

Hydropower: From Rivers to Oceans

With rising concerns of global warming and GHG emissions, the search for renewable energy sources has become more important than ever. Certainly, the human race has made considerable progress for such discoveries; from solar power to wind power to nuclear power- just to name a few - and the field of renewable energies is only advancing from here. Among viable energy sources lies hydropower, which despite implications of renewability and zero GHG emissions, lies a deep history of immense local environmental damage associated with traditional hydropower, which massively outweighs the surface-level benefits. Such environmental implications have made hydropower a controversial area in renewable energy topics, with traditional methods becoming more and more frowned upon by the general public. Despite its long history of environmental damage, recent technological developments have opened up a path for more sustainable alternatives and solutions, which despite recurring environmental impacts, offers a more promising renewable energy source.

Historical Background

The concept of hydropower itself is nothing new in human history, yet the commonly known conventional methods of dams and reservoirs rose in popularity during the late 19th and into the 20th century, a time where U.S. migration into the West saw significant movement with particular emphasis on agriculture and land expansion.¹ However, one particular problem of note was the arid climate of the region, a deterrent to the aforementioned hopes of agricultural land use. Suddenly, water was becoming even more of a scarce resource in a field where it was already in high demand. To combat the water problem, irrigation innovations and projects were created, including the highly common development of dams. In addition to agricultural irrigation, these dams also provided water supplies necessary to human development, as well as

¹ G. Di Baldassarre et al. (2021)

electricity in the form of hydroelectric power, among other things. Not only did this benefit the farming industry, but it also helped settlements flourish in otherwise unsurvivable conditions, providing basic utilities and economic growth.² In this period of dam development, hydroelectric power provided from dams accounted for nearly 40% of energy consumption in the U.S.,³ and it is hard not to see why it was so popular. Compared to other renewable energy sources, hydropower was considered one of the least technical, the most conventional, and the easiest to implement at the time.⁴ Economies grew as dams started to become the centerpiece of industrial and agricultural communities, following a natural supply-and-demand cycle between water sources and population needs of the time (Fig 1).

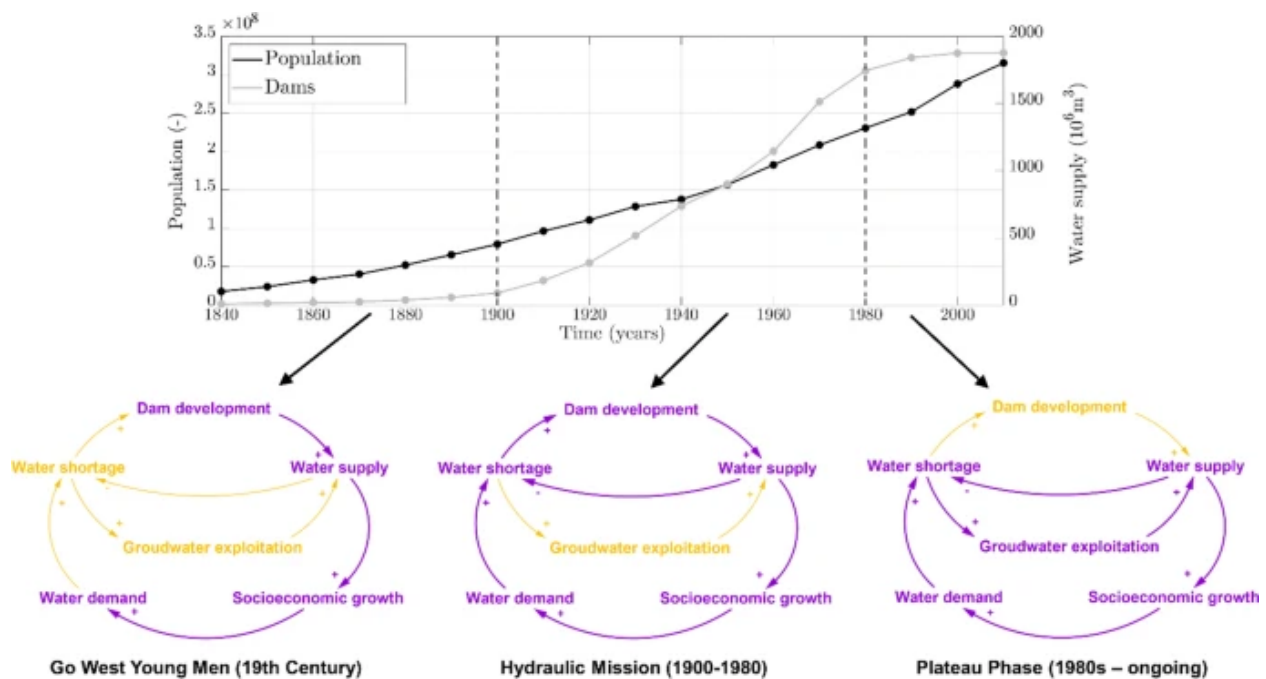


Figure 1. Temporal trends between human populations and dam development (Source: G. Di Baldassarre 2021)

² B.D. Richter, S. Postel et al. (2010)

³ E. Moran et al. (2018)

⁴ P. Gleick (1992)