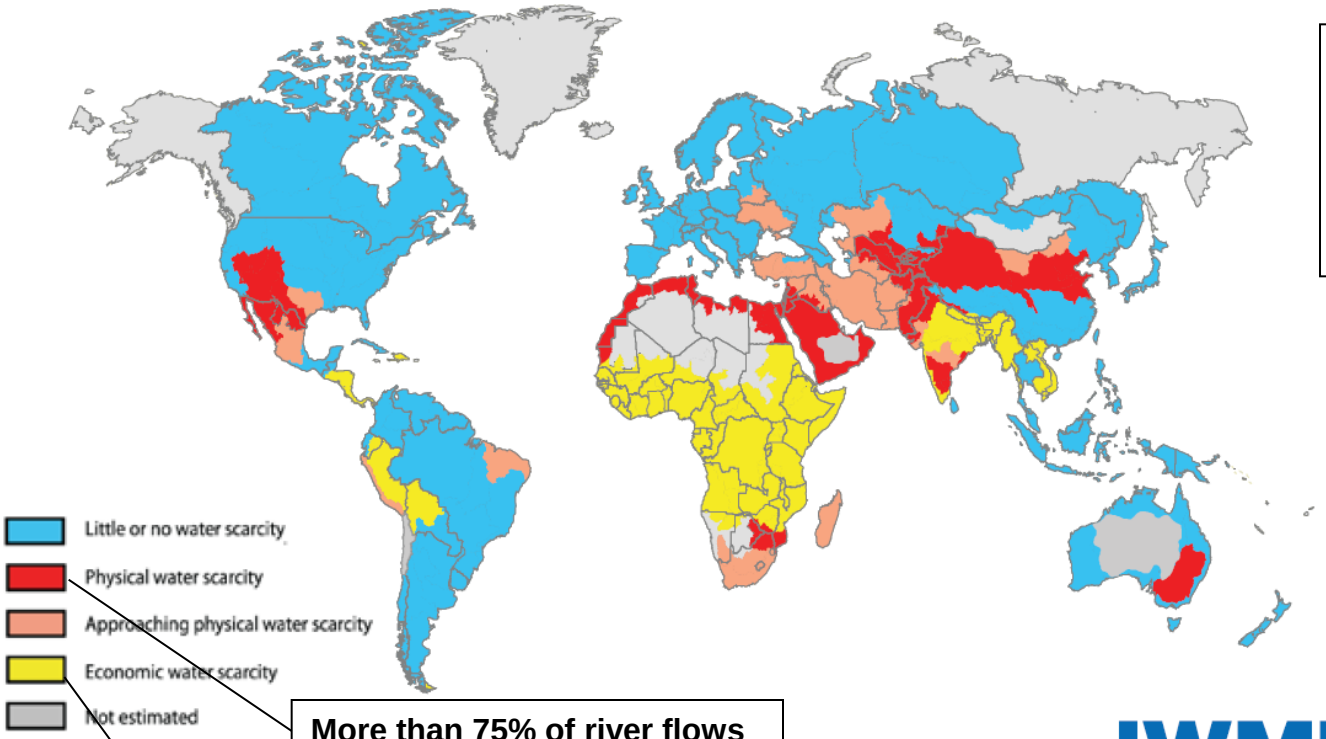
Nexus snapshots

- Global water demand (in terms of water withdrawals) is projected to increase by some 55% by 2050 (WWDR 2014)
- Global energy demand to grow by one-third by 2035 - with fastest growth in Asia at 2.3 per cent per annum. (IEA 2010)
- US & EU- 40-50 % water withdrawal for energy (Granit & Lindström, 2011).
- Food production and supply chains use 30% of total global energy demand (UNECE 2013)



Global trends and drivers

- Water scarcity: Aggregated global water supply gap, estimated to be 40% by 2030 assuming no efficiency gains



Increased climate variability intensifies existing problems

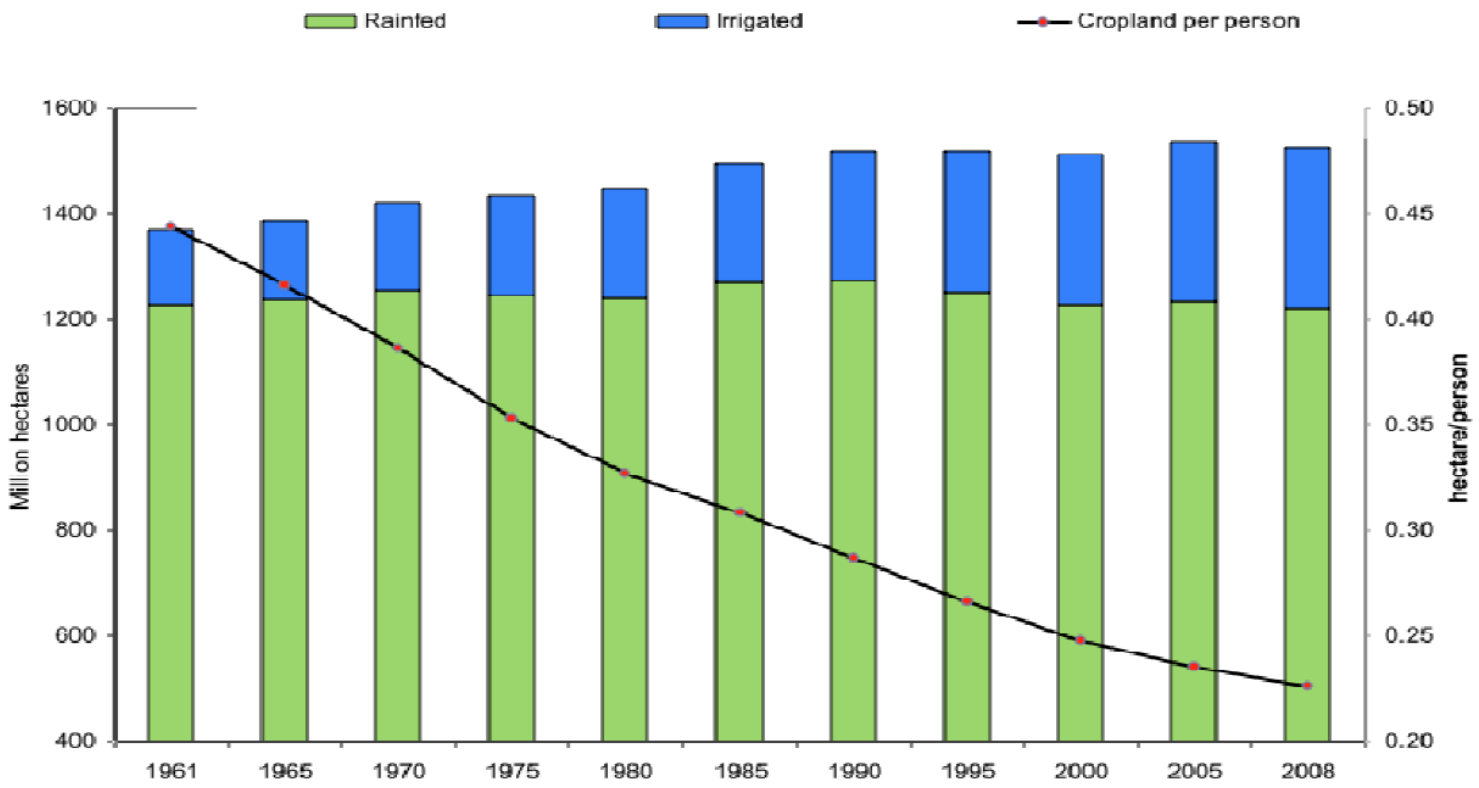
More than 75% of river flows are allocated to agriculture, industries or domestic purposes

Water resources can be abundant but lack of investment makes them unavailable for exploitation

IWMI International Water Management Institute

Global trends and drivers

- Increasing food demand – available land area for agriculture is reducing

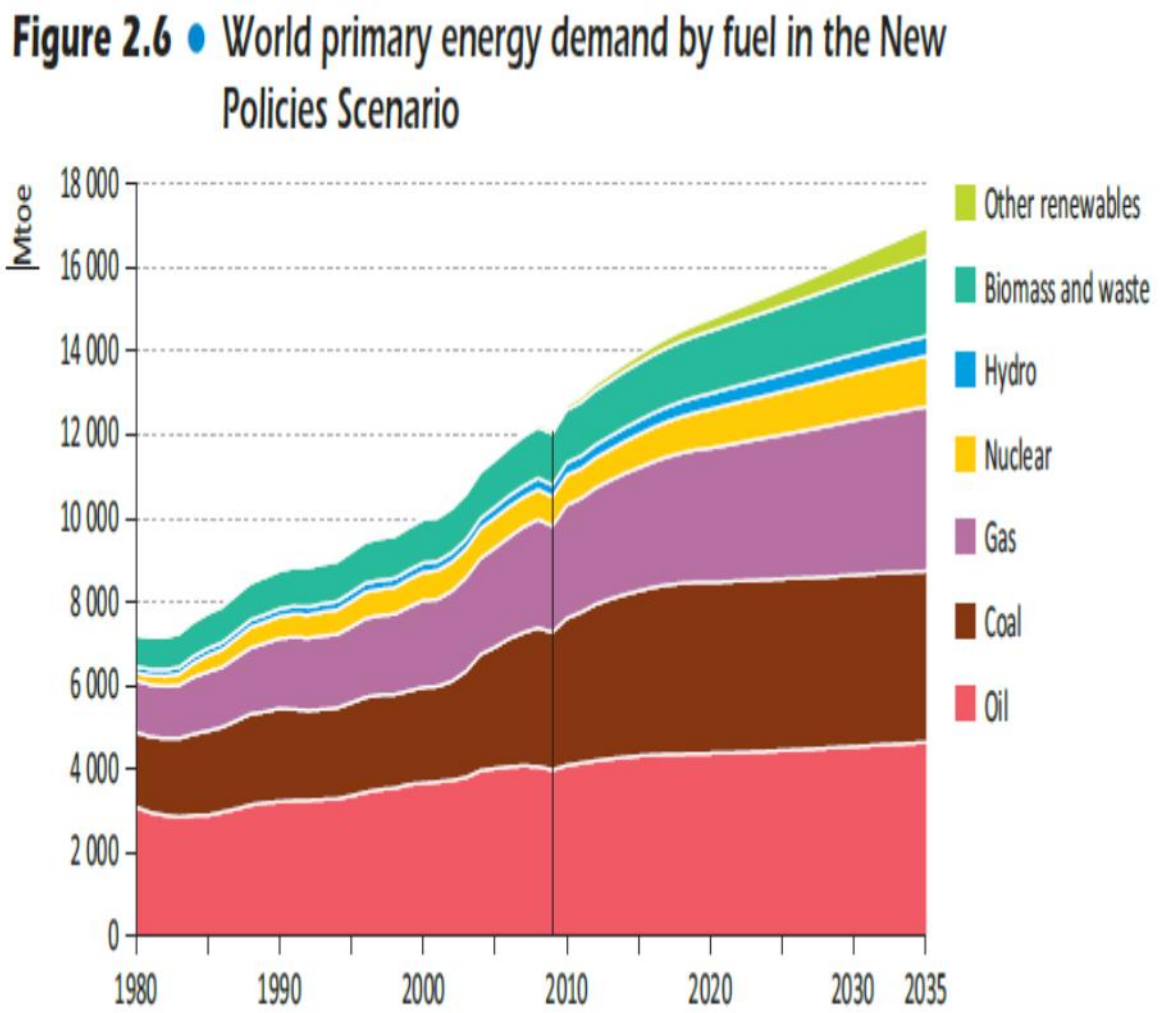


FAO, 2011

Projected energy demand - Increases by 40 % to 2035

- Oil: 18%
- Coal: 25%
- Natural gas: 43 %
- Nuclear: 70%
- RE: Grows the fastest in relative terms- little impact in absolute terms
  - Includes most water efficient options

IEA; 2012



Urbanization is driving demand for energy, food and water

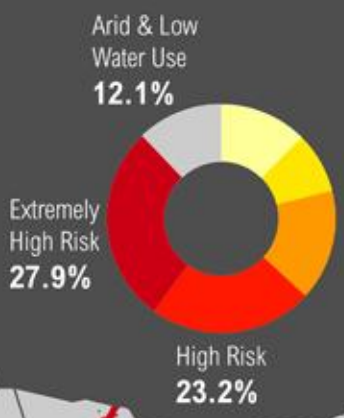
60-80% of commercial energy consumption in cities

Water needs for energy production will grow at twice the rate of energy demand.

Urban lifestyles increase consumption of water intensive foods

CHINA'S PROPOSED COAL-FIRED POWER PLANTS & BASELINE **WATER STRESS**

AQUEDUCT



Major Coal Base

Proposed Coal-Fired Power Plant Capacity (MW)

- 0 - 500
- 500 - 1000
- 1000 - 1500
- 1500 - 3000
- 3000 - 8000

NOTE

1. Baseline water stress is a measure of demand and supply for water in a given area, and is calculated as the ratio of local water withdrawal over renewable water supply.
2. The donut chart illustrates how much of China's total proposed coal-fired generation capacity sits in each water risk category.

REFERENCES

Aqueduct methodology: aqueduct.wri.org
Proposed generation capacity: www.wri.org/publication/global-coal-risk-assessment

As of July 2012, over **50%** of total proposed power generation capacity was located in areas with **high or extremely high baseline water stress**

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	Arid & low water use	Low	Low to medium	Medium to high	High	Extremely high
(Ratio: withdrawals/supply)		< 10%	10% - 20%	20% - 40%	40% - 80%	> 80%

Common Urban Nexus Challenges in China and Europe
中国和欧洲面临着共同的城市关系挑战

- Growing water and energy demand resulting from urban growth
- Coherence of energy and water policy
- Linking resource management to spatial planning
- Growing water demand for energy production
- Need for optimisation of urban infrastructure for water and energy efficiency
- Technical knowledge gap on water risks in unconvential energy

- 城市发展导致的不断增长的水资源和能源需求
- 能源和水资源政策的一致性
- 水资源管理与空间规划的关系
- 不断增长的能源生产对水资源的需求
- 优化城市水资源和能源效率基础设施的需求
- 在非传统能源水资源风险方面技术知识的欠缺

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Summary of key activities

Taihu Region Urban Water Security Programme

This program seeks to apply and develop a methodology for operationalizing nexus approach at a regional scale in the Chinese context. It will:

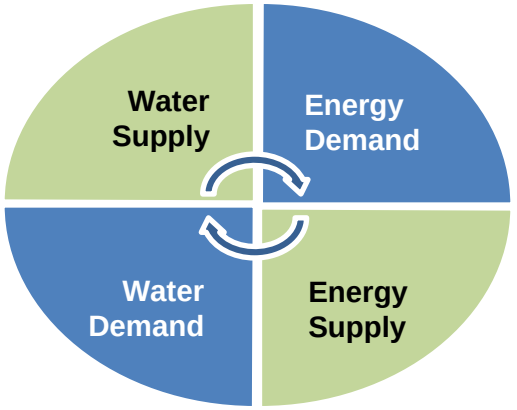
- Map and assess water and energy inter-linkages in the Taihu basin and how those are impacted by the urbanization process.
- Perform pathway and policy analysis to increase water-energy resource use efficiency
- Devise regional sustainable intensification development strategy

Managing water risks in China's energy sector

This programme will provide a systematic review and forecast on the water reserve in China's main energy bases with detailed situation, current utility condition and main feature. It will:

- Establish a quantitative model calculating the main energy bases maximum production scale considering local water carrying capacity.
- Provide policy proposal suggesting the main energy bases energy type, production methods and scale in the "Energy Thirteenth Five-Year Plan" to achieve both water and energy SDGs.

Water Evaluation and Planning System



Long range Energy Alternatives Planning

AQUEDUCT
Measuring and Mapping Water Risk

Tai Basin Urban Water Security Programme (2015-2017)

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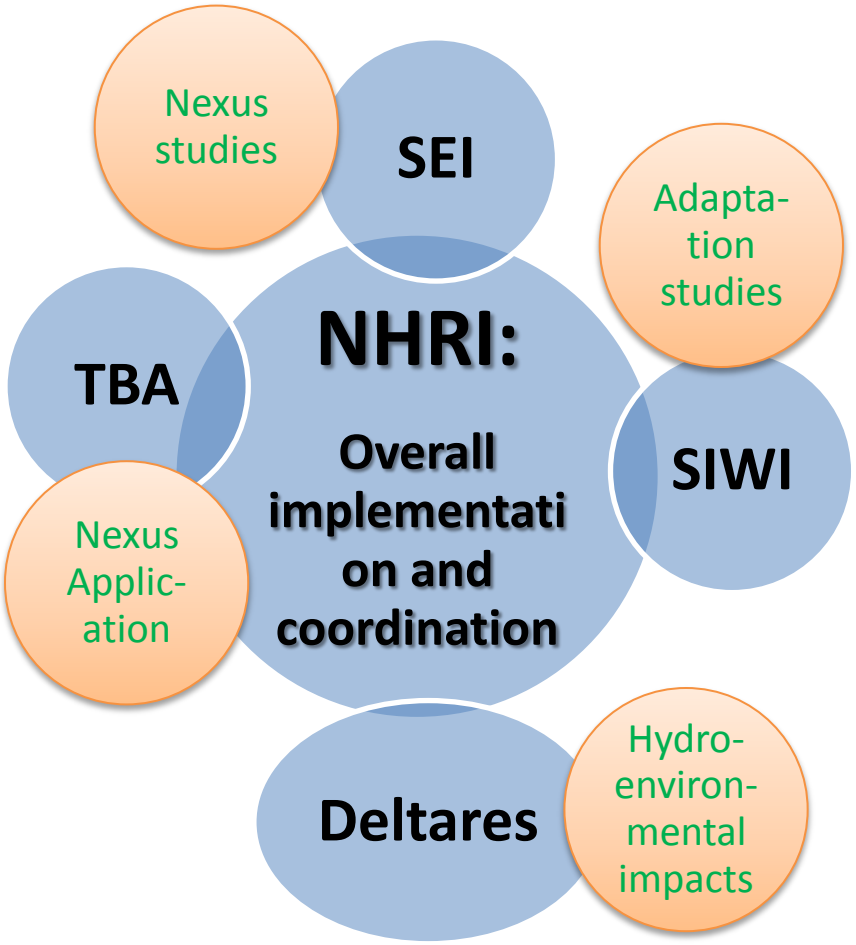
Water Evaluation and Planning System

Long range Energy Alternatives Planning

Implementation team

- **Partnership:**
  - The project will be implemented by a partnership led by NHRI. SEI will be the coordinating oversea organization. SIWI, Deltares and TBA are also important partners.
- **Project team:**
  - The project team is going to be made up by 20 specialists, of which 12 are from NHRI, 3 from SEI, 2 from SIWI, and 3 from Deltares.

- **Labor division:**



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Tai Basin Urban Water Security Programme (2015-2017)

Programme objectives:

- Assess of water-energy nexus under rapid urbanization in China which fits the country;
- Evaluate the adaptation of regional energy allocation and water supply, and search for optimized water-energy allocation strategies for sustainable urbanization;
- Provide policy recommendations for optimized water-energy allocation and usage.

Water Evaluation and Planning System

Long range Energy Alternatives Planning

NHRI Since 1935 南京水利科学研究院 SEI SIWI TBA

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Tai Basin Urban Water Security Programme (2015-2017)

Expected Outputs:

- Analytic system of planning and management of water-energy nexus;
- Forecast and assessment of hydro-environmental impacts of point-group energy distribution
- Forecast model of regional water-energy nexu
- Assessment system of water-energy allocation for urbanization in China.

Planned cooperation activities:

- Annual seminars and workshops
- Published papers and patents;
- Regular staff exchange, and 3-5 PHD/Master students.

Water Evaluation and Planning System

Long range Energy Alternatives Planning

NHRI Since 1935 南京水利科学研究院

SEI

SIWI

TBA

Tai Basin Urban Water Security Programme (2015-2017): Timeline

YEAR 1 (04.2015-03.2016): Context and background analysis – understanding the water-energy nexus

- One workshop in Europe and one in China
- Background report on the changing water-energy nexus in the Taihu basin from 1980 to 2010 (or with the most year with data)
- Two research papers

YEAR 2 (04.2016-03.2017): Water-energy nexus scenario analysis: Identifying sustainable intensification pathways, nexus innovation, policy and technology solutions

- One workshop in Europe and one in China
- Research report on water-energy nexus scenario analysis and sustainable development pathway for the Taihu Basin
- Four research papers

YEAR 3 (04.2017-03.2018): Synthesis, communication and dissemination

- Synthesis report on an operational approach for water and energy nexus research in the context of urbanization.
- Knowledge exchange and dissemination
- One workshop in Europe and one in China
- Two research papers

Water Evaluation and Planning System

Long range Energy Alternatives Planning

水专项规划案例分享

Cases of water special plan

Case Studies – Qingdao Water Energy Nexus

案例研究-青岛水和能源纽带

英国 驻华大使馆

Qingdao DRC

Qingdao Water resources Department

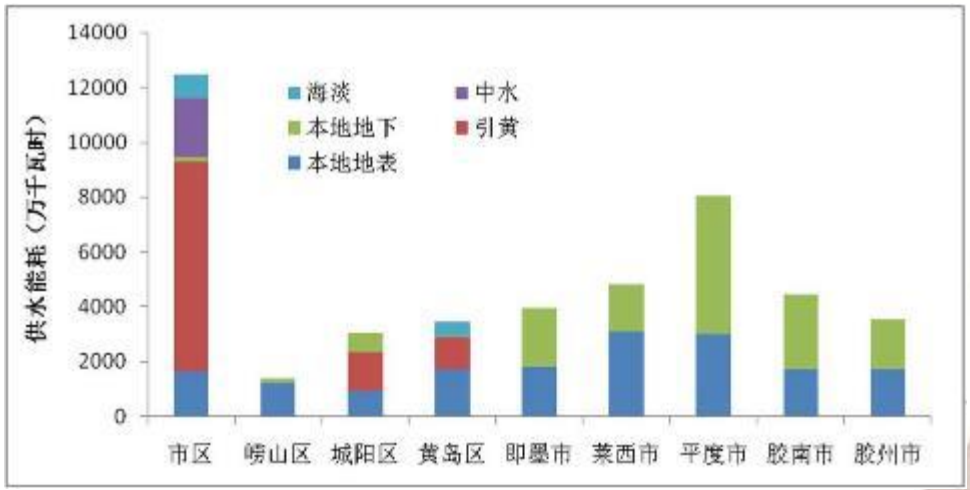
Plan Design Enable

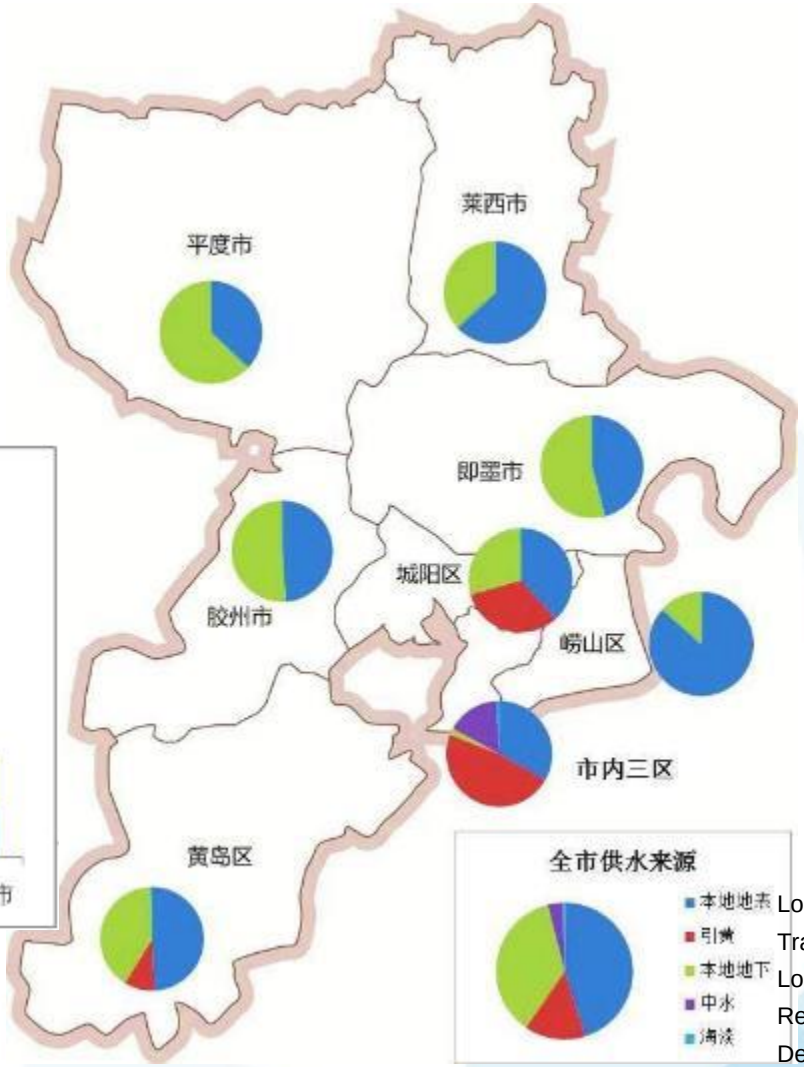
Qingdao: Water Use 2011
青岛：2011年水利用

1. Understand city Water resources

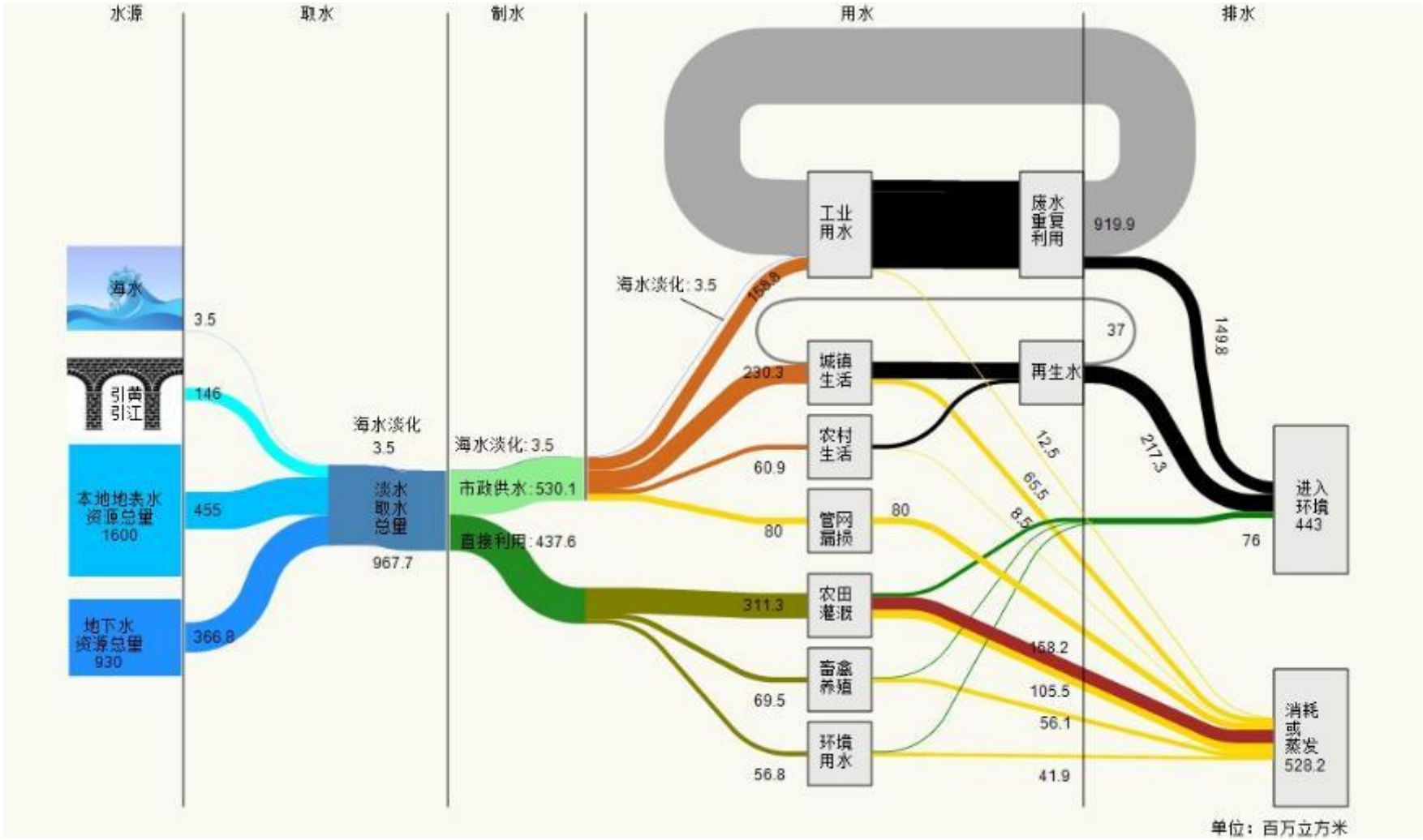
40% of local water resources has been exploited for the city. water supply.

该城市**40%**的当地水资源已经被消耗掉。





Qingdao: Sankey Diagram - Water Use 2011
青岛市2011年水源分配与利用桑基图



城市供水：非传统水资源的利用带来城市供水能源强度的迅速增长（青岛）

Water Supply: Increased energy intensity with the use of non traditional water resources

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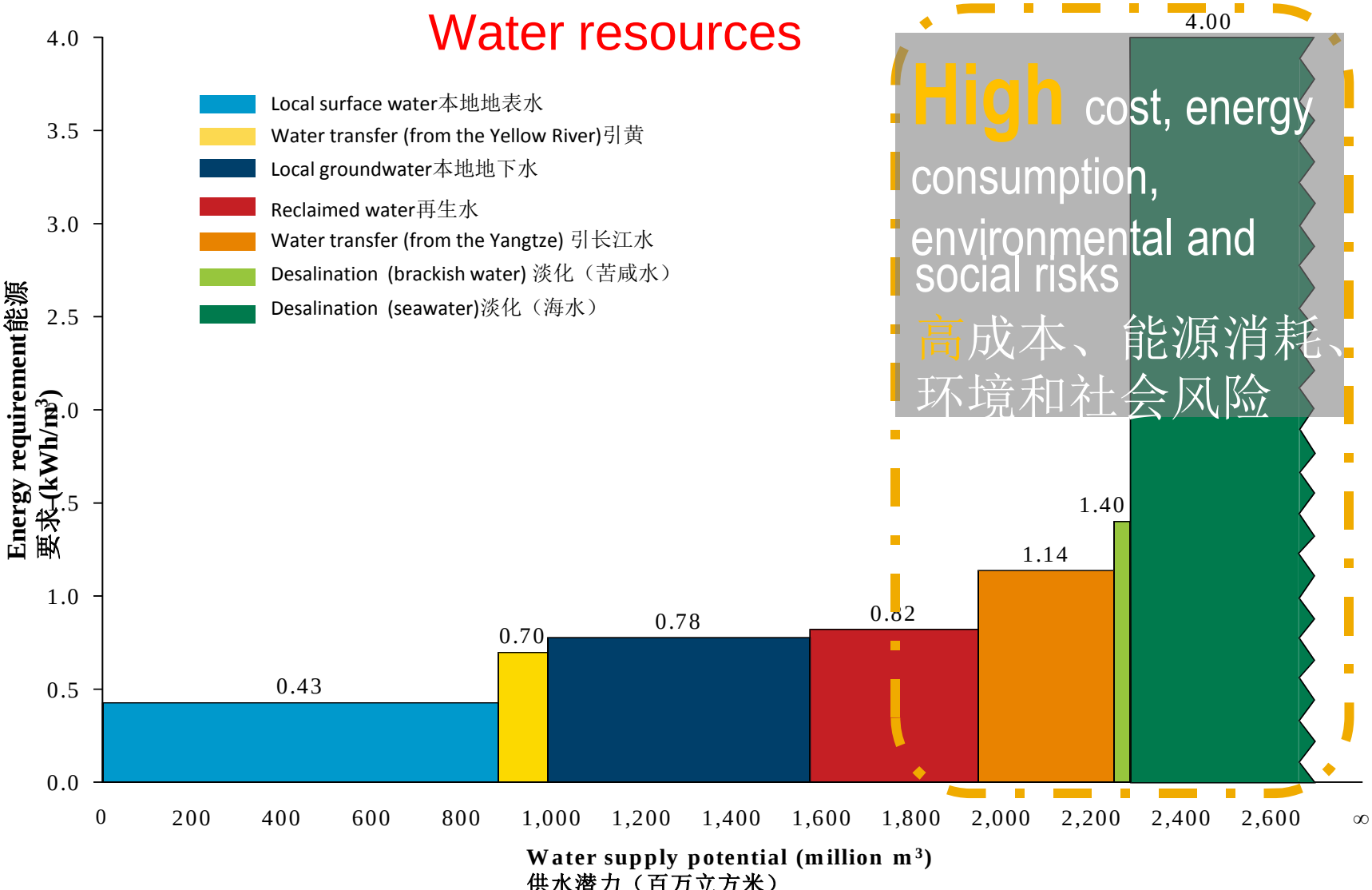
2. Energy associated with Water resources



High cost, energy consumption, environmental and social risks

高成本、能源消耗、环境和社会风险

Example: Energy Requirements of Different Scenarios
举例：不同情景下的能源要求

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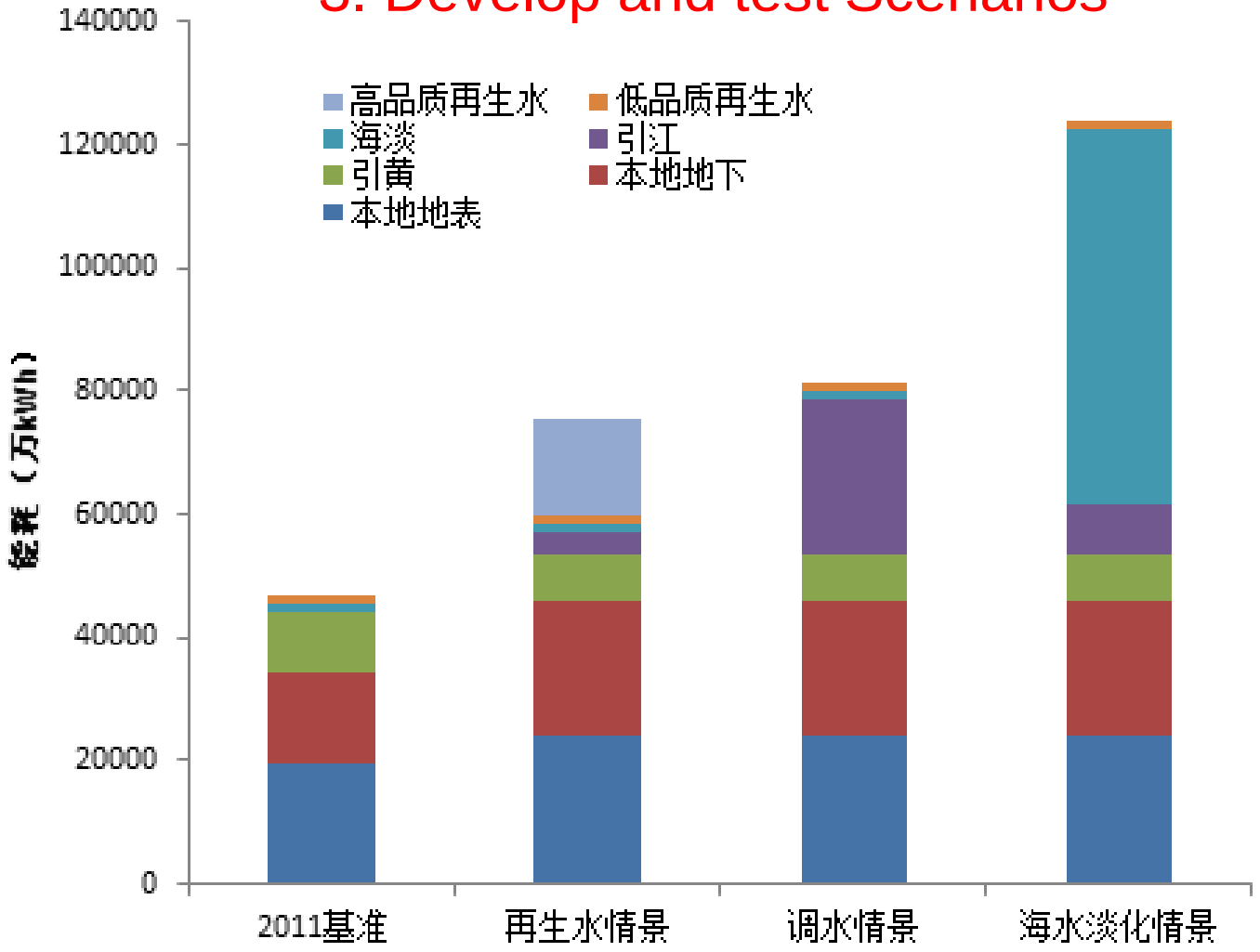
3. Develop and test Scenarios



Recommendations建议

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- To meet future demand Qingdao must exploit unconventional water resources 为满足未来需求，青岛必须利用非传统水资源
  - long-distance water diversion, 长距离输水
  - reclaimed water, 再生水
  - seawater desalination. 海水淡化
- The Choice of water source allocation will have a direct impact on the energy consumption and carbon emissions
- 水源分配的选择会直接影响能源消耗和碳排放
- Wastewater recycling the most energy efficient option
- 废水回收再利用是能源效率最好的方案
- Alternative is to take from farming, with social and economic consequence
- 替代方案是占取农业用水，但是会带来社会经济后果

Achievements and Next Steps
成果和下一步工作

Achievements:

- Partnership agreements between multiple parties
- 2 programmes in progress, 1 completed
- 1 research programme submitted to Chinese Ministry of Science and Technology to begin in January 2015
- Water energy nexus scoping case study performed in Ningxia
- Workshops and knowledge exchange on nexus

Plans:

- Urban Water Security Governance Programme, October-November 2014
- Taihu Regional Urban Water Security Programme Inception (2015-2017)
- Policy proposal for 13th 5 year plan for Energy to achieve water and energy SDG (March 2015)
- Staff and technical exchanges between partners (Spring 2015)

成果：

- 多个合作方之间的合作协议
- 2个项目正在进行中，一个已经完成
- 1个将在2015年1月开始的研究项目已经提交给了中国科学技术部
- 在宁夏进行了水资源-能源关系调查案例研究
- 关于欧盟和中国合作关系的研讨会、介绍和知识交流

计划：

- 城市水资源安全治理项目，2014年10月-11月
- 启动太湖地区城市水资源安全项目（2015年-2017年）
- 为实现水资源和能源可持续发展目标提出“十三五计划”政策建议（2015年3月）
- 合作方之间的人员和技术交流（2015年春季）

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完整的参与机构列表：
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