# Terms of reference (ToRs) for the procurement of services below the EU threshold

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

| | |
|---|---|
| **Repurposing Options for Coal Mines in India** | **Project number/ cost centre:** **18.9022.7-003.00** |

## 0. List of abbreviations

| | |
|---|---|
| AgriPV | Agro-Photovoltaics |
| AVB | General Terms and Conditions of Contract (AVB) for supplying services and work 2018 |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH |
| IGEF | Indo-German Energy Forum |
| PSH | Pumped Storage Hydropower |
| PSP | Pump Storage Projects |
| PTS | Power transmission system |
| PUSH | Pumped Underground Storage Hydropower |
| ToRs | Terms of reference |

## 1. Context

To enhance and deepen the dialogue about the energy transition, the German Chancellor and the Indian Prime Minister established the Indo-German Energy Forum (IGEF) in April 2006. The IGEF aims at initiating strategic cooperation projects between German and Indian governments, institutions, and the private sector. It aims at promoting cooperation in energy security, energy efficiency including energy conservation, renewable energy, investment in energy projects and collaborative research and development in identified areas, considering the environmental challenges of sustainable development.

The four Subgroups under the IGEF are:

I. Flexibilisation of Existing Thermal Power Plants

II. Renewable Energies

III. Energy Efficiency

IV. Green Energy Grid Integration

Under the IGEF it has been agreed to further exchange information on the topic of a just energy transition. This work aims to identify the future role of closed/abandoned/discontinued coal mines in the energy transition with focus on further use for the power sector.

One such role could be usage to develop pumped storage hydropower projects, as recently described in Ministry of Power (MoP) “Draft guidelines to promote development of Pump Storage Projects (PSP) in the country”. In them, MoP announces efforts to identify and develop exhausted mines / coal mines as prospective sites for pumped storage hydropower projects. By analysing the use of this technology in exhausted coal mines, this work also aims to assist MoP efforts in the matter.

## 2. Tasks to be performed by the contractor

The contractor is responsible for providing the following services:

Coal mines, both overground and underground, have played an important role in India’s energy security. As several mines are abandoned or to be closed and discontinued, this study aims to showcase global best practices and to thoroughly analyse the options for Indian mines.

The contractor shall provide a report with the following structure:

1. Context – *Introduce to the topic of repurposing in general on global and national scale*
2. Repurposing Options for Coal Mines
    a. Energy Storage
        *i.* Pumped Storage Hydropower (PSH) – *Give particular attention.*
            1. Introduction to repurposing option - *Give introduction. Why should the option be considered? Include information on Technology Readiness Level. Explain TRL assessment.*
            2. Global best practices with examples – *Showcase global good/best practices for repurposing coal mines with this technology. If the technology is not used for repurposing yet, showcase best practices for a use-case as close to repurposing*

*a coal mine as possible. Give examples with pictures and specifications. Show the value repurposing has brought to this site. Address the topics from subpoints 3.-8. in terms of the examples. For pumped (underground) storage hydropower, specifically address global good practices on minimum height difference.*

3. Working principle of technology – *Give a simple explanation of the working principle of the technology. The less established the technology, the more detailed. Include Diagrams. Detail also different technology options for PSH and PUSH, highlight differences, advantages and disadvantages, and consider them going forward.*
4. Conditions determining suitability of technology – *Show what specific conditions are needed for the technology to work at all but also for it to work effectively and sustainably. This should be exhaustive and go as far as covering geological conditions necessary for the options under 3.a. Specifically for (underground) pumped hydro storage: Put emphasis on minimum height difference required.*
5. Potential for symbiosis with other repurposing options – *Assess to what degree the technology can be combined with other options mentioned in the study. Point out potential synergies with the mentioned options. You may also look for synergies with repurposing options not mentioned in the study.*
6. Potential environmental impact locally and GHG emission reduction potential – *Dive into climate and environmental impacts of the technology. Assess if and how it can contribute to GHG savings also giving attention to life cycle emissions. Also thoroughly examine the impact on the local environment.*
7. Employment effects – *Assess potential direct and indirect employment effects of the technology.*
8. Economic feasibility analysis – *Assess the economic feasibility of repurposing a coal mine with this technology, addressing the conditions determining the economic feasibility of the technology. Show break-even points graphically.*
9. Pros and cons summarized – *Summarise beforementioned pros and cons in tabular form.*
10. Suitability for India – *Put the repurposing option in the Indian context and assess its suitability, taking into account all the points from above.*

ii. Pumped Underground Storage Hydropower (PUSH) – *Give particular attention.*
    1. See 2.a.i. – *as in 2.a.i.9, specifically address global good practices on minimum height difference for pumped underground storage hydropower*

iii. Compressed Air Storage
    1. See 2.a.i.

iv. Hydrogen Storage
    1. See 2.a.i.

v. Thermal Energy Storage
    1. See 2.a.i.
vi. Gravity Storage
    1. See 2.a.i.
vii. CO2 Storage
    1. See 2.a.i.

b. Renewable Energy
    i. Wind power on mining land
        1. See 2.a.i.
    ii. PV on mining land – also in combination with agriculture: AgriPV
        1. See 2.a.i.
    iii. Floating Solar – also in combination with fish cage culture / fishing
        1. See 2.a.i.
    iv. Geothermal Energy
        1. See 2.a.i.
    v. Compare annual and daily generation profile, power amount, water requirement, direct employment effects for a typical size of site of an existing thermal power plant in India.
c. Waste disposal – bio-reactor landfill
    i. See 2.a.i.
d. Water storage and flood protection
    i. See 2.a.i.
e. Tourism
    i. Recreational Parks
        1. Introduction – *Give an introduction to the repurposing option. Why should it be considered?*
        2. Global best practices with examples – *Showcase global good/best practices for repurposing coal mines with this option. If the technology is not used for repurposing yet, showcase best practices for a use-case as close to repurposing a coal mine as possible. Give examples with pictures and specifications. Show the value repurposing has brought to this site. Address the topics from subpoints 3.-6. in terms of the examples you choose.*
        3. Conditions determining suitability of repurposing option – *Show what specific conditions are needed for the option to work at all but also for it to work effectively and sustainably. Should be exhaustive.*
        4. Potential for symbiosis with other repurposing options – *Assess to what degree the options can be combined with other options mentioned in the study. Point out potential synergies with the mentioned options. You may also look for synergies with repurposing options not mentioned in the study.*
        5. Potential environmental impact locally and globally – *Dive into climate and environmental impacts of the option. Assess if and how it can contribute to the global fight against climate change, also giving attention to life cycle emissions. Also thoroughly examine the impact on the local environment.*
        6. Economic feasibility analysis – *Assess the economic feasibility of repurposing a coal mine with this option, addressing the*

*conditions determining the economic feasibility of the technology. Show break-even points graphically.*

7. Pros and cons summarized – *Summarise beforementioned pros and cons in tabular form.*
8. Suitability for India – *Put the repurposing option in the Indian context and assess its suitability, taking into account all the points from above.*

ii. Eco-Tourism
1. See 2.e.i.

iii. Memorial/Museum
1. See 2.e.i.

f. Wildlife Habitat
i. See 2.e.i.

g. Pisciculture
i. See 2.e.i.

h. Horticulture
i. See 2.a.i.

*i. Other options may be added by the contractor where deemed suitable*

3. Repurposing Coal Mines in India
   a. Overview on coal mines in India
   b. Status quo of repurposing of coal mines in India – *What is already being done with regards to repurposing mines in India? Experience so far? Pipeline? Status and plans by private, state and central Govt. stakeholders. Also include non-coal mines for this.*

The report shall be delivered by the contractor in word format. The report should afford roughly 3-5 pages to each repurposing option at Arial 11, 1.0 line spacing – more for PSH and PUSH, less for others. The contractor shall include numerous graphics and images to illustrate working mechanisms, best practices and other parts of the report. Final design to be done by GIZ.

The contractor shall create a powerpoint presenting the most important findings to GIZ and partners.

The contractor shall present the findings at an online event to be determined by GIZ.

Additionally, the contractor shall submit a short inception report as well as minutes for the meetings.

Certain milestones, as laid out in the table below, are to be achieved by certain dates during the contract term, and at particular locations:

| **Milestone** | **Deadline/place/person responsible** |
|---|---|
| Kick-off meeting | 01.06.2023 |
| Identify options and collect global best practices | 1 month from inception |
| Analyse repurposing options | 2 months after contract start |
| Final report | 3 months after contract start |

Period of assignment: From 01.06.2023 until 31.08.2023.

## 3. Concept

In the bid, the bidder is required to show how the objectives defined in Chapter 0 are to be achieved, if applicable under consideration of further specific method-related requirements (technical-methodological concept). In addition, the bidder must describe the project management system for service provision.

**Technical-methodological concept**

**Strategy**: The bidder is required to consider the tasks to be performed with reference to the objectives of the services put out to tender (see Chapter 1). Following this, the bidder presents and justifies the strategy with which it intends to provide the services for which it is responsible (see Chapter 0).

The bidder is required to present the actors relevant for the services for which it is responsible and describe the **cooperation** with them.

The bidder is required to present and explain its approach to **steering** the measures with the project partners and its contribution to the results-based monitoring system.

The bidder is required to describe the key **processes** for the services for which it is responsible and create a schedule that describes how the services according to Chapter 0 are to be provided. In particular, the bidder is required to describe the necessary work steps and, if applicable, take account of the milestones and contributions of other actors in accordance with Chapter 0.

The bidder is required to describe its contribution to knowledge management for the partner and GIZ and promote scaling-up effects (**learning and innovation**).

**Project management of the contractor**

- The contractor is responsible for selecting, preparing, training and steering the experts (international and national, short and long term) assigned to perform the advisory tasks.
- The contractor makes available equipment and supplies (consumables) and assumes the associated operating and administrative costs.
- The contractor manages costs and expenditures, accounting processes and invoicing in line with the requirements of GIZ.
  The contractor reports regularly to GIZ in accordance with the AVB of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH from 2018

The bidder is required to draw up a **personnel assignment plan** with explanatory notes that lists all the experts proposed in the bid; the plan includes information on assignment dates (duration and expert days) and locations of the individual members of the team complete with the allocation of work steps as set out in the schedule.

## 4. Criteria for eligibility of firms

The bidder must have the following administrative and financial requirements for conducting the assignment

- Be a registered as national organization or entity
- References on reports or feasibility studies are required

- Average annual turnover for the last three financial years should be at least 50,000 Euros
- The agency should have minimum 5 employees as of 31.12.2022
- The agency must have handled at least 4 reference projects with focus on areas of Renewable Energy or Storage Technologies with at least 1 projects in Pumped Storage Hydropower in the last three years with minimum commission value of Euro 10,000.
- The organization must be experienced in the areas of
    - techno-economic feasibility (min. 10 years)
    - energy technology (min. 10 years)
    - energy economics (min. 10 years)

The agency must have regional experience in India

## 5. Personnel concept

The bidder is required to provide personnel who are suited to filling the positions described, on the basis of their CVs (see Chapter 7), the range of tasks involved and the required qualifications.

The below specified qualifications represent the requirements to reach the maximum number of points.

**Team leader**

Tasks of the team leader

- Overall responsibility for the advisory packages of the contractor (quality and deadlines)
- Coordinating and ensuring communication with GIZ, partners and others involved in the project
- Personnel management, in particular identifying the need for short-term assignments within the available budget, as well as planning and steering assignments and supporting local and international short-term experts
- Regular reporting in accordance with deadlines

Qualifications of the team leader

- Education/training (2.1.1): University qualification (German 'Diplom'/Master) in Business Administration, Engineering, Economics or other relevant fields
- Language (2.1.2): Good business language skills in English*
- General professional experience (2.1.3): 20 years of professional experience in the Energy sector
- Specific professional experience (2.1.4): 10 years in Renewable Energy and/or Energy Storage
- Leadership/management experience (2.1.5): 6 years of management/leadership experience as project team leader or manager in a company

**Expert 1**

Tasks of expert 1

- Perform the tasks outlined in section 2 and report to team leader

Qualifications of expert 1
- Education/training (2.2.1): University qualification (German 'Diplom'/Master) in Business Administration, Engineering or Economics
- Language (2.2.2): Good business language skills in English*
- General professional experience (2.2.3): 10 years of professional experience in the Energy sector
- Specific professional experience (2.2.4): 5 years in Pumped Storage Hydropower

**Expert 2**

Tasks of expert 2
- Perform the tasks outlined in section 2 and report to team leader

Qualifications of expert 2
- Education/training (2.2.1): University qualification (German 'Diplom'/Master) in Business Administration, Engineering or Economics
- Language (2.2.2): Good business language skills in English*
- General professional experience (2.2.3): 10 years of professional experience in business or research
- Specific professional experience (2.2.4): 5 years in above-mentioned repurposing options

**Short-term expert pool with minimum 1, maximum 2 members**

Tasks of the short-term expert pool
- Perform the tasks outlined in section 2 and report to team leader

Qualifications of the short-term expert pool
- Education/training (2.6.1): 1-2 international experts with a postgraduate degree (German 'Diplom'/Master) in relevant fields
- Language (2.6.2): 1-2 international experts with good language skills in English*
- General professional experience (2.6.3): 1-2 international experts with at least 20 years of experience in the energy sector
- Specific professional experience (2.6.4): 1-2 international experts with at least 10 years of experience in repurposing coal mines and/or 0-1 international expert with at least 10 years of experience in Pumped Storage Hydropower and/or 0/1 international expert with at least 10 years of experience in above-mentioned repurposing options

The bidder must provide a clear overview of all proposed short-term experts and their individual qualifications.

## 6. Costing requirements

**Assignment of personnel**

Team leader and experts: Assignment in country of origin for up to 60 days (for team leader up to 20 expert days, total for experts 1 and 2 up to 40 expert days)

Short-term European expert pool: total up to 20 European expert days. International daily consultancy rates apply.

**Travel**

No travel costs are foreseen.

**Other costs**

Costs for required third-party studies which need to be procured are to be borne by the bidder. In case visas are required the costs for the same are to be borne by the bidder.

## 7. Requirements on the format of the bid

The structure of the bid must correspond to the structure of the ToRs. In particular, the detailed structure of the concept (Chapter 3) is to be organised in accordance with the positively weighted criteria in the assessment grid (not with zero). It must be legible (font size 11 or larger) and clearly formulated. The bid is drawn up in English (language).

The complete bid shall not exceed 15 pages (excluding CVs & other supporting company documents).

The CVs of the personnel proposed in accordance with Chapter 4 of the ToRs must be submitted using the format specified in the terms and conditions for application. The CVs shall not exceed 4 pages. The CVs must clearly show the position and job the proposed person held in the reference project and for how long. The CVs can also be submitted in English (language).

If one of the maximum page lengths is exceeded, the content appearing after the cut-off point will not be included in the assessment.

## 8. Annexes

The contractor is required to read the following documents and incorporate their findinds:

Compressed air energy storage plants in abandoned underground mines: Preliminary analysis and potential by Javier Menendez and Jorge Loredo https://www.researchgate.net/publication/333565916_Compressed_air_energy_storage_plants_in_abandoned_underground_mines_Preliminary_analysis_and_potential

The Coal Mines Regulations, 1957 https://www.dgms.gov.in/writereaddata/UploadFile/Coal_Mines_Regulation_1957.pdf

Low-enthalpy Geothermal Energy Potential of Mine Water from Closured Underground Coal Mines in Northern Spain by Javier Menendez and Jorge Loredo https://www.e3s-conferences.org/articles/e3sconf/abs/2019/29/e3sconf_icacer2019_02007/e3sconf_icacer2019_02007.html

Korba: Planning a Just Transition Transition for India's Biggest Coal and Power District by Banerjee et al. for iFOREST https://iforest.global/wp-content/uploads/2022/02/Korba-Report.pdf

Repurposing of a Closed Surface Coal Mine with Respect to Pit Lake Development by Louloudis et al. https://www.mdpi.com/2073-4441/14/21/3558

Challenges and Opportunities For New Pumped Storage Development by NHA https://www.hydro.org/wp-content/uploads/2017/08/NHA_PumpedStorage_071212b1.pdf

Parametric assessment of hydrochemical changes associated to underground pumped hydropower storage by Pujades et al. https://www.sciencedirect.com/science/article/abs/pii/S0048969718349489

Pumped Storage Hydropower FAST Commissioning Technical Analysis U.S. Department of Energy https://www.energy.gov/eere/water/articles/pumped-storage-hydropower-fast-commissioning-technical-analysis

Eco-friendly Use of Abandoned Coal Mines – Press Release by Ministry of Coal https://www.pib.gov.in/PressReleasePage.aspx?PRID=1796211

Data Collection Survey on Pumped Storage Hydropower Development in Maharashtra by Japan International Cooperation Agency and Electric Power Development Co., Ltd. https://openjicareport.jica.go.jp/pdf/12082897_01.pdf

Turga Pumped Storage Project Preparatory Study in India by Japan International Cooperation Agency and Electric Power Development Co., Ltd. https://openjicareport.jica.go.jp/pdf/12343943.pdf

Pumped Storage Hydropower in India and its Integration with Renewable Energy by Arun Kumar und Mantosh Pandey https://www.researchgate.net/publication/283723854_Pumped_Storage_Hydropower_in_India_and_its_Integration_with_Renewable_Energy

Underground Pumped-Storage Hydropower (UPSH) at the Martelange Mine (Belgium): Underground Reservoir Hydraulics by Kitsikoudis et al. https://www.mdpi.com/1996-1073/13/14/3512

An Exploratory Economic Analysis of Underground Pumped-Storage Hydro Power Plants in Abandoned Deep Coal Mines by Reinhard Madlener and Jan Martin Specht https://www.mdpi.com/1996-1073/13/21/5634

Underground Pumped Hydroelectric Storage: Using Existing Coal Mining Infrastructure of Prosper Haniel Mine, Germany by Rodolfo Alvarado Montero, André Niemann and Timo Wortberg https://www.iahr.org/library/infor?pid=8046 + second document via email

Underground Pumped Hydroelectric Storage by R. D. Allen, T. J. Doherty and L. D. Kannberg https://www.osti.gov/servlets/purl/6517343.pdf

Underground Gravity Energy Storage: A Solution for Long-Term Energy Storage by Hunt et al. https://www.mdpi.com/1996-1073/16/2/825

Overview of Large-Scale Underground Energy Storage Technologies for Integration of Renewable Energies and Criteria for Reservoir Identification by Matos et al. https://www.sciencedirect.com/science/article/abs/pii/S2352152X18301919

Toolkit: Environmental rehabilitation and repurposing by European Commission https://energy.ec.europa.eu/system/files/2020-05/environmental_rehabilitation_and_repurposing_toolkit_-_platform_for_coal_regions_in_transition_0.pdf

Stranded assets and early closures in global coal mining under 1.5 °C https://coaltransitions.org/publications/stranded-assets-and-early-closures-in-global-coal-mining-under-1-5%e2%88%98c/

A Global South Perspective on Stranded Regions: Insights from the Decline of Coal Mining in Cesar, Colombia https://coaltransitions.org/publications/a-global-south-perspective-on-stranded-regions-insights-from-the-decline-of-coal-mining-in-cesar-colombia/

Publication: Global Perspective on Coal Jobs and Managing Labor Transition out of Coal: Key Issues and Policy Responses by World Bank https://openknowledge.worldbank.org/entities/publication/fed57ec7-e4ef-5895-82f7-c2028e62b6f1

Socioeconomic Transition in the Appalachia Coal Region by World Bank https://documents1.worldbank.org/curated/en/531201635134585522/pdf/Socioeconomic-Transition-in-the-Appalachia-Coal-Region-Some-Factors-of-Success.pdf

Coal Mine Closure Standards by Raymond C. Pilcher, UNECE https://unece.org/sites/default/files/2022-03/17.%20Coal%20Mine%20Closure%20Standards%2022%20%20March.pdf