Comments on Hydropower and IGCEP 2030

Submitted by civil society groups, academics and representatives of lower riparian groups

1. The hydropower component of the NTDC's Indicative Generation Capacity Expansion Plan (IGCEP 2021-30) displays an alarming trend. It indicates an increase in planned hydropower share to more than half of the energy mix. This model would make future hydropower projects the centerpieces of Pakistan's energy expansion plans. While this may be good news for the global dam industry and relevant government agencies as large-scale infrastructures are "good for business", this does not bode well for the citizen, tax payers, and future generations.

2. The hydropower projects listed in the IGCEP 2021-30 overlook and hide the various technical problems, expected cost overruns, and the social and environmental damage likely to occur due to the listed projects. If these hidden and overlooked costs are included in the planning, most of the hydropower projects do not remain economically feasible. In fact, inclusion of the likely costs will increase per unit energy production by a significant factor.

3. In this comment, we as members of Pakistani civil society, academics, and representatives of lower riparian groups, list our various reservations and focus on the technical, economic, social, and environmental problems associated with the committed and anticipated hydropower projects. Our analysis is based on well-established findings by the scientific and policy communities regarding the cost of large dams and run-of-the-river power generation.

4. We fear that if these challenges are not sufficiently addressed and alternatives are not fully explored, the shift to hydropower will create a myriad of problems including: worsening the water and environmental crises in Pakistan, increasing water distribution conflicts, destroying river and wetlands ecology, increase coastal erosion and sea intrusion, and increase the risk of severe floods that may cause tens of billions of dollars in terms of damages.

IGCEP 2021-30 Hydropower plans:

5. As per IGCEP 2021-30**,** hydropower will constitute half of the energy mix by the year 2030. The new plan makes hydropower the largest single source of power generation with a base generation of 50%, followed by fossil fuel (25%), nuclear (13%), and renewables such as wind and solar (10%). [Table E3, IGCEP 2021]

6. In terms of committed projects, hydropower share is about 60%. The list of committed projects shows that out of 69 projects that will increase the generation capacity by 22,180 MW, 23 projects are hydropower that will generate 13,161 MW [see Table 5-3].

7. Most of the hydropower energy will be generated using large dams. While the IGCEP report doesn't list the design specification of the various projects, a quick analysis shows that at least

10 of the 23 projects include large dams[1], including mega dams such as Diamer Bhasha, Dasu, Mohmand, and large dams such as Kohala, Suki Kinari, Karot, Azad Pattan, and others.

8. While the report emphasizes that most of the dams are 'run-of-the-river' with minimal environmental and social costs, most of the share of additional hydropower generation is due to large dams, with a cumulative power of 12,718 of 13,161 MW, or about 97% of new hydropower will be done through large dams.

9. The report justifies this shift to hydropower based on two arguments: environmental concerns, particularly with regards to climate change, and reliance on indigenous sources of fuel. Evidence from existing hydropower dams in Pakistan and elsewhere in the world shows a different story. Here we outline some of the technical, environmental, social, and economic problems associated with large dams and hydropower.

The High Costs of Hydropower:

10. **Large dams are not suitable for current climate context:** The current climate context is defined by extreme weather events. The Himalayan-Karakoram mountain ranges are one of the global hotspots of this change, and experts have predicted extreme weather events, particularly floods with a combination of rapid glacial melt and extreme rains. Large dams are usually built with 100 year flood levels in mind, but given the likelihood of extreme weather these projects may not be feasible. Moreover, large dams generate greater risk by: increasing seismic risk in mountainous areas, reducing the floodplains ability to absorb large flood events, and increasing methane emissions into the atmosphere as a result of still water in the reservoir.

11. **Has NTDC incorporated the cost of evolving, dynamic risk of the proposed large and small dams?** Traditional risk assessments often assume the stability of factors defining risks, but such traditional risk assessments are unviable in the context of climate change and human-disturbances in the river basin.[2] Dam risk is susceptible to evolution over time and already existing water and land use patterns. Given that these variations are likely to impact the entire system of water management in Pakistan, would NTDC please explain how these varying risks are estimated and whether these are included in the cost estimates of per unit electricity?

12. **The glacier burst events are on the rise in the mountains:** Another serious risk factor in terms of large hydropower in the mountains is the risk of glacier busts. The glaciers in the Karakoram-Himalaya ranges are hotspots of climate change, melting at a rapid pace and, in some instances, breaking with the potential to cause glacial lake outburst floods. The recent devastating floods caused by glacial burst in India should be a cause of concern for Pakistani energy planners as we are bound to face similar extreme events in our country. Given this reality, will the NTDC explain what type of risk assessment was undertaken to incorporate these new realities?

13. **Many dam sites have high risk of earthquake:** The Himalyan-Karakoram-Hindu Kush mountain ranges are susceptible to earthquake events, and many of the proposed dams are being built in

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[1] Using the ICOLD definition of large dams as dams with a height of more than 15 meters.

[2] Milly, P. C. D., Betancourt, J., Falkenmark, M., Hirsch, R. M., Kundzewicz, Z. W., Lettenmaier, D. P., et al. (2008). Stationarity Is Dead: Whither Water Management? Science, 319(5863), 573–574.

areas of AJK and Khyber Pakhtunkhwa with active fault lines and which have in recent years seen extreme seismic activity. Dams built in areas of high seismicity pose a very high-risk potential for downstream communities. Studies have also shown that dams with large reservoirs can trigger earthquakes.[3] What is the potential cost of a dam burst due to seismic activity, along with the aforementioned variations due to rapid climate change?

14. **Large Dams are Uneconomic:** Multiple studies have shown that large infrastructure projects, and hydropower projects in particular suffer from severe cost underestimation. Bent Flyvbjerg, Professor of Major Programme Management at the Oxford Business School, has meticulously shown that large infrastructure projects – especially large dams -consistently underestimate or completely ignore costs of large projects, and overestimate their benefits. A recent study conducted by a team at Oxford University (Ansar et al, 2014) demonstrated that cost estimates of large dams are "systematically and severely biased below actual values." Projects run into schedule and cost overruns that can range from 150% to 200% of the estimated costs. Projects that are larger have bigger cost overruns. Furthermore, costs are usually higher in developing and underdeveloped countries. If these cost overruns are applied to the case of many of the hydropower projects proposed in the IGCEP 2021-30, we can expect the capital cost component of per unit electricity to be double. For instance, Diamer Bhasha dam, estimated at 14 billion USD, could cost between USD 20 billion to up to USD 30 billion.

15. **Long gestation periods and difficulty scaling up:** Large infrastructure, in particular dams and hyd el projects don't produce any electricity until various components are completed. Unlike Wind and Solar these projects also don't scale very well. In short, there is limited flexibility once we have committed to large hydro as our central response to the energy crisis.

16. **The social costs of dams are massive:** Beyond the added risk and cost overruns, dams also incur large social costs. These occur primarily in terms of displacement and loss of livelihood. These costs are also severely underestimated in the IGCEP 2021-30 calculations. The World Commission on Dam (WCD), established by the World Bank, governments, and civil society actors in 1997, conducted a comprehensive study of large dams and found that global dams displaced about 40-80 million people by year 2000 due to drowning in the upstream areas.[4]

17. **Downstream displaced groups are overlooked:** Studies estimate that **downstream** displacement due to loss of ecology and livelihoods can be upwards of 472 million people with conservative estimates.[5] This means that the downstream loss of livelihood can be of the order of ten times of the upstream displacement costs. The cost of resettling the displaced must also be reflected in the plans, but is ignored by the EIA and SIA documents. In the context of Pakistan, the WCD conducted a case study of the Tarbela Dam and found that planners in Pakistan have only considered the social impact in the reservoir area of the dam, but not on the downstream

[3] Moustafa, A. (2015). Earthquake Engineering: From Engineering Seismology to Optimal Seismic Design of Engineering Structures. BoD – Books on Demand.

[4] WCD. (2000). Dams and Development: A new framework for decision-making: The report of the World Commission on Dams. London and Sterling, VA: World Commission on Dams.

[5] Richter, B. D., Postel, S., Revenga, C., Scudder, T., Lehner, B., Churchill, A., et al. (2010). Lost in Development's Shadow: The Downstream Human Consequences of Dams. Water Alternatives, 3(2), 14–42.

areas.[6] These ignored costs are borne by communities, and indirectly by the national exchequer through loss of livelihood and potential revenue through taxation.

18. **Dams destroy downstream ecology:** The costs of large dams are not only limited to displacement, but the environmental impact of hydropower dams are widespread and well documented. Hydropower impacts downstream river ecology by altering the seasonal flows and by potentially stocking and diverting river flows in the Indus Basin Irrigation System. Sediment trappings is a well-recognized phenomenon and lack of nutrient supply to flood plains, deltas, and wetlands severely depletes the biota and endangers large numbers of animal and plant life. While large dams are the biggest culprits, even small disruption in seasonal flows can have severe impact on fish migration patterns, which will incur economic and social costs for downstream and deltaic fishing communities.

19. **Dams in Pakistan are a big source of water conflicts:** The large dam based hydropower systems create conflicting demands between power generation, irrigation, and maintaining ecological flows for sustainable ecosystems, especially in the downstream area. We have seen this type of conflict emerge repeatedly with the Indus River System Authority (IRSA) and WAPDA at odds during the monsoon months regarding maximum water storage for later irrigation purposes or maximizing hydropower to meet summer demands by releasing maximal water. Unfortunately, environmental flows and downstream ecological communities are not considered a party in these debates, particularly riverine, deltaic, and coastal fishers and land users. Global initiatives and scientific communities have included the ecosystem users beyond energy users and agriculturalists in their stakeholders, with decommissioning and reoptimization of existing flows to meet all these various demands. Are the political, social, and economic consequences being fully considered as Pakistan moves towards further reliance on hydropower, thus increasing the stakes of some while undermining others'.

20. **Lower riparian provinces are also party to this energy planning:** Unlike wind and solar, water is a common-pool resource that, in its current uses in Pakistan leaves little leverage for dams relying on seasonal storage. Pakistan has a long history of water conflict at the international and sub-national levels. In particular, the province of Sindh and the Indus Delta region has seen declining flows over the years, which has added to long-standing grievances. Since most of the hydropower projects will be constructed in KPK or AJK, the gains from any tariffs for these areas are unlikely to be evenly distributed. In fact, Sindh is likely to bear most of the environmental and social cost of these hydropower plants.

21. **Hydropower will severely damage an already declining Delta:** A study conducted by NASA shows that the Indus Delta is under severe stress due to both climate change and upstream water uses, uses that include irrigation and hydropower use.[7] The consequences of these are alarming, as demonstrated by a recent report by Pakistani scientists: the Indus Delta is reduced

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[6] Asianics Agro-Dev. International (Pvt) Ltd., & WCD. (2000). Tarbela Dam and related aspects of the Indus River Basin Pakistan. A WCD case study prepared as an input to the World Commission on Dams. Cape Town, South Africa: World Commission on Dams. Retrieved August 10, 2017, from http://s3.amazonaws.com/zanran_storage/www.dams.org/ContentPages/1311315.pdf.

[7] Coleman, J. M., Huh, O. K., & Jr, D. B. (2008). Wetland Loss in World Deltas. Journal of Coastal Research, 24(sp1), 1–14.

to 8% of it's historic size and loses about 200 square km of land each year to coastal erosion; sea intrusion has caused water up to 100 km inland to turn brackish.[8] Water shortages in the Indus Delta have resulted in ongoing protest. While hydropower may not ostensibly 'divert' and 'consume' additional water, the storage of water during high-flow seasons is likely to cause further decreased flows.

22. **The run-of-river 'mislabeling':** As mentioned above, the IGCEP 2021-30 has listed many large dam based hydropower systems as 'run-of-river', ostensibly to support the claim that many social and environmental costs are minimized. As per the European Network of Transmission System Operators for Electricity, run-of-the-river hydropower is distinguishable from dam or ponding hydropower plants, where the former has natural flows while the latter do not. It is important to clarify the criteria being used to label some hydropower plants as run-of-river, whether these have significant reservoirs or even an upstream large dam. The construction of dams for 'run-of-river' hydropower also makes sense in the context of the rivers with variation in seasonal flows, which is the case for most rivers listed in the hydropower plans, including the Indus, Jhelum, and Kunhar rivers. It appears that the label of run-of-river is used to 'greenwash' large hydropower dams. Moreover, the cumulative effect of many small run-of-river plants on streamflow has not been considered.

23. **Hydropower is an unreliable source of energy generation:** The notion that hydropower provides a cheap solution to Pakistan energy needs, and a shift to up to 50% of the mix, will solve Pakistan's energy crisis is absurd, and not supported by evidence. We have listed the various costs that are not accounted for in the per unit energy calculation – the costs associated with cost overruns, increased risk of failures, social and environmental impacts. The shifts in seasonal flows along with increased flood events mean that the river systems cannot be relied upon for reliable generation of electricity.

Our Recommendations and Demands:

24. We take this opportunity to register our reservations about the planned dependence on hydropower despite its numerous problems. Pakistan's shift to hydropower signals a number of problems. The proposed hydropower projects will have huge economic cost overruns, will cause environmental damage, are unsuitable for the climate and seismic conditions, and will have adverse social and economic consequences for lower riparian groups, particularly the communities of land and water users in Sindh, the Indus Delta, and the riverine communities. The 'fuel' of hydropower, water, is a scarce and public good that is already severely taxed. By adding more hydropower without considering those with existing legal and established claims on water use, the IGCEP 2021-30 indicates a plan that is likely to increase water conflict in Pakistan. The true cost of hydropower, some of which is highlighted in this brief comment, is huge. It is incumbent upon NEPRA, NTDC and other responsible bodies to take into account all these various costs.

25. The hydropower commitments of IGCEP 2030 seem to neither consider the rapidly changing climatic conditions, nor the existing socio-hydrological realities of Pakistan's river systems and the millions dependent on the vast mosaic of healthy river ecosystems. These projects will lock

[8] Siyal, D. A. A. (2018). Climate Change: Assessing Impact of Seawater Intrusion on Soil, Water and Environment on Indus Delta Using GIS and Remote Sensing Tools Final Report 2018, 149.

us into costly, technically unsound, environmentally destructive, and politically charged projects. The planners also seem to have ignored what's happening across the globe. Thousands of dams have already been removed in the US and Europe in the past several decades, after careful reflection on their economic, social, and ecological costs. Pakistan must not repeat these mistakes and commit billions of US dollars in inefficient and disruptive energy systems.

26. Following international best practice as established by the World Commission on Dams Report of 2000, and insights from subsequent research, all alternative options to a new large hydropower plant should be considered. This includes but is not limited to: underwater storage (on the model of 'water banking' in the US West), solar power, tidal power, wind power, micro-hydel, and controlling inefficient and consumption of water. Wind and Solar offer the greatest potential and must be prioritized instead of costly hydropower.

27. The government must be prepared to ensure substantial participation of a broad range of stakeholders in the planning process. This includes not only credentialed planners and politicians, but direct representatives from communities that are impacted by factors including but not limited to: flooding, resettlement, fluctuation of flows downstream, electrification, and changes in transport network. To ensure substantial and meaningful participation, is the government prepared to circulate (along with translation into local languages) all relevant planning and socio-environmental impact statements with all stakeholders in a timely fashion?

28. Is the government prepared to develop a comprehensive water strategy that does not reduce the Indus to its potential hydro-energy? A wise, efficient, and responsible government policy to Indus waters must integrate energy policy with other domains, including but not limited to: agrarian policy, trade policy, livelihood stability, conservation, heritage, constructive federation building, friendly international relations, and long and medium-range planning for wise use of Pakistan's natural resources.

29. We expect that NEPRA, NTDC, and other government bodies will take our intervention seriously. We expect responses to our concerns, in particular to our specific points regarding the overlooked and ignored costs, climatic and seismic risk calculations, estimation of social and environmental costs, the exacerbation of climate change in coastal areas, and the costs of increased water conflict in the country (#10-22).