The research article "Khan I, Sustainability challenges for the south Asia growth quadrangle: A regional electricity generation sustainability assessment, Journal of Cleaner Production. 243 (2020), 118639, 1–13. DOI: https://doi.org/10.1016/j.jclepro.2019.118639" [1] is linked to this data article. The electricity generation related data were collected from the electricity authorities of Bangladesh, Bhutan, India, and Nepal annual reports, which were publicly available through their websites. Two methods of sustainability assessment, the 'global' and 'multi-criteria decision analysis (MCDA)' were employed. These two methods were adopted from recent literature. Related data were thus also collected from previous studies in the literature. These two models were explicitly used through a step-by-step calculation using the collected data. These data and methods will allow the researchers to replicate the methods readily. The use of this data and method will also enhance applying a similar approach to other related datasets. Overall, this dataset and method of calculation allow the researcher or analyst to avoid a number of issues: (i) it eliminates considering a large volume of electricity generation data from a myriad of sources for the four countries; (ii) this dataset is ready to be used for any further related sustainability assessment, thus reducing the steps by breaking large datasets.
down in a way that makes the analysis much easier, and (iii) the calculation steps are ready to be used for any other similar dataset.

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Specifications Table

| Subject                  | Energy (Sustainability) |
|--------------------------|--------------------------|
| Specific subject area    | Regional sustainability assessment was conducted using two different sustainability assessment methods. |
| Type of data             | Equation Table           |
| How data were acquired   | Data were collected from the annual reports of the respective countries' electricity authorities:  
                            - Bangladesh power development board (BPDB)  
                            - Bhutan electricity authority (BEA)  
                            - Central electricity authority (CEA) in India  
                            - Nepal electricity authority (NEA) |
| Data format              | Raw Analyzed Filtered Processed |
| Parameters for data collection | For the comparison purposes of the results obtained from the global and multi-criteria decision analysis models, global data for the indicators were collected from the literature.  
                            Electricity generation related data were collected from 2014 to 2016.  
                            The literature survey for data collection was conducted by categorizing the indicators as economic, environmental, and social for the MCDA model.  
                            The countries or regions for which total generated energy was not found, installed capacity data was collected. |
| Description of data collection | For the global model, data were used from [2,3].  
                            For the multi-criteria decision analysis model, indicators' data were collected from the literature and presented as tables in excel file and in [1].  
                            Energy generation and capacity related data were collected from each country's electricity authority's website. |
| Data source location     | Institution:  
                            - Bangladesh Power Development Board (BPDB)  
                            - Bhutan Electricity Authority (BEA)  
                            - Central Electricity Authority (CEA) in India  
                            - Nepal Electricity Authority (NEA)  
                            Region: South Asia Growth Quadrangle (SAGQ)  
                            Countries: Bangladesh, Bhutan, India, and Nepal |
| Data accessibility       | With the article |
| Related research article | Author's name: Imran Khan  
                            Title: *Sustainability challenges for the south Asia growth quadrangle: A regional electricity generation sustainability assessment*  
                            Journal: *Journal of Cleaner Production*  
                            DOI: https://doi.org/10.1016/j.jclepro.2019.118639 |
1. Data

All the data are stored in one Excel file containing a number of sheets (see supplementary data in the Appendix A). The first sheet ‘Equations’ shows the equations used for the sustainability assessment for the global model and MCDA model. The next ten sheets namely SI-Coal, SI-Oil, SI-Gas, SI-Small Hydro, SI-Large Hydro, SI-Solar, SI-Wind, SI-Biomass, SI-Geothermal, and SI-Nuclear show step-wise detail calculation associated with data for the global model for sustainability assessment. The sheet ‘Global SI’ presents the calculated sustainability index for the different electricity generation technologies. The next five sheets Bangladesh, India, Bhutan, Nepal, and SAGQ used the calculated sustainability index from the global model and applied it to either total generated electricity or total installed capacity for the years 2014, 2015, and 2016. The sheet ‘Country-SAGQ SI’ shows country-specific and regional (i.e., SAGQ) sustainability index obtained from the global model. The last two sheets ‘Eco & Env’ and ‘Social’ present the data used for the MCDA model to assess sustainability. These are listed in Table 1.

2. Experimental design, materials, and methods

The calculation equations and use of data are listed in Table 1. Step by step calculation methods for the Global and MCDA models are illustrated in Figs. 1 and 2, respectively.

The method of calculation for the global sustainability index model comprises four basic steps and is illustrated in Fig. 1. In the first step, different values for different factors (i.e., $A_i, n_i, m_i$) were used from [2,3] and each indicator in social, economic, and environmental criteria was calculated using equation (1). The sustainability index for each generation technology was calculated in the second step. References [2,3] were also used for the values of $a_i$, $b_i$, and $g_i$ using equation (2) to obtain the technology-specific sustainability index. The final two steps calculate the historical and future sustainability index using equations (3) and (4), respectively.

On the other hand, there are five steps to calculate the sustainability index of the power generation system through the MCDA model. In the first step, social, economic, and environmental indicators were collected from the literature. The list of articles used can be found in the excel file in the sheets named as ‘Eco & Env’ and ‘Social’. SMARTER (Simple Multi-Attribute Rating Technique Exploiting Ranks) method was then employed to assign a weight to the indicators using the equation (5) as shown in Table 1. Details of this weighting method can be found in Refs. [4,5]. Using equation (6), total weights for each technology and criteria (i.e., social, economic, and environmental), were calculated. The sustainability index for each technology was then calculated through equation (7). Finally, the system sustainability index was calculated using equation (8). All these steps are depicted in Fig. 2.
Table 1
Data and method.

| Sustainability Models | Main Equations Used                                                                 | Calculations/Method                                                                 | References/Data Sources |
|-----------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------|
| Global Model          | $V_i = \frac{1 - \exp \left( -m_i \left( \frac{P_i - P_{i,min}}{n_i} \right)^{0.5} \right)}{1 - \exp \left( -m_i \left( \frac{P_i - P_{i,max}}{n_i} \right)^{0.5} \right)}$ | In the excel file, sheets: SI-Coal, SI-Oil, SI-Gas, SI-Small Hydro, SI-Large Hydro, SI-Solar, SI-Wind, SI-Biomass, SI-Geothermal, SI-Nuclear, and Global SI | [2,3]                   |
|                       | $S_{IT} = \frac{\sum_{i=1}^{16} a_i^* b_i^* c_i^* V_i}{10}$                        | In the excel file, sheets: Bangladesh, India, Bhutan, Nepal, and SAGQ                | [3]                     |
|                       | $S_{IT} = \frac{\sum_{i=1}^{10} F_i}{E_{Tot}} S_{IT}$                             | Detailed method was adopted from [4].                                               | [4,5]                   |
|                       | $S_{IT} = \frac{\sum_{i=1}^{10} C_i}{C_{Tot}} S_{IT}$                             | For this, data were used from sheets: 'Eco & Env' and 'Social'.                     |                         |
| MCDA Model            | For weight assignment: if N is the number of total technologies considered, then the weight ($w$) of the indicator for kth technology will be: | Adopted from [4].                                                               |                         |
|                       | $w_k = \left( \frac{1}{N^2} \right) \frac{\sum_{i=1}^{N} \left( \frac{1}{i} \right)}{\sum_{i=1}^{N} \left( \frac{1}{i} \right)}$ |                                                                      |                         |
|                       | Here, $w_1 \geq w_2 \geq \ldots \geq w_k$, $w_1 + w_2 + \ldots + w_k = 1$          |                                                                      |                         |
|                       | $N = 10$, and $k = 1$ to 10.                                                        |                                                                      |                         |
|                       | $W_c^T = \sum_{k} w_k$                                                             | Adopted from [4].                                                               |                         |
|                       | Where: $W_c^T$ : Total score reflecting the performance of technology T on criterion c. |                                                                      |                         |
|                       | $T$: Generation technology; e.g. coal, gas, oil, hydro.                             |                                                                      |                         |
|                       | $c$: Criterion; e.g. economic, environmental, social.                               |                                                                      |                         |
|                       | $w_k$: Indicator specific assigned weight obtained from equation (5).               |                                                                      |                         |
|                       | $S_{IT} = \frac{\sum_{c} \left( \frac{1}{N^2} \right) \left( \sum_{k} W_c^T \right)}{\sum_{c} \left( \frac{1}{N^2} \right) \left( \sum_{k} W_c^T \right)}$ | Adopted from [4].                                                               |                         |
|                       | Where: $S_{IT}$ : is the technology specific sustainability index.                  |                                                                      |                         |
$N_c$: Number of indicators for criterion $c$.

$W_c^T$: Total score reflecting the performance of technology $T$ on criterion $c$.

\[
S_{\text{System}} = \frac{\sum_{j=1}^{N} \frac{C_j}{C_{\text{Tot}}}}{S_I^T}
\]  

(8)

Where:

$S_{\text{System}}$: Overall electricity generation system sustainability index.

$C_j$: Output capacity (MW) of the technology in the future (or present) year.

$C_{\text{Tot}}$: Total system capacity (MW) in that future (or present) year.

Adopted from [4].
Fig. 1. Method of calculation for the Global sustainability index assessment model.
Fig. 2. Method of calculation for the MCDA sustainability index assessment model.

Objective: Sustainability Index Calculation using MCDA Model

Social, Economic, and Environmental indicators’ values were collected from the literature

SMARTER (ref. [4,5]) weighting method was employed to assign weight to specific indicator using equation (5)

Total weight for each technology and criteria (social, economic & environmental) was calculated using equation (6)

Technology specific sustainability index was calculated using equation (7)

Total system sustainability index was calculated using equation (8)
Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104808.

References

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