

Major River Basins & Dam Overview in Vietnam

Brief on Natural Characteristics

Location.

Vietnam is situated in South - East Asia with its main land lying between north parallels 8° - 23° and east meridians 102° - 109° . It has a territory of $331,000 \text{ km}^2$ and a population of 83 mil. . The country's mountainous topography (three-quarters are mountains and hills) and subtropical humid monsoon climate profoundly affect the quantity and distribution, both temporally and spatially, of water.



Vietnam in South - East Asia

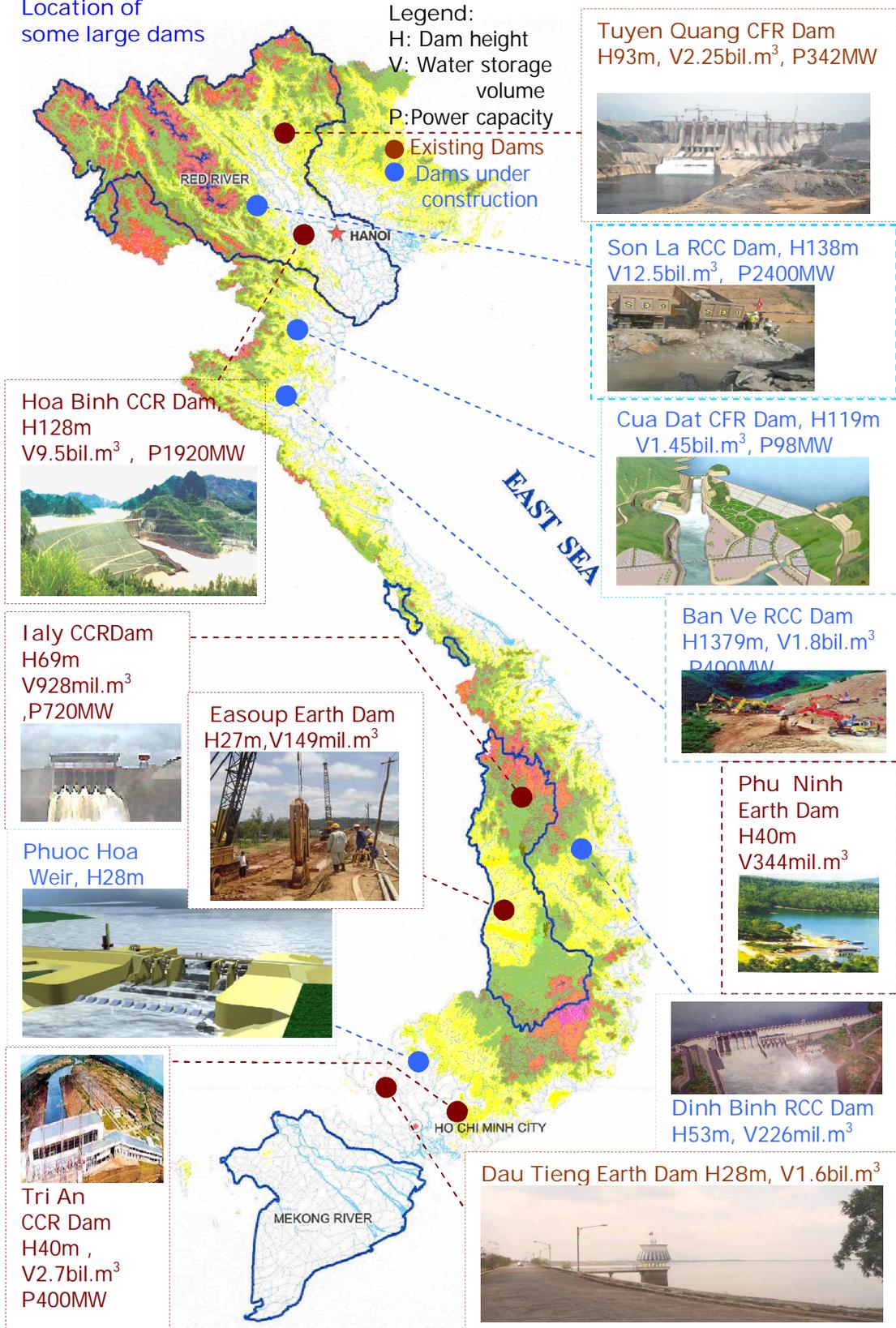
Water Resources Distribution.

Mean annual rainfall, which almost is the only source of surface flow, is about 2,000 mm; but about 75% accumulates in only three months (more than 30% usually in only one peak month). This occurs from July to September in the Northern and Southern areas and from September to December in the Central area. The mean annual runoff totals 880 billion m^3 (ranking 12th in the world), of which 70% is generated outside the border lines and flows downstream into Vietnam. The mountainous landscape offers substantial potential for hydropower and water storage.

In wet seasons this promotes rapid flood concentrations, makes heavy inundation in alluvial plains and deltas, where most big cities are located. In dry seasons, there are water shortages (the minimum monthly flow of most basins is just 1% of annual runoff) and drought, which threaten the water supply and living condition of millions people with impacts on environment, agriculture, aquaculture, etc...

Location of some large dams

Legend:
 H: Dam height
 V: Water storage volume
 P: Power capacity
 ● Existing Dams
 ● Dams under construction



General task in the water sector is flow redistribution to water storage in wet season for flood mitigation then flow promotion in next dry season by use of both construction (dyke, reservoir, weir, sluice, canal, ...) and non-construction (afforestation, inhabitant relocation, ...) measures.

Major River Basins

As for characteristics of topography and river basins, Vietnam is considered to be composed of *three regions: Northern, Central and Southern ones*

- Almost the **North Vietnam** belongs to the *Red River System Basin* of 87,000 km² (the rest is outside the border) and taking more than 15% of total runoff of the country. The Red River Delta is of 16,654 km² with a high density of population and big cities. Beside the task of power generation for the whole country, big reservoirs therein must have an important part in flood mitigation in the delta together with an embankment river dyke system, which have been built for many centuries and also directly protects the delta from floods.

- The **Central Vietnam** stretches from the North (parallel 20°) to the South (parallel 11°) and is composed of two subregions: the *East Coastland* and the *South –West Highlands*. The coastal subregion, a very narrow land strip between mountains and sea, is composed of a lot of small separate basins (the largest of them are less than 30,000 km²). They have considerable hydropower potential due to their high stream slopes as sources of the rivers are in the mountainous areas close to the coastline. This subregion faces yearly 7÷10 typhoons and tropical storms coming from East Pacific Ocean with high rainfall and flood peaks. Sources of Mekong tributaries are in the highlands. They flow towards the main stream outside the Western border. Floods and droughts usually come suddenly right after each other. This situation can be mitigated by reservoirs only in connection with power generation.

- The **South Vietnam** can be divided into two subregions. The East subregion is the *Dong Nai River Basin* (44,100 km²) with a big potential of power energy and water supply. Rapid downstream industrial and urban development (including Ho Chi Minh City) urgently raises the issue of water requirements. To the West is the downstream *Mekong Delta* of 39,000 km² in Vietnam territory only (5% of the whole Mekong basin). It takes a huge water amount about 500 bil. m³ (more than 60% of total runoff of the country). This low and plane delta yearly meets with serious challenges of big floods in the wet season and drought with salinity intrusion in the dry

one. No reservoir but many big water systems (long canals, sluices, field embankment dykes,...) for flood control, inundation mitigation, irrigation, fishery, aquaculture and water way are needed.

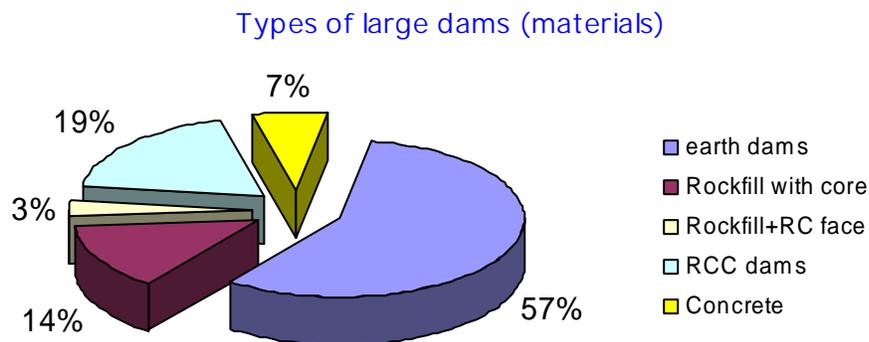
Overview of Dam and Reservoir Development

Dam History.

Vietnam has a historical tradition in making water constructions. Old earth dyke systems in the Red River Basin have been built since 12nd century. First big channels were digged in the Mekong Delta 300 years ago. Some large irrigation systems composed by weirs, canals and sluices were built in the 1920s and 1930s. More than 2500 pools (each of them has storage volume less than 5 mil. m³) and 500 reservoirs have been built. Since 1990 in the downstream Da River in North-West Vietnam (70 km to Hanoi) there has come into operation the big Hoa Binh Reservoir with its volume $V=9.5$ bil. m³ and a rockfill dam of height $H=128$ m to generate power of capacity $P=1920$ MW. Now a more enormous upstream Son La Reservoir is under construction (it is planned to operate the 1st turbine in 2009) with $V=12.5$ billion m³ and a roller compacted concrete dam of $H=139$ m to generate power $P=2400$ MW.

Types of Large Dams.

In Vietnam the largest *earthfill* dam is of $H=60$ m; *clay core-wall rockfill* (CCR) dam $H=128$ m; *concrete face rockfill* (CFR) dam $H=119$ m; *traditional gravity concrete* dam $H=46$ m; *roller compacted concrete* (RCC) dam $H=53\div 139$ m.



Beside common technical demands, the dam construction therein needs much special technical research works such as: flood frequency design; optimum combination of local material dam and spillway sizes; river diversion versus peak flood; dam material treatment;... due to natural conditions.

National Programs.

Reservoirs in Vietnam are of two categories, in which the first ones especially for energy and the other multipurpose reservoirs for combination of flood mitigation, water supply, irrigation and power generation. There are presently *3 National Programs* with more than 10 bil. USD investment being implemented in 10 years (2005-2015):

- *Program for Medium and Small Water Systems* in dispersed areas in highlands and mountains aiming at satisfying local water demand and reducing poverty;
- *Program for Large Multipurpose Water Systems* with big reservoirs ($V=0.3\div 1.5$ billion m^3) and high dams ($H=50\div 115m$);
- *Program for Large Hydro Power Plants* with high power capacity ($P=150\div 2400$ MW).

An Hong Anh (Sept. 2006)