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1 2 From divergence to convergence: Navigating the water-energy-food nexus in 3 case of the Teesta 4 5 6 7 8 Abstract 9 10 The Teesta River dispute between India and Bangladesh has been a matter of debate 11 and criticism, particularly due to the 2 failure on the part of the government to negotiate 12 an agreement on sharing the waters of the Teesta. The river considered as vital for 13 both the countries, and hence coming to a consensus is a major challenge given the 14 diverse interest, and benefits, arising out of it. Considering the depth of the issue, the 15 paper makes an attempt to analyze the issue from a holistic water-energy-food nexus 16 to try and investigate the issue more closely. The paper is qualitative in nature, where 17 inferences have been drawn from the various literature on the nexus and attempt has 18 been made to provide a more holistic approach towards the issue. The study contends 19 that adopting the nexus approach would provide a solution in arriving at a consensus, 20 and resolving the underlying issues between the two, through an integrative policy. 21 22 Keywords: Water-energy-food nexus, Resource security, Resource efficiency, Teesta, 23 India-Bangladesh 24 25 26 27 28 29 30 31 Introduction 32 33 1 Management of the water resources, becomes crucial in the light of water becoming a 34 scarce, and limited resource. Since water is linked with various aspects like social, 35 economic, political, ecological, as well as strategic, therefore, there is competition 36 between the states to secure their own interest, considering the increased demands for 37 it. These demands can range from basic drinking and sanitation, to food, energy, 38 economic, and development. So, when water is to be shared, the decision related to its 39 use, and distribution, brings in complexities due to the different values attached to it, 40 which can lead to contestation, conflict, and at times cooperation. Cooperation 41 becomes obligatory for the nations here, due to the interdependency brought through 42 the transboundary water sharing. The situation becomes more and more complex, as 43

water scarcity and dependency intensify, as it further widens the gap between demand 44 and supply. It becomes all the more difficult for the nations around the world to 45 secure

the resource, posing a threat to the global security, which in turn is linked to 46 the areas of water-energy-food sectors (WEF) (Bazilian et al 2011). Often the 47 decisions and policies formulated with regard to water sharing and management, fails 48 to highlight the issue concerned, due to the ignorance of the interlinkages that exist 49 between the three sectors. It therefore, becomes pertinent to understand the nexus 50 which are interrelated yet distinct, as decision in one sector is bound to have its 51 implications upon the others. Not only that even ignorance and too much attention or 52 emphasis on one sector can have serious repercussions upon the others. Since the 53 three sectors are interconnected and water being a finite resource is central to it, it 54 affects the policy formulation and policy choices. Therefore, it becomes all the more 55 significant for nations particularly those sharing the water resources to consider the 56 linkages that exist, making the study of the nexus even more crucial. It not only helps 57 in resolving the environmental issues but also in reaping optimum benefits. 58 In the light of the above arguments, the water sharing 2 between India and Bangladesh 59 on the Teesta River has been taken as a reference point which has primarily attracted 60 the attention of the policymakers, academicians and the researchers alike. The river 61 which has its source in the Indian state of Sikkim 1 at an elevation of 5280m, flows 62 through the state of West Bengal to Bangladesh before meeting the Brahmaputra 63 River in Kurigram (Suryanarayanan 2010). The Basin has a catchment area of 12,159 64 sq km, of which 16 percent of the area lies in Bangladesh whereas the rest lies with 65 India (see Fig. 1 below) (Khawas 2016). 66 67 68 69 70 71 72 73 74 75 76 Figure 1. Teesta Catchment Basin 77 78 79

80 81 Source: Based on the study 82 83 It has been a matter of concern for both the countries, where despite several attempts 84 at negotiation, arriving at a consensus and concluding a treaty has been a challenge 85 since 2011. 1 Since then, the Agreement has not seen the light and various attempts at 86 negotiations has desperately met with disappointments raising serious questions about 87 the credibility and effectiveness of both

the governments as well as the policy makers. 88 The factor of Domestic Politics has and still continues to play a dominant role in both 89 the countries but the inability to come to a consensus and negotiate on Teesta water 90 sharing requires an in-depth and a holistic approach to be adopted to analyze the issue 91 more remotely in identifying the priority interconnectedness. 92 Therefore, based on the said arguments the paper aims to 93 1. Analyze the issue from the nexus perspective. 94 2. Navigate whether adopting the approach can help resolve the issue and create 95 opportunities for both. 96 97 Review of literature 98 99 The water-energy-food nexus is relatively a new approach as an academic discipline, 100 that has come into light where researcher and academicians have been probing into 101 the approach to find a viable solution to the problems related with water sharing and 102 management. 103 With an emphasis on integration and interdependence of the three sectors- water, 104 energy and food, the approach focuses on the synergies and tradeoffs that exists 105 between them (Bazilian et al 2011; Larson 2014; Wolf et al 2016). This approach is 106 seen as crucial in understanding not only the interrelationship between the sectors, but 107 also in determining the policy choices. Developed in the 1990's and 2000's 108 particularly with regard to the Bonn 2011 conference and in the wake of the world109 wide food and economic crisis. The nexus aims at looking into the water issue from a 110 holistic approach and accordingly tends to find a sustainable solution. 111 But as pointed out by Bazilian et al (2011), the nexus primarily depends upon the 112 perspective of the policy makers, and their relative priorities. If it is water perspective, 113 then food and energy happen to be the user of the resource where water is needed to 114 57% 27% 16% Sikkim West Bengal Bangladesh

produce, transport and use all forms of energy and produce food. If it is food, then 115 water and energy are the inputs, while in energy perspective the others happen to be 116 the output which is required for extraction, utilisation, distribution as well as 117 treatment of waters. In the nexus, water is regarded as central as it is an irreplaceable 118 resource. Factors like increased population, urbanisation, industrialisation along with 119 climate

change has further accelerated the dependence upon the resource thereby 120 pushing the demand for it leading to its over extraction. 121 In case of ensuring food security, the resource is essential for irrigation and increased 122 productivity, hence majority of the water resources tends to be consumed by the 123 agricultural sector. The situation is more crucial when a nation thrives on an agrarian 124 economy. This is collaborated by the report of the Food and Agriculture Organisation 125 (FAO), Aquastat, where agriculture accounts for 69 percent of annual water 126 withdrawals, while industry 19 percent and household 12 percent. But if we view it 127 regionally, then the figure somewhat varies like the case of Asia, wherein, agriculture 128 accounts for more than 80 percent, while, industry is 10 percent and household a mere 129 9 percent. This figure tends to tilt upwards as the world population grows. It is further 130 estimated that the demand for food, water and energy will increase by 35, 40 and 50 131 percent respectively by 2030 (NIC, 2012). This in turn is bound to have its 132 implications, and put additional stress upon the water resources. As increased 133 population would lead to increased demand, which would also lead to an increased 134 water withdrawn capacity, as there will be greater pressure to ensure food security. To 135 provide food at an affordable price would eventually lead to increased productivity. 136 This would not only lead to greater use of fertilisers, pesticides, farm machinery, long 137 distance channeling of water, modern food processing and packaging, rapid transport 138 but in turn would transform agriculture into more and more water intensive 139 (Chellaney 2014). Food security also requires equitable access but disagreements 140 related with policies and access to water, mismanagement impedes it (Scott et al 141 2018). 142 Again, to ensure food security, energy is required and water is regarded as vital for 143 energy production. According to Malik (2009), 85 percent of the electricity is used in 144 most farms to pump groundwater for crop production. In fact, energy is regarded as 145 the backbone of the economy and hence there is a greater emphasis amongst the 146 nations towards its development particularly in terms of hydropower generation. 147 Roughly 75 percent of the industrial withdrawals are used for energy production and 148 90 percent of global power generation

is water intensive (UNESCO, 2014). As per the 149 IEA, this water withdrawal for energy consumption is likely to increase 20 percent by 150 2035 which in turn will increase stress on water resources. Thus, there is a 151 competition amongst the nation towards the drive for energy which by 2035 is going 152 to increase by 87 percent (Hoff 2011) leading to further exploitation of the water 153 resources. Complexities arises because the world would look for an alternative source 154 of energy, which in turn leads to another issue of equity, related to access as pointed 155 by Scott et al (2018). This is because the alternative sources that exist makes the true 156 price of energy more internalized, thereby making energy less affordable. Hence 157 making access restricted and limited and thereby impacting the vulnerable, the poor 158 and especially the developing countries. 159 The water security comes third in the nexus, but is the central focus of both food and 160 energy security. It is defined as the 'reliable 7 access to safe drinking water and 161 sanitation' together with ecological protection (UNDP, 2007), a basic human right 162 (Hoff, 2011); 'reliable availability of an acceptable quality and quantity of water' 163 along with addressing the water-related risks and issues of 'environmental protection 164

and mismanagement of water resources' (Rashid, 2014). According to the World 165 Water Council (2000) & the UN Water (2013), water security entails meeting the 166 basic needs; securing food supply; protecting the ecosystem; managing the risks; 167 protection of the livelihoods, human rights, culture and recreational values; adequate 168 water supply for socio-economic development and activities; collaborative approach 169 to Transboundary water resource management to promote freshwater sustainability 170 and cooperation; good governance and accountability. The failure to do so leads to 171 water insecurity, which makes nations to undertake various measures often leading to 172 conflicts and confrontations. 173 It is also to be noted here that each and every sector is bound to affect as well as 174 complement one another. If we talk about water for food, then it though helps in 175 securing food security and increase production thereby improving the livelihood and 176 economy, yet it also can affect the water resources. This

is due to the dependency 177 upon water resources for agriculture hence increased productivity means increased 178 use of water resources more so in water intensive food products. This in turn implies 179 over extraction of groundwater and thereby exhaustion of the resources leading to 180 water scarcity. Similar is the case with water for energy. It is significant in generation 181 of electricity through development of power plants/hydros, cooling of plants etc. Yet 182 one cannot ignore the fact that it also has the tendency of affecting the quality and 183 quantity of the water resource to a larger extent creating an unsustainable pressure. 184 So, although these sectors seem independent yet a closer analysis would reveal their 185 growing interconnectedness and dependency making proper management of the 186 resources significant. It also brings to the fore that a neglect in one and over emphasis 187 on the other can have serious implications like social and political instability, 188 geopolitical conflict and environmental damages which makes it all the more 189 significant for policy makers to give adherent push towards it (Hoff 2011; Bizilova 190 2013). Therefore, understanding the nexus is important to develop an integrated 191 approach towards water management which in turn would facilitate social stability 192 and economic growth. Understanding the nexus is seen as significant in maximizing 193 the benefits and minimize the tradeoffs, improve resource use efficiency and lower 194 the social and environmental impacts () thereby emphasizing on sustainability. 195 196 Methodology 197 The study is analytical, therefore qualitative, where inferences have been drawn from 198 the existing literatures, which includes reports and publications to gain insights on the 199 issue. 200 201 202 Discussion 203 204 The rising 8 demand for water, food and energy has emerged as a nonconventional 205 security threat around the world. Among the various reasons cited, one that can 206 explain the failure of the policy/decision is the lack of nexus approach in 207 understanding the core of the issue which in turn has also led to undermining of the 208 interests of the various stakeholders concerned. 1 The Teesta River basin is a 209 transboundary river shared between India and Bangladesh which has its source in the 210 Indian state of Sikkim. The basin is home to 30m people with 29 percent in India, and 211 71 percent in

Bangladesh (Sardar 2021). The river is rain-fed so there is seasonal 212 variation where 90 percent i.e. 54BCM of the volume falls in the monsoon (June213 September), whereas a mere 6BCM is found during the lean season (October-May) 214

making the ratio 1:10 (Raj, 2013). Complexities arise due to increased scarcity and 215 dependency upon the river, together with different values attached to water, leading to 216 lack of consensus. 217 So where and how the nexus is related?In the case of Teesta, the issue lies in the fact 218 that there is a greater dependency upon the river for securing not just food, but also 219 energy security, and hence it affects and implicates the policy choices of both the 220 countries. An informal trade off does exist between the country where water is 221 essentially viewed as a 'peace deal' whereby in lieu of sharing waters by India during 222 the lean season, Bangladesh cooperates on tackling various security concerns of the 223 former (Raj 2013). 224 225 Figure 2. W-E-F nexus in Teesta 226 227 228 229 230 231 Source: Based on the study 232 233 234 It becomes imperative to note that both the countries, depend upon the Teesta 235 particularly the northern parts 2 of West Bengal and northwestern Bangladesh as the 236 region economy is particularly agrarian. The agricultural production accounts to 19 237 percent for Bangladesh 4 (Bangladesh Bureau of Statistics, 2012) and 14.2 percent for 238 India (Central statistical organisation, India, 2011). Therefore, to sustain food security 239 both the sides undertook the Teesta Irrigation projects in Dalia (Bangladesh), and 240 Gajaldoba (India). Both the projects aims at irrigating around 540,000 hectares, and 241 922,000 hectares of land respectively, along with other integrated functions like flood 242 control, recreation, increase cropping intensity, agricultural productivity, fisheries 243 development, hydropower, tourism (https://en.banglapedia.org/index.php/Barrage; 244 Strategic foresight group 2013; Mukherjee and Saha 2016; Rahaman and Abdullah 245 2020). But to ensure its goal an adequate amount of water from the Teesta is required 246 which if not maintained would lead to food insecurity. In fact, as per the study 247 conducted by Syed et al (2017), a total of 93,523 cusses of water is required to 248

facilitate irrigation, whereas 1 the flow of the river is 6,984, 51,966 and 27,987 cusses 249 in dry, wet and lean seasons respectively. Therefore, the supply is limited while the 250 demand is higher which has further intensified due to increased use of water intensive 251 agriculture and industrialization. Further as the population increases so also the 252 Teesta River water Food security Teesta Irrigation Projects Energy security hydropower

pressure over food security, and thereby on water availability (Sambou et al 2023). 253 Therefore, issue of water availability or lack of it has sown the seed of mistrust 254 1 between the two countries. To elucidate it further, there was a study conducted by 255 Zannah et al (2020) which suggest that from 1967-1990, the annual runoff of the river 256 ranged between 3674 cusecs in high flood seasons to 139 cusecs to mean monthly 257 minimum flow which has drastically reduced. The reason being anthropogenic i.e., 258 construction of dams and the barrage upstream by India, which has led to diversion of 259 the flow of the waters of the Teesta via side canals. Further studies aimed at making 260 an assessment of the mean annual outflow discharge at Gajaldoba barrage also 261 pointed out to the same. Since the freshwater resources is limited and getting 262 exhausted in the Teesta catchment hence there is a greater dependence on 263 groundwater and monsoonal rains (Wahid et al 2007). So, there is less availability of 264 water in the region thereby affecting its agriculture. The river is rain fed so it is 265 dependent upon the monsoonal discharge however, as the river descends downstream 266 due to seasonal variation the volume of the water gets affected together with the 267 problem of climate change factor which adds further to the water woes. 268 Therefore, decreased water flow is the concern of both upstream and downstream 269 countries, and one of the reasons why the state of West Bengal emphasizing on 'state 270 first priority'. Since the region relies heavily on 1 the flow of the Teesta for its 271 livelihood keeping the interest of the farmers in concern, the state government wants 272 to secure the water first and foremost for its people. Therefore, water security issues 273 can lead to insecurity among the riparian nations.According to Mondal and Saleh, 274 (2003) due to its over

extraction coupled by poor management, and land use change, 275 the level of groundwater is drastically getting reduced by 1.2m/year in various parts of 276 the area. Not to forget the impact it has on lowering the aquifer levels. Since there is a 277 greater demand for food grains to meet the needs of the population thriving there, 278 hence attainment of food security becomes all the more pertinent. And since the 279 ground water discharge is getting exhausted therefore there calls for a greater 280 attention to find an alternate source of freshwater and groundwater particularly during 281 the dry season. 282 Likewise, the concerns related with food security is also related with the energy 283 security, particularly in terms of the construction of dams for the generation of 284 hydroelectricity. Hydropower is regarded as synonymous to development, economic 285 growth and considered as the source of clean, cheap and renewable source of energy. 286 Hence nations are emphasizing on its development. The state of Sikkim alone has a 287 hydro potential of 8000 MW peak with a firm base of 3000 MW and around 39.15 288 percent of the capacity is yet to be developed (Government of Sikkim, Energy and 289 Power department). The rapid elevation of the Teesta that makes it very suitable for 290 hydro ranging from 8598 meters to 213 meters (The Asia Foundation, 2013). These 291 cascades of dams even though have ecological as well social implications yet they are 292 furthered in the region particularly in the state due to the developmental notion. Along 293 the Teesta Basin, six Hydro projects -Teesta Stage I, Teesta Stage II, Teesta Stage III, 294 Teesta Stage IV, Teesta Stage V and Teesta Stage VI of 3635 MW was awarded to 295 NHPC, NTPC and private developers. The Government of Sikkim sells the hydro- 296 electricity of Teesta III HEP (1200 MW) to Punjab, Haryana, Rajasthan, Uttar 297 Pradesh at a very cheap rate of 3 INR/unit (CFA, 2019). These projects are seen as a 298 source of revenue, employment, development and assuring energy security for all. 299 However, the same cannot be said for downstream Bangladesh as it has not been able 300 to exploit the waters of the Teesta for hydro. Though time and again, the country 301 claims of furnishing the same in the near future. 302

Therefore, the upstream of the river is used for energy security and as the river 303 discharge downstream it is used for food security. There are arguments and counter 304 arguments that it is bound to have its implications downstream as the flow of river 305 gradually decreases. It in turn is said to have further heightened the issue of water 306 scarcity for the lower riparian having its repercussions for securing food and energy 307 security. 308 However, it needs to be realized here that whatever maybe the priorities energy or 309 food security, the fact remains that both are dependent on the availability of the water 310 from the Teesta River. Water is needed for sustaining energy security, as well as food, 311 and both are deemed crucial for livelihood, and development. As we have already 312 seen above, how there is an interconnectedness between the three sectors, hence any 313 action and decision taken on one is going to have its impact upon the other. If India is 314 achieving its energy security, through construction of hydro projects upstream then it 315 needs adequate water which though countered do affect the quality and quantity of the 316 water downstream. Then it also has its own Irrigation project at Gazaldoba for 317 ensuring food security and the same applies for Bangladesh. Therefore, for India 318 waters of the Teesta is vital for energy and food security and the latter for Bangladesh. 319 Hence, in order to maintain a balance, both nations would undertake decisions which 320 might not be favorable to one other and that is exactly what is happening with regard 321 to the Teesta. Bangladesh wanting an equal share of the waters means India 322 particularly West Bengal losing out most of its waters which it would not want as it 323 affects the food security and same is the dilemma with the case of Bangladesh. In 324 order to ensure adequate waters, it has been adamant in shipping out more waters 325 from India and that is exactly what is leading to the deadlock. 326 These priorities seem independent but a closer analysis would indicate its 327 interconnectedness. The upstream emphasis is on energy security but one cannot deny 328 the fact that even for securing food one needs energy. Like lower region of the Teesta 329 basin along Bangladesh lacks access to energy hence it also will impact the food 330 security. Swain (2004) in this regard attributes to the differences of perception as 331

leading to conflicts between states and its internal groupings. He pointed out how 332 state's developmental projects which is undertaken to secure the water resources at 333 times are viewed as countering the interest of the local people leading to conflicts 334 within and between the states. Not only that each stakeholder here including the state 335 parties concerned have set their own priorities over the use of the waters of the Teesta. 336 Sikkim interms of hydro power and 2 West Bengal and Bangladesh related with food. 337 But one does not understand the interconnectedness that exists and how these 338 priorities need to be seen in an integrated manner. The waters of the Teesta are 339 significant for Boro cultivation in case of India and Kharif and Rabi crops for 340 Bangladesh. The situation becomes critical during the lean season where kharif crop 341 demand for water significantly increases, while that of the Boro crop is tripled while 342 the supply is limited due to decreased 1 flow of the river. 343 Another issue which is generally kept at the back-burner, is related with water scarcity 344 and its impact on basic human rights i.e., safe and clean water for drinking and 345 sanitation. It is also recognized by the UNGA (2010) and also falls within the 346 Sustainable Development Goals no 6, as Water Sanitation and Hygiene (WASH). The 347 issue of arsenic contamination in ground water is common in Siliguri-Jalpaiguri 348 region in India (Bhattacharyya & Mukherjee, 2009), and Bengal basin region of 349 Bangladesh (Sarkar et al, 2022). This situation is worrisome considering the level of 350 water decreasing, and people in the region compelled to be dependent upon the 351

groundwater extraction for drinking purpose. The arsenic contamination therefore, 352 exposes the vulnerability of the people living along the basin. 353 Results 354 Adopting the nexus is vital here as it aims at balancing the trade offs and facilitating 355 more synergies for sustainable development (Wu et al, 2021). Since water is critical 356 aspect in the nexus and given the water availability issues both countries can think in 357 terms of adopting mechanism towards it. 358 Water and food security 359 It becomes significant to think about maintaining 1 the flow of the water in this case of 360 Teesta River before its

utilization. Both the countries should emphasize on 361 conservation and protection of water resources, and shift to less water intensive 362 farming methods and crops thereby improvement in the irrigation system. This would 363 help significantly in maintaining a balance and also ensure sustainability. The nexus 364 approach focusses on 'creating more with less'. With water scarcity evident along the 365 basin, countries can adopt the approach in addressing the dwindling water flow of the 366 Teesta collectively, first and foremost, and then think in terms of using the available 367 water resources for food production, and also in locating the alternate source of water. 368 Because the river is monsoon fed, both countries can come together in storing the 369 excess waters during the monsoon and using it during the lean period. 370 Water and energy security 371 Energy security 2 is vital for the economy of both the countries. In order to facilitate it, 372 steps should be taken more towards the development of renewable sources of energy 373 like wind, solar which has less implications on the ecosystem. Further, emphasis 374 should be taken on reducing energy consumption and more on energy recovery. Since 375 geographically, India as an upper riparian has the advantage of utilizing the waters of 376 the Teesta, as per the International Water Law, and technically has been doing so 377 through furthering of numerous projects upstream in Sikkim, the same cannot be 378 applied for Bangladesh. Therefore, both can identify the benefits that they can share 379 out of it, where India can help the latter, through providing electricity at a low and 380 affordable cost, to mitigate their energy deficit. 381 Energy and food security 382 Since ensuring food security, energy is required therefore adaption of solar pumping 383 for irrigation is seen effective. Which would not only reduce the cost but also stress 384 6 on the use of resources for the generation of energy. 385 Therefore, it calls for understanding of the issue from the broader nexus approach to 386 understand the intricacies related to the issue, so that an integrated approach can be 387 adopted. In fact, various countries like 3 United States and European Union have 388 already started adopting smart tools for water supply networks (Helmbrecht et al, 389 2017) which can be furthered by India and Bangladesh at a regional level for 390 integrated water 1 management of the Teesta

Basin. Nexus solution and nexus 391 investment is seen essential in reducing pressure on the ecosystem, and thereby 392 producing sustainable transboundary benefits (unece.org). It again to a large extent 393 depends upon the transboundary cooperation mechanism including the governance 394 system as follows; 395 □ Strong cooperation among the transboundary nations in this case India and 396 Bangladesh, identifying the multiple benefits including the trade offs and the 397 synergies. Which can range from sharing the revenues as well as sharing the 398 electricity developed through hydros. 399 □ Innovative and integrative infrastructure to facilitate cooperation and benefits 400 out of the nexus including financing. 401

□ Development of transparent mechanism to share data and minimize the social 402 and ecological impacts. 403 □ Cross sectoral coordination and institutional arrangements supporting 404 integrated approach. 405 □ Integrated policy approach towards sustainable use of the water, its treatment, 406 and protection. 407 408 Therefore, instead of physically attributing the waters of the Teesta, it is very much 409 pertinent to understand this nexus and whatever be the vested interest of the 410 concerned state parties be it food or energy security, the centrality or the crux of the 411 issue happens to be the availability of the water resources. Many claims 412 anthropogenic reasons as affecting the water flow but they fail to identify the climate 413 change factor (natural reason) which has been a major source contributing to the 414 decreased flow. In fact, the factor of climate change was highlighted by the Paris 415 Agreement and the Sustainable Development Goals (SDG's). Emphasis should be 416 taken to understand the intricacies involved and adopt policies aimed at integration 417 and proper coordination of sector-based policies. One of the major issues that seems 418 neglected is the very incorporation of the stakeholders which not only include the 419 state parties or the private sectors but also the people living along the basin. 420 Incorporating them within the domain of decision making can further understanding 421 of the nexus and the issues concerned. Participation of the stakeholders also happens 422 to 3 be one of the indicators of SDG

6. The nexus not only help in addressing the water 423 issues along the basin but also seen as vital in promoting intersectoral and 424 transboundary cooperation, better resilience, improving ecosystem services, increased 425 transparency, improved resource security and furthering regional peace and stability. 426 Conclusion 427 Until and unless a sort of balance is maintained with regard to maintaining food and 428 energy security which in turn involves proper 1 management of the water resources. 429 Hence it calls for adoption of a more holistic and integrative approach which would 430 take the nexus into consideration as well as the various stakeholders' involvement in 431 the policy formulation. With regard to Teesta, one needs to focus upon the question of 432 who actually is making the decisions? And the decisions for whom? Water is a vital 433 resource for both the countries. Water Scarcity issues related with mismanagement, 434 topographical constraints, dependency factors make securing the waters of the Teesta 435 all the more vital. However, lack of knowledge and emphasis upon the nexus and the 436 interconnectedness impacts the decision making as the focus tends to be more on the 437 'Rights' issues rather than the 'Needs'. Thus, strengthening the nexus perspective 438 becomes all the more pertinent. The issue of Teesta needs to be understood from the 439 nexus perspective to understand the complexities associated with the use, distribution 440 of resources and its implication on the policy formulation. Both India and Bangladesh 441 can follow on the lines of the Mekong River Commission in implementing the nexus 442 approach as a solution to their long-time water issue over the Teesta Basin. 443 444 445 446 447 Statement and Declarations 448 449 Funding Not Applicable 450 451

Conflicts of interest/Competing interests: The author declare 3 that there is no conflict 452 of interest. 453 454 Availability of data and material: The data used in the study is collected from the 455 government sources which includes 4 Bangladesh Bureau of Statistics; Ministry of 456 Agriculture, Government of Bangladesh; Central Statistic Organisation, Government 457 of India; Energy and 5 Power department, Government of

Sikkim; FAO, IEA, 458 UNESCO, UNDP report. 459 460 Code availability Not Applicable 461 462 Authors' contributions: The data were collected form the primary and secondary 463 sources some enlisted above and analyzed by the author. The manuscript has been 464 read and approved by the author. 465 466 467 References 468 469 Bangladesh agriculture at a glance (n.d). Ministry of Agriculture, Government of the 470 people's republic of Bangladesh http://www.moa.gov.bd/statistics/bag.htm 471 Accessed14 August, 2024. 472 Banglapedia, Barrage, https://en.banglapedia.org/index.php/BarrageAccessed 13 473 November, 2024]. 474 4 Bangladesh Bureau of Statistics. (2014) Yearbook of Agricultural Statistics- 2012. 475 Ministry of Planning, Government of the People's Republic of Bangladesh. 476 http://203.112.218.65:8008/WebTestApplication/userfiles/Image/LatestReports/Agri 477 Yearbook-2012.pdf Accessed 21 June, 2025. 478 Bazilian M, Rogner H, Howells M, Hermann S, Arent D, Gielen D, Steduto P, 479 Mueller A, Komor P, Tol R S J, Yumkella K K (2011) Considering the energy, water 480 and food nexus: towards an integrated modelling approach. Energy Policy, 39 (12): 481 7896-7906.http://dx.doi.org/10.1016/j.enpol.2011.09.039 482 Bhattacharyya D, Mukherjee P K. (2009) Contamination of shallow aquifers by 483 arsenic in upper reaches of Tista river at Siliguri-Jalpaiguri area of West Bengal, 484 India. Environmental Earth Sciences, 57(7): 1687485 1692.http://dx.doi.org/10.1007/s00254-008-1450-6 486 Bizikova L, Roy D, Swanson D, David H, Mccandless, V M (2013). The Water487 Energy-Food Security Nexus: Towards A practical planning and Decision –Support 488 Framework for Landscape Investment and Risk Management. Canada: International 489 Institute for Sustainable Development. 490 Central Statistical Organization, India, (2011). Annual report 2010-2011. Department 491 of Agriculture and Cooperation, Ministry of Agriculture Government of India 492 http://agricoop.nic.in/Annual%20report2010-11/AR.pdf[21 August, 2024] 493 Chellaney B. (2014). Water, Peace, and War Confronting the global water crisis. 494 New Delhi: Oxford University Press. 495 Energy and 5 Power Department, Government of Sikkim. 496 https://sikkim.gov.in/departments/energy-and-power-

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