Hydropower
Hydro energy comes from waves and rivers, it can be used and transformed into electricity.

Hydropower is a renewable energy, because the water system of earth has continuous cycle.

Hydropower is a kind of clean, non-polluting energy with low cost operation.
Hydropower

- It is not like solar energy and wind power; it can produce electricity 24 hours per day, and has little impact on the Environment.

- All of the Hydropower systems need a long-lasting and continuous flow of water sources.

- Mini and Micro Hydel Plants
  
  A. Micro Hydel: capacities up to 0.5 MW
  
  B. Mini Hydel: capacities up to 50 MW

** Water is an inexhaustible, precious natural resource in building Hydropower stations.
World renewable energy supply capacity by the end of 2008 (units: GW)

- Hydropower supplies about 51.6% of world’s electricity among the renewable energy resources that can generate electricity.
Characteristics of Hydropower

- **Can save Natural Resources**: coal, oil and uranium, and other valuable non-renewable mineral resources.

- **Clean energy source**: It does not produce any greenhouse gas emission / it does not emit any harmful gases, dust or ash. It has no nuclear radiation pollution.

- **High efficiency**:
  - The hydropower efficiency is about 80%
  - The thermal power plants is only 30% - 50%

- **Low cost of production**: There is no need to purchase, transport and storage the fuel. It just needs less operators, higher labour productivity, simple operation, and higher operational reliability.

- **Multi Purpose Use**: Hydropower station can be applied in comprehensive utilization, such as flood control, irrigation, shipping, urban and rural life supply water, aquaculture, tourism and other tasks, in order to receive optimal benefits in the development of economy and society.
Development of Hydropower issues

Advantages

a. **Economics**

The major advantage of Hydropower is elimination of the fuel cost, immune to fossil fuels, such as oil, natural gas and coal with low construction and operating labour cost. The dam serves as multiple purposes.

b. **Greenhouse gas emissions**

Hydropower station does not burn fossil fuels, they do not directly produce carbon dioxide (a greenhouse gas). While some carbon dioxide is produced during manufacture and construction of the project, this is a tiny fraction of the operating emissions of equivalent fossil-fuel electricity generation.
Development of hydropower issues
Disadvantages

a. **Damage to the environment**

Hydropower projects can damage surrounding or downstream ecosystems of the plants. It can lead to scouring of river beds and loss of riverbanks. In addition, it also has impact on birds. Since building dam for agricultural and energy use, many native and migratory birds have become increasingly endangered.

b. **Population relocation**

Hydropower station has the need to relocate the native people, whose history and culture sites may be flooded and lost. Such problems have arisen in the Three Gorges project.
According to Electric Power Survey report, the demand is increasing by 8.21% per year. But there is no change in the supply.
ANDHRA PRADESH & TELANGANA
Resources In India, power generation is largely dependent on coal, gas, and hydroelectric sources.

Non-conventional sources of energy such as wind and solar energy, account for a small share of the total installed capacity.

Our country depends on Thermal power (57%). Next to thermal comes Hydel Power (19%), renewable energy for 12% and natural gas for about 9%
India currently suffers from a major shortage of electricity generation capacity.

The International Energy Agency estimates India will add between 600 GW to 1200 GW of additional new power generation capacity before 2050.

Continuous usage of natural resources may complete within 200 years. Till now we completed 60% of it.

Top most developed economies are effectively using Atomic & Hydel Power.
Power Generation Capacity in India by end of 11th Plan

<table>
<thead>
<tr>
<th>Source</th>
<th>Central</th>
<th>State</th>
<th>Private</th>
<th>Total</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro</td>
<td>8654</td>
<td>3482</td>
<td>3491</td>
<td>15627</td>
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<tr>
<td>Thermal</td>
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<td>23301</td>
<td>11552</td>
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<tr>
<td>Nuclear</td>
<td>3380</td>
<td>-</td>
<td>-</td>
<td>3380</td>
<td>4.3</td>
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<tr>
<td>Total</td>
<td>36874</td>
<td>26783</td>
<td>15043</td>
<td>78700</td>
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<tr>
<td>Share (%)</td>
<td>46.9</td>
<td>34</td>
<td>19.1</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
Hydro power in the world

Hydroelectric Generation by Country, 2011
(Billion Kilowatt-hours)

China: 694
Other: 1,018
Brazil: 430
Canada: 377
United States: 328
India: 217
Russia: 165
Japan: 85
Norway: 122
Venezuela: 84
Sweden: 66

Total: 3,498 Billion Kilowatt-hours

Source: BP

Earth Policy Institute - www.earth-policy.org
The proportion of hydropower in some countries’ total electricity

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Canada</td>
<td>96.3</td>
<td>92.3</td>
<td>76.6</td>
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<td>63.0</td>
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<tr>
<td></td>
<td>Italy</td>
<td>92.7</td>
<td>92.7</td>
<td>37.5</td>
<td>26.7</td>
<td>14.8</td>
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<tr>
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<td>Japan</td>
<td>85.2</td>
<td>58.0</td>
<td>22.8</td>
<td>16.0</td>
<td>11.0</td>
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<tr>
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<td>France</td>
<td>48.7</td>
<td>55.9</td>
<td>40.2</td>
<td>28.4</td>
<td>13.0</td>
</tr>
<tr>
<td></td>
<td>United States</td>
<td>25.9</td>
<td>17.7</td>
<td>15.3</td>
<td>12.0</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>Norway</td>
<td>99.7</td>
<td>99.3</td>
<td>99.4</td>
<td>99.8</td>
<td>99.6</td>
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<tr>
<td></td>
<td>Sweden</td>
<td>95.4</td>
<td>89.5</td>
<td>68.5</td>
<td>64.3</td>
<td>50.3</td>
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<tr>
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<td>Brazil</td>
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<td>80.4</td>
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<td>87.0</td>
<td>96.0</td>
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<tr>
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<td>36.7</td>
<td>39.0</td>
<td>41.3</td>
<td>37.5</td>
<td>26.3</td>
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<tr>
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<td>China</td>
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<td>12.5</td>
<td>17.7</td>
<td>19.4</td>
<td>20.3</td>
</tr>
<tr>
<td></td>
<td>World</td>
<td>35.6</td>
<td>29.0</td>
<td>23.5</td>
<td>21.3</td>
<td>18.4</td>
</tr>
<tr>
<td>Sl. No</td>
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<td>Net Generation</td>
<td>Country</td>
<td>Net Consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------</td>
<td>----------------</td>
<td>----------------------</td>
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<td>Europe</td>
<td>947.62524</td>
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<td>China</td>
<td>770.919</td>
<td>China</td>
<td>770.919</td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td>Central &amp; South America</td>
<td>736.09638</td>
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<td></td>
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<td>5</td>
<td>Brazil</td>
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<td>6</td>
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<td>427.37601</td>
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<tr>
<td>7</td>
<td>Canada</td>
<td>366.416</td>
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<td>366.416</td>
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<tr>
<td>8</td>
<td>Eurasia</td>
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<td>246.87</td>
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<td></td>
</tr>
<tr>
<td>9</td>
<td>Russia</td>
<td>168.101</td>
<td>Russia</td>
<td>168.101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>India</td>
<td>135.271</td>
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<td>135.271</td>
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</tr>
<tr>
<td>11</td>
<td>Norway</td>
<td>117.766</td>
<td>Norway</td>
<td>117.766</td>
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</tbody>
</table>
Growth in hydropower installed capacity in India & China (billion kWh)
China's installed electricity capacity by fuel, 2011

- coal: 65%
- hydropower: 22%
- wind: 6%
- solar: 0.2%
- oil: 3%
- gas: 9%
- nuclear: 1%

installed capacity: 1,073 gigawatts

India installed power capacity, 2011

- coal: 57%
- hydro: 19%
- biomass & other renewables: 12%
- gas: 9%
- nuclear: 2%
- diesel: 1%


Source: FACTS Global Energy
Chinese exploitable hydroelectric resources take about 378 million kW, which is equivalent to annual generating capacity of 1920 billion kWh, making up 16.7% of the world’s total amount, which is the first in the world.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Valley</th>
<th>The installed capacity million kW</th>
<th>Annual Generating capacity billion kWh</th>
<th>Nationwide %</th>
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<tbody>
<tr>
<td>1</td>
<td>Nationwide</td>
<td>378.53</td>
<td>1923.3</td>
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<td>2</td>
<td>Yangtze River</td>
<td>197.24</td>
<td>1027.4</td>
<td>53.4</td>
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<td>3</td>
<td>Yellow River</td>
<td>28.00</td>
<td>116.9</td>
<td>6.1</td>
</tr>
<tr>
<td>4</td>
<td>Pearl River</td>
<td>24.85</td>
<td>112.4</td>
<td>5.8</td>
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<tr>
<td>5</td>
<td>The Luanhe River</td>
<td>2.13</td>
<td>5.18</td>
<td>0.3</td>
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<td>6</td>
<td>The River of Northeast</td>
<td>13.70</td>
<td>43.9</td>
<td>2.3</td>
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<td>7</td>
<td>The River of southeast</td>
<td>13.89</td>
<td>54.7</td>
<td>2.9</td>
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<td>8</td>
<td>Coast The River of Southwest International</td>
<td>37.68</td>
<td>209.8</td>
<td>10.9</td>
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<tr>
<td>9</td>
<td>Brahmaputra River and other rivers in Tibet</td>
<td>50.38</td>
<td>296.8</td>
<td>15.4</td>
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<tr>
<td>10</td>
<td>Northern inland and river of Xinjiang</td>
<td>9.96</td>
<td>53.8</td>
<td>2.8</td>
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</tbody>
</table>
## Major Hydropower plants in China

<table>
<thead>
<tr>
<th>Name</th>
<th>Maximum Capacity (MW)</th>
<th>Country</th>
<th>Construction started</th>
<th>Scheduled completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three Gorges Dam</td>
<td>22,400</td>
<td>China</td>
<td>1993</td>
<td>2009</td>
</tr>
<tr>
<td>Xiluodu Dam</td>
<td>12,600</td>
<td>China</td>
<td>2005</td>
<td>2015</td>
</tr>
<tr>
<td>Longtan Dam</td>
<td>6,300</td>
<td>China</td>
<td>2001</td>
<td>2009</td>
</tr>
<tr>
<td>Xiangjiaba Dam</td>
<td>6,000</td>
<td>China</td>
<td>2006</td>
<td>2015</td>
</tr>
<tr>
<td>Nuozhadu</td>
<td>5,850</td>
<td>China</td>
<td>2006</td>
<td>2017</td>
</tr>
<tr>
<td>Jinping Hydropower Station</td>
<td>4,800</td>
<td>China</td>
<td>2007</td>
<td>2014</td>
</tr>
<tr>
<td>Laxiwa Dam</td>
<td>4,200</td>
<td>China</td>
<td>2006</td>
<td>2010</td>
</tr>
<tr>
<td>Xiaowan Dam</td>
<td>4,200</td>
<td>China</td>
<td>2002</td>
<td>2012</td>
</tr>
<tr>
<td>Jinping Hydropower Station</td>
<td>3,600</td>
<td>China</td>
<td>2005</td>
<td>2014</td>
</tr>
<tr>
<td>Pubugou Dam</td>
<td>3,300</td>
<td>China</td>
<td>2004</td>
<td>2010</td>
</tr>
</tbody>
</table>
Three Gorges Project
The Three Gorges Project is the largest water conservancy project in the world.

It is located in the middle of Yangtze River near Yichang City in Hubei Province.

The Project consists of dam, flood release structures, power stations, and navigation structures with the full functions of flood control.

The total storage capacity at normal pool level (NPL) at 175m of the reservoir is 39.3 billion m$^3$ (1387 TMC).
Three Gorges Project

- Started in 1993 and completed in 2009.
- Length of dam 2309.47m
- Height of Dam: 185m
- Spillway Length: 483m
- Bottom Out Lets – 23 Nos. (7M x 9M)
- Surface Sluice Gates – 22 Nos. (8M x 17M)
- Type of Dam: Concrete Gravity Dam
- Maximum Discharge Capacity – 1,02,500 m3/sec.
Three Gorges Project

- The installed generating Capacity is **22,400MW**, (the largest hydropower station in the world) (26x 700MW + 6x 700MW).
- Power Plants – 02 Nos. (Left – 26 x 700 MW & Right 6 x 700 MW – Total – 22,400 MW).
- Navigation – Ship Lock: Five Stepped Flight Locks each 280 x 34 x 5m capable of passing 10,000 Ton Barge fleet.
- Ship Lift: One Stage Vertical Hoisting type, capable of carrying 3,000 Ton capacity – Height of Lift – 113M.
The total inundated land by the TGP Reservoir is 632 km². 24.5 Hectares Farm land, 34.596 Million M² Housing area and 824.24 km road length existed in the inundated area. 846.2 thousand residents with a total population of 1.1 million people had been resettled / relocated. In view of the importance of the project the state council made a series of preferential polices to ensure the success of resettlement. The development oriented resettlement policy has been adopted by approving 40 Billion – Yuan which counts for about 45% of the total cost of the whole project.
Before starting of the project construction 8-yr pilot works for the resettlement have been carded out with investment of 237 million RMB.

Based on the experiences got from the pilot works the development orient resettlement policy has been adopted and detailed resettlement planning worked out.

The resettlement planning has arranged that about 1/3 people will move out of reservoir area and be settled in different providences.

After relocation about 60% of rural population will continue with agriculture production and other 40% need to create new job opportunities in industries and tertiary industries.
The Three Gorges Project is adopted the way of river diversion by stages and three phases in construction.

Construction and the first stage project needs to be prepared, and cut off realized is the sign during the first phase (1993-97).

The goal in the second phase (1998-2003) is to realize the initial reservoir stage, power production by the first group of units in the left power plant, and navigation in ship lock.

The goal in the third phase (2004-09) is to realize all units to be put into operation and complete all the construction work.

The total construction period is 17 years and it is completed in 2009.
Xiluodu Dam
Xiluodu Hydropower Project

- Xiluodu Hydropower Project is located by the Jinsha River.
- It is a huge project with comprehensive benefits of power generation, sediment control, and flood control with downstream navigation improvement.
- Drainage area is $454.4 \times 10^3$ km$^2$, which is 96% of the Jinsha River valley area.
- The normal water level at 600 m of the reservoir has a capacity of 12.67 billion m$^3$ (447 TMC).
- Dam is a concrete arch dam – length of 700 m with the height of 278 m.
It has nine generating units with single capacity of 700 MW. The project has a total installed capacity of 12,600 MW.

The project of the construction of Xiluodu hydropower station began in December 26th, 2005.

Total construction period has lasted 36 months to achieve the river closure in 2008.
Longtan Dam
The Longtan Hydropower Project is located in Red River, Guangxi Autonomous Region.

The Longtan Hydropower Project is one of the top-ten key projects of the Great Western Development Plan and the strategic projects of “power transmission from west to east”.

The main function is power generation, incorporated with flood control, navigation, etc.

It is designed as grade-I project structure. The project has 6300 MW of total installed capacity.
The Longtan RCC (Roller Compacted Concrete) dam has a maximum dam height, that is 216.5 m, crest length is 849.44 m, and a 3 dam-body concrete volume is 7.67 million m³.

RCC volume accounts for 64% in total, and it reaches 4.91 million m³. This is a construction breaking world record which is much higher than the existing domestic or international dam construction levels.

It has the total upgrade maximum height of the vertical ship-lifts, the total height of 179.00 m.

The new technology used in the designation work
Longtan Hydropower Project

- It used RCC dam technology to build 200 m high in seismic areas of high intensity.
- Equipped with 2-steps vertical ship-lifts, which solves the transportation problem.
- The largest span is with minimum spacing, units of the giant hydraulic transition process and so on.
- All are beyond the existing norms, comprehensively using many kinds of ways and means to design studies.
Conclusions

- With the global industrialization, the process of energy production and consumption accelerates in dramatic scale, and it results in serious environmental pollution emissions.

- The world economy can develop with the water resources of 8.8 trillion kWh/year. Fully develop and utilize alternative energy to substitute coal would reduce nearly 10 billion tons of carbon dioxide emissions a year.

- In recent years, as people around the world has become concerned about economy, population and environment construction of the hydropower station has played a big roll in the society.
The development of hydropower is one of the measures to guarantee energy supply today and tomorrow.

As you know, each coin has two sides, dam construction and hydropower development make people worry about the environmental and ecological impact.

But the advantages of the development and utilization of water resources still outweigh the disadvantages.

Scientific utilization of hydropower resources will inevitably make great contributions to the Country’s social, economic, and energy development in the future.
Every body Should feel saving power is their social responsibility. So that it will be helpful for the coming generations

One should remember that
1 Unit of Power Saved
= 2 Units of Power Produced
THANK YOU!!