Utilize water energy guided by New Recycle Economics

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Three Parallel River Valley of Yunnan in China

- plenty of water energy

  accounting for one-fifth of the total water energy resource of China

- small scale of agriculture and less cultivated area limited by land resources and low water level

  In 2008: total cultivated area 607.2 thousand ha

  food production 1.52 million tonne

  water for agriculture 1.52 billion m^3.

water energy ⇌ water for agricultural irrigation

balance

How to balance?

- Make full use of hydro power generation
  premise that water for agricultural irrigation is ensured
- The storage period and the irrigation period should be stagger
- Construction ecological reservoirs

"four ecological" principles:
ecological planning ecological design,
ecological construction ecological operation

Utilize water energy Develop local economy

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- A typical case of water energy utilization in China
- 5R concept of New Recycle Economics and its application in water energy utilization
- “Four ecological” principles for construction of reservoirs
- International effects of water power station construction

❖ A typical case of water energy utilization in China

Three Parallel River Valley

General situation and characteristics

- are major rivers in China from view of length and annual runoff

the Jinsha River:

annual runoff 41.6 billion m^3

the Lancang River (abroad part named as Mekong River)

flowing abroad: average annual runoff 73.81 billion m^3

mainstream length 2153 km, valley area 164,000 km^2

in Yunnan: mainstream length 1170 km

valley area 92000 km^2

the Nu River (abroad part named as Salween)

flowing abroad: average annual runoff 70.97 billion m^3

in China: mainstream length 2020 km, valley area 126,000 km^2

within Yunnan Province: length 619 km, valley area 34000 km^2

Special physiognomy of three rivers

- three parallel rivers:

  the nearest distance only 20 km

  the longest distance not more than 80 km

- large fall and rich in water energy resources

the Jinsha River: fall 3000 m (the part above Stone Drum)

the Lancang River: fall 4583 m (in China)
fall 1780 m (the part in Yunnan)
the Nu River: fall 4848 m (in China)
fall 1131 m (the part in Yunnan)

almost all the fall of all the branched of the three parallel rivers is more than 1000 m.

- locate in high mountain valleys, difficult to use the water for agricultural irrigation

- listed in The World Natural Heritage

- **An inevitable choice for regional economic development ------ hydro power**

  - Small water consumption

the Lancang River in Yunnan is 2.19 billion m^3,
accounting for only less than 4.0% of the annual runoff,
the annual water consumption per capita is 369 m^3,
88% of the average level of China.

the Nu River in Yunnan is 0.84 billion m^3,
accounting for only less than 3.0% of the annual runoff,
the annual water consumption per capita is 288 m^3,
69% of the average level of China.

the Jinsha River are even lower.

- less possibility to improve water utilization efficiency

maximum reservoir draft rate to maintain a good ecological system: 40%, for the three rivers, it is only less than 4%.

water consumptions per capita are less than the average level of China

⇒ improve water utilization efficiency is necessary but limited by

land resources and low water level:

less flat field

only small dams

impossible to develop to be Medium or large cities

- unable to develop shipping industry, difficult to put forward tourism

large fall, narrow, rapid flow, more bays and dangerous beaches

- large ships can not navigate through in long-distance

good climate and natural scenery, not too high altitude,
but inconvenient land transport, far distance between tourist spots

- impossible to develop large scale tourism

- Difficult to develop other industries

no mineral resources in large scale or easy to exploit

local technology and education is laggard

- impossible to develop mining industry or high-tech industries

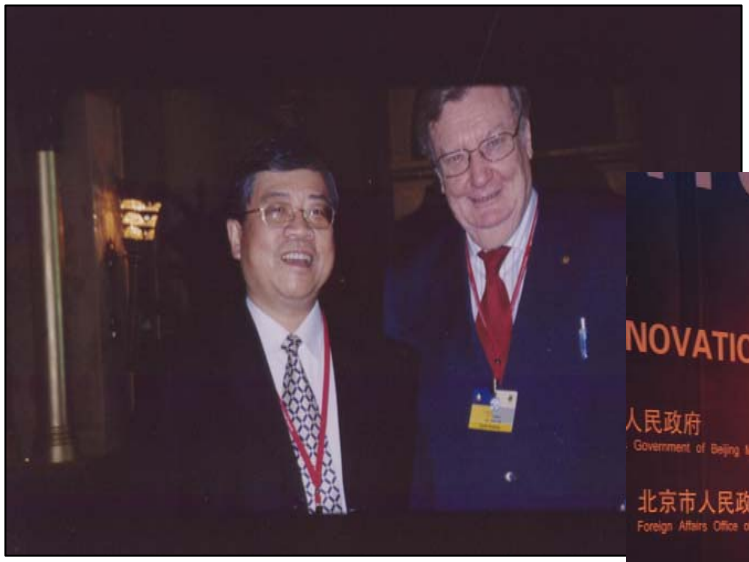
❖ 5R concept of new recycle economics and its application in the use of water energy

The new conception of “5R” was promoted for the first time in the “Festival of Thinkers” from March 26 to 29, 2005 organized by the Ministry of Education of United Arab Emirates Country.

the first on the left is Prof. Wu

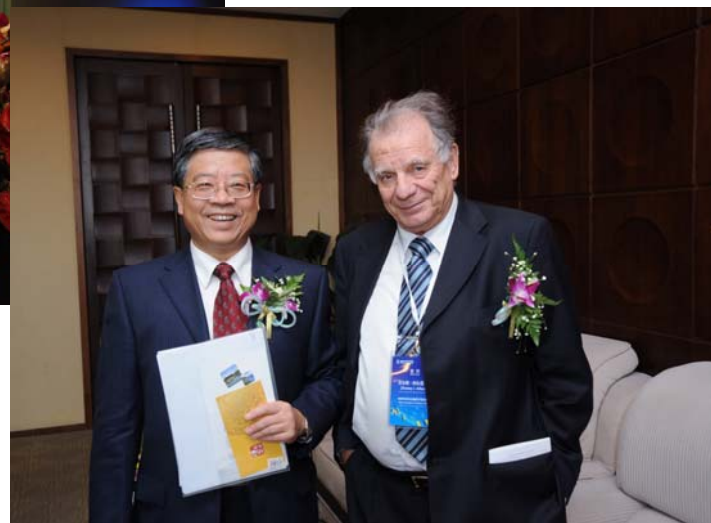
Local report for the “Festival of Thinkers”

The conception of “5R” achieved common acknowledgement in the “Festival of Thinkers” and also the Nobel Laureates Beijing Forum 2007, 2008 and 2009.



Prof. Wu (the left) and Dr. C. Rubbia, Physics Nobel laureate

Prof. Wu in the Nobel Laureates Beijing Forum 2007

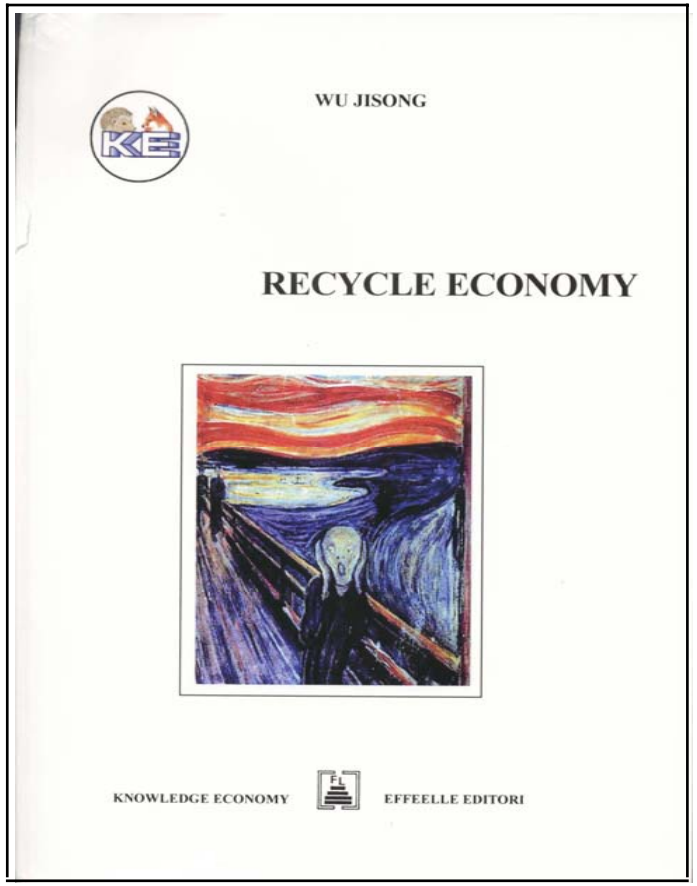


Prof. Wu (the left) and Dr. Z. Alferov, Physics Nobel laureate

Interviewed by king of Sweden (the right), Chairman (the second from left) Mrs. Lena and President (the left) Dr. B. O. Nilsson of Royal Swedish Academy of Engineering Sciences (IVA) in the IVA Annual Meeting 2009.

Mrs. Lena introduced me in the meeting as:

- Proposed Knowledge Economy
- Extended and innovated Recycle Economy
- Presided the first group of ecological repair in China



New Recycle Economics: Chinese Economics

--- new concept of “5R” (Chinese and English Version)

Tsinghua University Press, 2005.

Italian Effeelle Editori, 2006.

- Rethink- Innovate economic theory guided by scientific view of development

researches mainly the relationships among social economics, science and technology and the ecosystem

the recycle of capital, labor and natural resources;

social fortune and natural fortune

Application in water energy:

view from large-scale system of society, economy and resources, ensure not only food production, region economic development, but also the utilization of new energy.

- Reduce- Set up new value viewpoints that are in harmony with nature

reduce the demand of material within reason

“satisfy the needs, not the desire”

“rational demand” was prompted.

Application in water energy:
construction of water energy engineering should build up the concept of harmony with nature, rather than change the natural ecosystem using unrestrained engineering;
while agricultural irrigation should take water-saving measures;
and the storage period and the irrigation period should be stagger.

- Reuse- Build the new viewpoint of resource optimization

emphasize the comprehensive use of resources,
make full use of renewable resources
depend on rich and renewable resources

Application in water energy:
distribute water to downstream to ensure the quantity of water intake, 40%,
do not change the river morphology.

- Recycle- Build the new viewpoint of ecology recycle industry

waste is a resource, a resource which is often handled in an improper way in an improper place at an improper time,

construct ecological industry chains

Water energy is a renewable and clean energy, so the use of hydro power generation is an excellent application of Recycle in water energy.

- Repair- Establish the new development viewpoint of repairing the ecosystem

  the ecosystem is not only the basis of social fortune but also the second fortune.
  the targets of production are not only to create social fortune, but also to maintain and repair ecosystem and reach harmony with nature.

Application in water energy:
make full use of hydro power generation at the premise that water for agricultural irrigation is ensured;
protect, maintain, and repair the natural ecosystem;
construct water conservation forests in the upstream and maintain ground vegetation system in the downstream.

❖ “Four ecological” principle for construction of reservoirs

Constructing a water reservoir is bound to change the surrounding ecosystem, however, it is not bound to be a negative one.

The key lies in what sort of guidelines are applied, where and how the reservoir is constructed, and which kind of reservoir is built.

It is quite possible to build ecotypic water reservoirs.

The reservoir construction in the three parallel rivers:

guided by the New Recycle Economics

follow the "four ecological" principles:

ecological planning, ecological design,

ecological construction, ecological operation

achieve three wins of economic development,

ecological protection

and international harmony

Ecological planning

Expand the positive effects of the reservoir construction on the ecosystem and reduce and repair the negative effects, so as to repair the ecosystem ruined by human activities.

In all the period of the year, especially during low water period, the flow reduction due to the stagnant function of cascade power station should be less than 15%

The distribution of rainfall during one year is very uneven in the three rivers valley. The rainfall from May to October accounts for 75% of the total rainfall.

So it is worth to pay more attention to the maintenance of ecology during the low water period.

- Minimize the cultivated land submerged by water from the reservoirs and the migration population

According to the reservoirs construction plan of the three rivers:
the migration population is 288000,
accounting for 3.1% of the total of the region,
the cultivated land submerged by water is about 30000 hectares,
accounting for 1.7% of the total of the region.

So the plan is within the allowable scope of ecology.

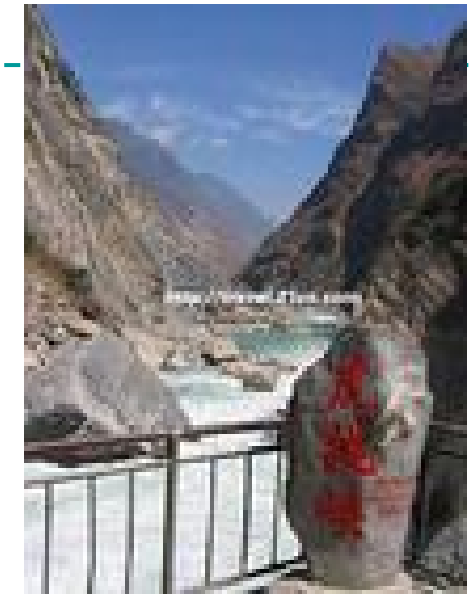
However, the migration must be settled appropriate.
The key is the capacity of sustainable development after resettlement.

devote compensate and combine with policy to support the tourism development

- Protect the World Natural Heritage and other cultural relics

✓ Within the reasonable stated scope of the Three Parallel Rivers World Heritage Site, retain a section of original river and construct no or less power stations.

✓ protect Tiger Leaping Gorge of Jinshajiang and the natural and cultural sites such as the channel from China to Myanmar and India



- Strategy for the water self-purification capacity reduction caused by slow flow after reservoir construction

The water flow will be slowed after reservoir construction which will reduce the capacity of water self-purification.

✓ the ecology compensation should be included in the water price, and

✓ construct sewage treatment plants using the obtained funds to maintain natural ecosystem.

Ecological design

Design specific facilities and implement the ecological principles.

- Reservoir water level
  - ✓ make balance between economic benefit and ecological impacts
  - ✓ minimize ecological impacts.

- Construct fish channel
  ensure the seasonal migration

- Sand flushing
  - ✓ design sand flushing facilities
  - ✓ ecology compensation should be concluded in the water price and the obtained funds should be used for vegetation construction to reduce the sand sediment.

Ecological construction

Follow the principle of maintaining the ecology system as far as possible and civilized construction.

- Minimize the construction area and damage to vegetation
  - ✓move away the dust avoiding the areas expansion of vegetation damage
- Avoid the construction of new facilities
  - ✓For example, roads must be built for the transport, but the construction should utilize the former roads.
  - ✓reduce the construction of tabernacles as far as possible

- clean-up the vegetation based on forest of the reservoir area remove temporary buildings and restore the vegetation or make compensation for this after construction.

Ecological operation

Follow the ecological principles during the operation of power generation after the construction of reservoirs.

- Ensure the normal operation of ecology maintenance facilities such as fish channel
- Ensure the water flow of the rivers during low water period
- Transfer water during operation to flush sand to reduce the sand sediment in the reservoirs and natural river

International effects of water power station construction

- Maximum reservoir draft rate in the upstream to maintain a good ecological system: 40%.

  for the three rivers valley, it is only less than 4%

- The construction of water reservoir will effect the flow in different period, so no matter in the water storage or release period, the draft rate should be less than 40%.

- It must come to an agreement that the water storage period in the upstream and the water use period in the downstream must be staggered.

- Having field studied the countries in the downstream of the Liancangjiang River, such as Burma, Thailand, Laos and Cambodia. The water shortage is mainly due to the downstream water overuse.

❖ Conclusion

- guided by the New Recycle Economics
- implement the "four ecological principles"
- construct new type of hydropower station

➢ promote the local economic development and reduce the negative effects on ecology

➢ construct ecological reservoirs and achieve the harmonious development between human and nature

Thank you!