Expansion of India-Denmark Partnership (INDEP 2020-2024)

Introduction:
In December 2019, the Minister of Development Cooperation approved the India-Denmark Energy Partnership 2020-2024 (INDEP) funded by the Danish Climate Envelope with 60 million. In September 2020, the Indian and Danish Prime Ministers signed the India-Denmark Green Strategic Partnership (GSP). This agreement provides a framework for strengthening the cooperation on energy. Consequently, a budget expansion of 9 million DKK to INDEP has been proposed by the Danish Energy Agency (DEA), which will allow the partners to intensify and further unfold the green engagements. Building on the key results of INDEP, the overall aim of the expansion is to further contribute to India's targets in the Nationally Determined Contribution (NDCs) under the Paris Agreement on Climate Change, as well as SDG7, SDG13 and other SDGs.

New key results are:
Advanced transmission planning
India has one of the largest synchronous grids in the world, and with the rapid expansion of renewable energy in the country, transmission planning is becoming increasingly important. Transmission planning is a holistic decision-making process, which among others involves stakeholder engagement and scenario description leading to better utilization of the transmission system and a more easy integration of renewable energy. This work will assist the Indian agencies in integrating renewable energy as the advanced transmission planning can ensure that the renewable energy, often generated in remote locations, can be transmitted to the load centers in an efficient way.

Identification of best available technologies for electricity storage in India
Storage of electricity has high priority for the partners. It is important for balancing the power system when realizing India's renewable energy capacity targets of 175 GW by 2022 and 450 GW by 2030. An Indian technology catalogue and a power system analysis focusing on the use of large-scale electricity storage in a future Indian power system with significant renewable energy penetration. This component will be a supplement to the planned Energy Outlook 2022.

Intensifying activities on integration of renewable energy
In response to a strong demand from the Indian partners, activities on integration of renewable energy will be intensified, and existing thematic sub-areas on integration of renewable energy will be boosted in response.

Justification for support:
India has a population of over 1.3 billion and is the 3rd largest greenhouse gas (GHG) emitting country globally (although not on a per capita level), with the power sector accounting for half of GHG emissions. India's energy demand is expected to rise over the coming years to an extent comparable to the EU's combined energy demand. The expansion will target climate change mitigation and SDGs prioritised in Denmark's strategy "The World 2030" for cooperation with emerging economies.

Major risks and challenges:
The institutional capacity of the Indian partners might not be sufficient for fully utilizing the advanced solutions provided through the expansion.

File No.	2019-18948				
Country	India				
Responsible Unit	GDK				
Sector	23110 – Energy policy and administrative management				
Partner(s)	GDK with Ministry of Climate, Energy and Utilities (MCEU)/Danish Energy Agency (DEA)				
DKK mill.	**2021**	**2022**	**2023**	**2024**	**Tot.**
Grant	9				**9**
Projected ann. disb.	1.7	2.9	3.4	1.0	**9**
Duration	2021 – 2024				
Previous grants	60. mio. DKK				
Finance Act code	§06.34.01.70				
Head of unit	Rasmus Abildgaard Kristensen				
Desk officer	Tilde Hellsten				
Financial officer	Christina Hedegaard Hyttel				

Relevant SDGs *[Maximum 5 – highlight with grey]*

No Poverty	No Hunger	Good Health, Wellbeing	Quality Education	Gender Equality	Clean Water, Sanitation
Affordable Clean Energy	Decent Jobs, Econ. Growth	Industry, Innovation, Infrastructure	Reduced Inequalities	Sustainable Cities, Communities	Responsible Consumption & Production
Climate Action	Life below Water	Life on Land	Peace & Justice, strong Inst.	Partnerships for Goals	

Strategic objectives:

Reduced greenhouse gas emissions and leverage of the partnership in mobilising further resources for India's green transition.

Justification for choice of partner:

The Ministry of Power is already a partner in INDEP. No new partners are introduced.

Summary:

Danish energy transition is of great interest to Indian partners at the central government level and at state level. By sharing the Danish expertise on developing energy systems to accommodate renewable energy sources with the Indian partners an enabling environment for the green transition is created.

Budget in mio. DKK:

DEA Programme management	0.275
Advanced Transmission planning	2.850
Deep dive electricity planning	2.375
Long-term advisor on energy-modelling	3.500
Total	**9.000**

India-Denmark Energy Partnership (INDEP)

2019-2024

Appendix to the Programme Document

Additional activities under the INDEP

DRAFT

[DATE]

List of key abbreviations

CEEW	Indian Council on Energy, Environment and Water
DEA	Danish Energy Agency
GSP	India-Denmark Green Strategic Partnership (signed 28th September 2020)
INDEP	India-Denmark Energy Partnership
INDEP PD	India-Denmark Energy Partnership Programme Document
LTA	Long-term Advisor (commonly referred to as a Sector Expert in an Indian context)
MOP	The Indian Ministry of Power
SDGs	UN Sustainable Development Goals
SLDCs	State Load Dispatch Centres
TOC	Theory of Change

1. Background

The India-Denmark Energy Partnership (INDEP) are described in the INDEP Programme Document (INDEP PD), that was endorsed by the Council of Development Policy on 11th September 2019 and approved by the Minister of Development Cooperation in the commitment letter of 12th December 2019. The INDEP are funded by the Danish Climate Envelope with 60 million DKK for the period 1st January 2020 to 31st December 2024.

On the 28th September 2020, the Indian and Danish Prime Ministers signed the India-Denmark Green Strategic Partnership (GSP). Given the shared desire to remain trusted partners, the two Prime Ministers agreed to elevate India-Denmark relations to a Green Strategic Partnership. The Partnership aims at advancing political cooperation, expand economic relations and green growth, create jobs and strengthen cooperation on an ambitious implementation of the Paris Agreement and the UN Sustainable Development Goals (SDGs).

In the area of Energy and Climate Change, the Prime Ministers confirmed the close partnership that the India-Denmark Energy Partnership (INDEP) illustrates. The parties' commitment to further strengthening the energy partnership over the coming years, and the additional activities under INDEP, described in this present appendix to the INDEP PD, should be seen as a realisation hereof.

On the 18th November 2020, the Joint Working Group (JWG) on Energy between the Danish Energy Agency (DEA) and the Indian Ministry of Power (MOP) met to discuss possible strengthening of existing areas of cooperation under the GSP. During the meeting, a high level of Indian interest was identified on three areas of strengthened collaboration:

i) A Sector Expert/Long-term Advisor (LTA) on integration of renewable energy, to be placed within the structure of MOP. This would supplement the existing Sector Expert/Long-term Advisor on energy modelling that will be posted in the Central Electricity Authority (CEA) under MOP from early 2021.
ii) A deep dive on electricity storage
iii) Advanced transmission planning

These strengthened areas of cooperation has since been further developed at a technical level. The cooperation are mandated under the "Memorandum of Understanding on India-Denmark Energy Cooperation", signed 5th June 2020. The additional activities under the INDEP will, as the INDEP as a whole, draw on Denmark's world-leading experiences from its low-carbon transition, which is in high demand in both India and around the world.

The proposed areas of strengthened collaboration are incorporated into an updated work plan in Annex 3. The update of the work plan is based on the endorsement of the overall priorities at the JWG meeting on 18th November 2020 and is formulated in dialogue with the Indian partners. The formal approval of the concrete alternations of the work plan will be done at the next JWG meeting in early 2021.

2. Strategic Considerations and Justification

As presented above, a strong mandate is given from the GSP to the strengthening of the existing INDEP. The Indian partners are continuously asking for Danish expertise and exchange of knowledge to further develop and evolve the Indian energy sector. As described in the INDEP Programme Document (INDEP PD), the Indian transition towards a sustainable society is pivotal for the global combat against climate change and the implementation of the SDGs. With a population of 1.4 billion and one of the world's fastest-growing major economies, India will be vital for the future of the global energy markets. The Indian ambitions for sustainable development and renewable energy deployment are impressive and the INDEP can support this development going forward. The programme justification from the INDEP PD therefore still apply to the rationale of the INDEP and the additional activities. Around 750 million people in India gained access to electricity between 2000 and 2019, highlighting both the massive need and possible impact for an effective and timely transition to a low-carbon society with high share of renewable energy.

The specific additional activities have been gathered with a view to combine the demand and wishes from the existing Indian partners with areas of Danish expertise and experiences from the Danish energy transition. This follows the Theory of Change from the INDEP PD, where effective partner engagement at strategic level was identified as a key impact driver. It also provides the opportunity to respond to the recurrent partner demand for strengthening the focus on renewable energy integration, including with the employment of a Sector Expert/Long-Term Advisor from Denmark in the Indian authorities. This is combined with a wish to look further into the technical concepts of Danish Energy Islands, which includes advanced interconnection between different markets as well as energy storage, specifically a deep dive on electricity storage and the possibilities that this provides for underpinning more renewable energy in the electricity system.

As such, the strategic considerations and justification of the additional activities under the INDEP are in line with the approach that was presented in the INDEP PD and specifically table 2.1. Moreover, the extensive cooperation can continue with focus on the two key line ministries MNRE and MOP that will continue to be the partners of the programme. No additional partners will be needed.

At the Prime Minister's meeting on 28th September 2020, Prime Minister Narendra Modi expanded on his famous phrase that *"India has the scale, Denmark has skills"*: The Indo-Danish cooperation now needs expansion of scope with a focus on speed. Scale, skills, scope and speed are pillars of the proposed additional activities for the INDEP to foster an intensified and innovative green transition in one of the world's most important emerging economies. Moreover, the green transition can be a driver for a sustainable economic recovery from the COVID-19 pandemic with a specific focus on a just transition. The creation of an energy system that fosters investments in renewables and green technologies will create jobs and growth. The Indian Council on Energy, Environment and Water (CEEW) has estimated that the implementation of the current Indian targets of 100 GW solar and 60 GW wind capacity are likely to generate about 1.3 million direct jobs on a Full-Time Equivalent basis in India by 2022. In Denmark, we have shown how this can be done in a just way by incorporating former industries such as fisheries and offshore oil and gas into the offshore wind industry, applying knowledge and know-how on areas such as sailing routes and offshore conditions to foster a transition for the society as a whole.

3. Presentation of the additional new elements of the INDEP

The following section will present the new additional elements of the INDEP. The sections will include references to the updated results framework, presented in annex 2 of this appendix.

a) Posting of a Sector Expert/Long-term Advisor (LTA) on integration of renewable energy

During the recruitment phase of the LTA on energy modelling it became clear that the Indian partners wished for the LTA to also cover the area integration of renewable energy. However, this would be too wide a subject for a

single expert and energy modelling was chosen as the primary area of focus. However, the Indian request for a LTA on integration of renewable energy have persisted. Moreover, it has become clear from the current activities under the integration of renewable energy that there is high-level buy-in from participants in POSOCO, CERC and CEA.

The role of the LTA is to be the focal point for Danish knowledge on integration of renewable energy and key to the coordination on this issue between the partner organizations. The LTA will share Danish experiences and knowledge within a green transition to enable Indian partners to exploit the lessons learnt in Denmark. The LTA will be the in-house entry point for Danish knowledge and stakeholders and provide the Indian partners quick and direct access to information on relevant Danish energy know-how. Regarding more comprehensive issues included in the work programme, the LTA is expected to direct relevant queries to the DEA, who will find the relevant Danish expert or plan a capacity building technical exercise with relevant experts. The LTA will be an important facilitator in the cooperation and dialogue between the DEA and MOP. The presence of a LTA is expected to make the programme more efficient and effective, a shared understanding between DEA and MOP.

The LTA on integration of renewable energy would supplement the existing LTA on energy modelling (that will be posted in the Central Electricity Authority (CEA) under MOP from early 2021). The LTA on integration of renewable energy will be placed within the structure of MOP (specific placement will be identified in dialogue with the Indian partners).

b) A deep-dive on electricity storage

A deep-dive on electricity storage is a new activity added to the existing outcome 2, by expanding both output 2.1 and 2.2. Storage of electricity has high priority for CEA under MOP as an important technology for balancing the power system when realising the renewable energy capacity targets of 175 GW by 2022 and 450 GW by 2030.

To that end, two new activities expand the current activities as part of the INDEP outcome 2:

1) Development of an Indian technology catalogue focusing on electricity storage technologies supplementing the current activities for developing a technology catalogue for power technologies
2) Power system analysis for the use of large-scale electricity storage in a future Indian power system with significant renewable energy penetration. These analyses supplement the existing activities of capacity building and implementing state-of-the-art modelling methods and tools in the Indian government institutions.

A technology catalogue on electricity storage is expected to be published in the first half of 2022 and serve as a basis for power system analysis. As a consequence, activities on power system analysis focusing on electricity storage are expected after the finalisation of the aforementioned technology catalogue. The activities will be organized with the current Indian implementing partners, and hence no new partners are required.

The power system analysis of the value of electricity storage could either be incorporated in the already planned Indian Power Outlook (expected by the end of 2022) or be done in a dedicated report analysing the value of electricity storage in India in future years. The choice of specific products will be agreed with the Indian implementing partner

c) Advanced transmission planning

Advanced transmission planning is a new activity under outcome 3, by expanding output 3.2. India has one of the largest synchronous grids in the world, and with the rapid expansion of renewable energy in the country, transmission planning is becoming increasing important. Regional distribution of large-scale renewable energy calls for regional transmission planning and solutions. Agencies under MOP such as CEA and PowerGrid have expressed

demand for technical assistance in transmission planning, to learn lessons from the European Network for Transmission System Operators for Electricity (ENTSO-E) and Energinet, in handling the increasing shares of variable renewable energy.

Transmission planning is a holistic decision-making process, which involves stakeholder engagement, scenario building and can lead to better utilization of the transmission system to integrate more renewable energy. This includes screenings to identify where needs of increasing the transmission capacity are. This aims to identify bottlenecks in the transmission system, which can vary depending on the consumption and generation of the system, including variable generation from renewable energy (i.e. when the wind blows or not).

This work will assist the Indian agencies in integrating renewable energy as the advanced transmission planning can ensure that the renewable energy, often generated in remote locations, can be transmitted to the load centres in an efficient way. This underpins the overall goal of CO_2 reductions, as it eases the integration of increased shares of renewable energy.

The work on advanced transmission planning would initially focus on sharing experiences and best practices from Europe through an online workshop. Further developments will include benchmarking of the approach to transmission planning methodologies and techniques, by comparing the Indian methodology and approach to best practices from Europe and giving recommendations for enhancements. The initial benchmarking study will be completed by summer 2021. Following this, technical assistance will be given towards the ongoing transmission planning in CEA's National Electricity Plan 2022, according to recommendations from benchmarking study. Technical assistance will also be provided in years 2022-2024 on Cost-Benefit Analysis methodology for transmission infrastructure investment, which will assist PowerGrid in planning their asset investment to integrate increasing share of RE.

4. Theory of Change, key assumptions, drivers and risk

The overall intervention logic and Theory of Change (TOC) of the INDEP will remain unchanged from the INDEP PD. The programme can effectively respond to key Indian challenges and opportunities by utilizing DEA's expertise and experience and will engage in a demand-led partnership with India in these areas. This present appendix and expansion is an example of this responsive partnership based on demands from the partners.

On the new activities, the same approach will applied under the government-to-government modality whereby key partners in India are exposed to the practices in Denmark and supported in a range of technical cooperation initiatives to transfer knowledge and good practice to India. This is done through the existing measures of the government-to-government modality, including study tours, technical cooperation and longer-term inputs by DEA and the LTA in India.

The conditions and assumptions for realisation of the programme targets also remains unchanged as the interest and willingness of the Indian partners as well as the perceived usefulness of Danish input remain pivotal. Moreover, the key partners remain the same, with MOP and its agencies as the partners for the new and additional activities. As described in the INDEP PD, it can become relevant to include inter-state agencies (such as State Load Dispatch Centres (SLDCs)) in the early stages to create a bridge between the federal and state level. This need will be continuously assessed through the Assessment tool for other possible partners under the INDEP, which was developed as part of the INDEP Inception Phase.

A key assumption for the TOC remains, as described in the INDEP PD, that Indian partners need to remain committed to sustained engagement and willingness to allocate staff time and inputs in-kind to engage effectively with DEA staff and other experts. The strengthened collaboration puts an intensified workload towards the Indian

partners in terms of both staff time and inputs for the activities. Lack of engagement from Indian partners continues to have a major potential negative impact on the INDEP. However, the recently signed MOU with MOP as well as the Prime Minister signed GSP showcase a high-level buy-in and mandate to allocate time. This is further underlined by the partner engagement consistently remaining high even during a troubled time with COVID-19. The DEA will continuously monitor and mitigate this risk through the various government-to-government instruments such as high-level meetings and visits, peer-to-peer exchange, technical assistance and day-to-day local presence through the LTAs.

A highly relevant contextual and increasing programmatic risk is, if the recovery response to the COVID-19 pandemic compromises national ambitions and appetite for investments in low carbon development. The current Indian recovery responses have not decreased or limited Indian targets for renewable energy or green transition. However, it has risen them either and the coal sector persists as a central element to spur economic growth. This risk will be mitigated by high-level policy dialogue and continued engagement in identifying cost-efficient renewable energy options, whilst demonstrating immediate benefits in terms of such as reliability of electricity supply and job creation. Moreover, the GSP displays the Indian commitment to an ambitious green transition.

In relation to the COVID-19 pandemic, the reduced ability to travel poses a risk of weaken the relational ties with key partners of the programme and constrain the progress of the programme. This risk is mitigated through recurrent virtual meetings with the key partners as well as the physical presence of the Energy Counsellor at the Danish Embassy in New Delhi, the presence of the LTAs within the partner institutions. The LTA on offshore wind is already in place and the LTA on energy modelling will be in place in early 2021. In addition, the LTA on integration of renewable energy, as promised in this appendix, will further strengthening the ties.

5. Annex 1: Updated budget

The annex presents two separate budgets: The first budget (table 1) outlines the distribution of the new additional funds between the three new additional activities (as presented in section 3). The second budget (table 2) is an updated budget for the entire INDEP with the inclusion of the new additional funding. In table 2, the activities on electricity storage are divided between output 2.1 and 2.2, while the activities on advanced transmission planning are placed on output 3.2. This is in accordance with the results framework in annex 2. The cost of the existing LTA on energy planning and the new additional LTA on integration of renewable energy are evenly divided on outcome 2 and 3.

Table 1: Budget outline for the new additional activities presented in this appendix

Budget for new additional activities (all figures DKK 000)	**2021**	**2022**	**2023**	**2024**	**Total DKK**
Long-term advisor on integration of renewable energy	.700	1.400	1.400		3.500
Deep dive on electricity storage	.475	950	.950		2.375
Advanced transmission planning	.475	.475	.950	.950	2.850
DEA Programme Management	.50	.75	.100	.50	275
Total	**1.700**	**2.900**	**3.400**	**1.000**	**9.000**

Table 2: Updated budget for the entire programme (2020-2024) detailed per output

Budget at output level (all figures DKK 000)	**2020**	**2021**	**2022**	**2023**	**2024**	**Total DKK**

Output 1.1	0	.616	1.496	1.435	1.163	4.710
Output 1.2	0	.616	1.722	1.670	1.420	5.427
Output 1.3	1.023	1.518	1.117	1.095	9.14	5.666
Sub-total Outcome 1	**1.023**	**2.749**	**4.335**	**4.199**	**3.497**	**15.803**
Output 2.1	1.198	2.522	2.808	2.700	1.850	11.079
Output 2.2	.681	2.266	2.446	2.332	1.363	9.088
Sub-total Outcome 2	**1.880**	**4.788**	**5.254**	**5.032**	**3.213**	**20.167**
Output 3.1	.393	1.049	1.153	1.061	6.43	4.299
Output 3.2	.763	3.206	3.045	3.374	2.931	13.319
Output 3.3	.345	1.286	1.432	1.313	8.46	5.221
Sub-total Outcome 3	**1.501**	**5.541**	**5.630**	**5.748**	**4.419**	**22.839**
Unallocated reserve	0	1.350	1.550	1.550	1.550	6.000
Inception Phase	.315	-	-	-	-	.315
DEA Programme Management	.540	.590	.615	.640	.590	2.977
Framework contract tendering	.500	0	0	0	0	.500
MFA Mid-term Review	0	0	400	0	0	.400
Total	**5.759**	**15.018**	**17.785**	**17.170**	**13.270**	**69.000**

6. Annex 2: Updated results framework

The results framework presents the overall programme objective and impact indicators (with baseline and target) from the INDEP PD. Development engagement 1 (with outcome and outputs) is presented here to show the complete result framework for INDEP but the additional funding is solely allocated to new activities under development engagement 2. Hence, the results framework for development engagement 1 remains unchanged from the INDEP Inception Report.

Programme		**India-Denmark Energy Partnership (INDEP)**	
Objective		Reduced greenhouse gas emissions and leverage of the partnership in mobilising further resources for India's green transition.	
Impact Indicators		Contribution to emission reductions (tons of carbon dioxide equivalents) and mobilisation of investments for renewable energy (USD). [1][combined quantitative and qualitative analysis]	
Baseline	Year	2019	High political ambitions expressed in NDG, SDG and RE targets, but insufficient flexibility in power generation, limited integration of RE, inadequate supply chain and markets for offshore wind, investment risk and high cost of capital resulting in high RE prices and lack of incentives for investors and states for higher levels of RE; inadequate modelling to guide state and federal investment planning and demonstrate cost-effective investment potentials, and lack of inter-state trade of electricity.
Target	Year	2024	Emissions (CO_2 tons) and investment (USD) on track for meeting India's target of 175G 2022 (as implied by the 175GW or scenario-guided adjusted target) and following best practice.[2]

Development Engagement 1		**Partner: Ministry of New and Renewable Energy (MNRE)**	
Outcome 1		**India has taken ownership of the centre of excellence for offshore wind and the integration of renewable energy that promotes and creates an enabling environment for lowering the cost of offshore wind power using best available practice in planning and cost reducing measures to continue the implementation of ambitious targets.**	
Outcome indicator		Volume of wind power investment under procurement (INR/USD)[3] (as a contribution arising from the promotion of a comprehensive, coherent and cost-effective approach by the centre of excellence that meets best available practice and contributes to meeting political targets as implied the 5 GW or scenario-guided adjusted target) [4] [combined quantitative and qualitative analysis]	
Baseline	Year	2022	Input from the Centre of Excellence is requested in MNRE's preparation of the next phase of development of offshore wind (YES)

[1] The programme will contribute to emission reductions measured in tons of carbon dioxide equivalent, but this cannot be accurately estimated at the overall programme level as impacts of the contribution are impossible to separate from those of many other initiatives in India. Moreover, impacts are likely to manifest themselves concretely in the longer term, beyond completion of the five-year programme. The long-term planning and scenario modelling will be able to dimension CO_2 equivalent reduced and implied capital investment (USD) of meeting India's target of 175GW in 2022 (as implied by the 175 GW or scenario-guided adjusted target) and also show the progress in terms of close to irreversible decisions (such as investment under procurement) and thus indicate the total likely emissions reduction and investments by 2024. The degree of the programme's contribution will need to be assessed qualitatively with all three outcomes potentially contributing to strengthened awareness and capacity of decision-makers and experts that will lead to more well-informed decision making contributing to the achievement of the targets set in SDG 7 and SDG 13 and India's NDC.

[2] As noted above, the measurement of the target will be based on a combined qualitative and quantitative assessment of the contribution of the programme taking into account the degree to which installed capacity is on track for meeting targets and the degree to which the programme has increased the cost-efficiency of implementation and operation of renewable energy

[3] Under procurement means that an instruction to produce tender and procurement documents has been taken (already 1 GW is under the process). This is judged as a good indication of what will happen – a close to irreversible decision is taken once contracts are awarded but given the time span for this process a lesser threshold of "under procurement" has been chosen for deciding the volume of wind power that the programme has contributed to.

[4] The degree of the contribution of the programme will need to be assessed qualitatively and reported on as a narrative. The criteria to be used include: i) the achievement of the outputs which would indicate that the programme has made substantial contribution to the speed and quality of implementation and ii) the view of the Indian partners and stakeholders (perhaps obtained by survey) on the contribution of the programme.

Target	Year	2024	Wind power under procurement that meets best available practice contributes to meeting political targets (as implied the 5 GW or scenario-guided adjusted target)
Output 1.1		**An enabling framework that streamlines site selection, clearances and procurement while reducing risk to investors.**	
Output indicator		Progress on implementation of necessary measures for an enabling framework that streamlines site selection, clearances and procurement of offshore wind while reducing risk to investors (YES)[5] [combined quantitative and qualitative analysis]	
SSC	Year	2019	Offshore wind is not yet tendered in India
SSC Target	Year 1	2020	MNRE has published the first offshore auction in India where input from Danish experiences can be seen (YES/NO)
SSC Target	Year 2	2021	De-risking of procurement based on the lessons learned from the first tender and from Danish experiences can be verified in the Indian documentation (YES/NO)
INDEP	Year 1	2022	Input from the Centre of Excellence WG1 can be documented in MNREs preparation of the next phase of development of offshore wind (YES/NO)
Target	Year 2	2023	Permitting process of the development of offshore wind has been streamlined and happens in a planned procedure (YES/NO)
Target	Year 3	2024	The first offshore wind project is on track to be connected to the grid and Danish experiences have contributed to the approval framework (YES/NO)
Output 1.2		**Development and implementation of coordinated measures for minimising grid infrastructure and supply chain obstacles to the development of the offshore wind sector**	
Output indicator		Progress on implementation of necessary measures for minimising grid infrastructure and supply chain obstacles to the development of the offshore wind sector while reducing risk to investors (YES)[6] [combined quantitative and qualitative analysis]	
SSC	Year	2019	No infrastructure ready to integrate offshore wind
SSC Target	Year 1	2020	Centre of excellence has established a convening forum for improvement of grid infrastructure and supply chain development for offshore wind and facilitates a multi-stakeholder set of measures
SSC Target	Year 2	2021	Several events have been held with relevant stakeholders, who perceive that the events have added value to developing supply chain infrastructure and technology solutions (YES/NO)
INDEP	Year 1	2022	Centre of Excellence has a proven role in activities, such as exchanges or seminars within grid infrastructure and port development, which build capacity in Indian partners (YES/NO)
Target	Year 2	2023	Centre of Excellence plays a determining role in activities, which expose Indian partners to key decision makers within grid infrastructure and port development (YES)
Target	Year 3	2024	Port and grid infrastructure have significantly improved to enable sustainable development of the first offshore wind project (YES)
Output 1.3		**Technical standards and rules that promote innovation and research.**	

[5] The indicator comprises a number of elements: i) adoption of integrated spatial planning and site selection, ii) adoption of streamlined permitting procedures, iii) improved tendering processes. The indicator is chosen to measure a combination of progress in all these areas (and or updated priorities) year by year. The annual update is a further indication of the relevance and demand driven nature of the programme interventions for the Indian partners.

[6] Capacity and convening forums for continuous improvement of grid infrastructure and supply chain development for offshore wind that improves the coordination and development of regional infrastructure will need to be developed. Many of the activities needed for improvement of grid infrastructure and supply chain development are concurrent between federal and state and between many different ministries as well as the private sector and civil society. The use of a multi-stakeholder approach also allows for harmonisation of all relevant national and international interventions.

Output indicator		A comprehensive and updated system of standards, rules, testing and demonstration is in place[7][8] [combined quantitative and qualitative analysis]	
Baseline	Year	2019	Standards and rules are not harmonised with international practice
Target	Year 1	2020	Review of current standards and technical rules undertaken
Target	Year 2	2021	Assessment of prioritised improvements and adjustments
Target	Year 3	2022	A comprehensive and updated set of standards and rules drafted and submitted for approval in line with international best practice
Target	Year 4	2023	Experience exchange on setting up testing and demonstration facilities for national innovations has taken place
Target	Year 5	2024	Testing and demonstration of national innovations is taking place

Development Engagement 2		**Partner: Ministry of Power (MOP)**	
Outcome 2		**Energy planning decision making is guided by state-of-the-art long-term-energy modelling tools based on a regularly adjusted technology catalogue.**	
Outcome indicator		Implementation, updating and adjustment of long-term energy modelling tools and technology catalogue (YES/NO updated and adjusted). The long-term energy modelling tools and technology catalogue are updated by the relevant Indian institutions (indicating that the tools and catalogues are being used for decision making) [qualitative analysis]	
Baseline	Year	2019	Energy planning not guided by technology catalogues
Target	Year	2024	At least one further update of the renewable energy outlook and technology catalogue is planned and budgeted for after 2024.
Output 2.1		**Enhanced energy modelling capacity in the relevant Indian institutions.**	
Output indicator		Renewable energy outlook report based on modelled scenarios published by the relevant Indian institution(s)[9] [combined quantitative and qualitative analysis]	
Baseline	Year	2019	There is a 5-year national electricity plan (2017-2022) but no long-term energy outlook available
Target	Year 1	2020	Agreed framework for energy modelling in India and a capacity development action plan
Target	Year 2	2021	Initial model runs undertaken and long-term data collection process initiated
Target	Year 3	2022	Intermediate model runs undertaken and long-term data collection process consolidated
Target	Year 4	2023	Indian power outlook report published based on modelled scenarios
Target	Year 5	2024	The power outlook report is used to guide decision making
Output 2.2		**Technology catalogue established, updated and used.**	
Output indicator		Energy stakeholders adopt and make use of the technology catalogue[10] [combined quantitative and qualitative analysis]	
Baseline	Year	2019	No systematic, shared framework for technology parameters (incorporating: energy and technical; environment and cost aspects)
Target	Year 1	2020	Mapping of technologies and structure for technology catalogue completed
Target	Year 2	2021	Stakeholder workshops and/or forums to share state-of-the-art technology knowledge

7 Testing and demonstration is at exchange of information level only to avoid commercial sensitivity

8 The indicator for this output measures progress in developing a system of standard, rules, testing and demonstration – a sequence of activities from year to year are identified and progress measured against reaching the planned sequence.

9 The indicator for this output measures progress in developing a framework of energy modelling from model to energy outlook report – a sequence of activities from year to year are identified and progress measured against reaching the planned sequence.

10 The indicator for this output measures progress in developing a technical catalogue that is necessary for modelling as well as for tendering and other purposes – a sequence of activities from year to year are identified and progress measured against reaching the planned sequence.

Target	Year 3	2022	First technology catalogue for prioritised technologies published and disseminated to stakeholders. Work on technology catalogue on electricity storage initiated.
Target	Year 4	2023	Power sector technology catalogue used by stakeholders for energy modelling. Technology catalogue for electricity storage published.
Target	Year 5	2024	Expanded and updated technology catalogue completed
Outcome 3		**Flexibility and integration of increasing levels of RE in the power system (through optimized flexibility, forecasting, energy efficiency, consolidated grid codes, efficient design of the power market, and other measures).**	
Outcome indicator		Increased RE share in the electricity mix (% share) (normalised for installed capacity and weather) (as a contribution arising from the promotion of state-of-the-art forecasting, grid codes, market development and operational improvements in integration and flexibility of RE that contributes to meeting political targets as implied the 175 GW RE or scenario-guided adjusted target) [combined quantitative and qualitative analysis]	
Baseline	Year	2019	A normalised baseline would need to be established (estimated 2017: 10% electricity production (CEA))
Target	Year	2024	% share of RE on track to reach targets (as implied the 175 GW target or scenario-guided adjusted target)
Output 3.1		**Revised and strengthened grid codes for VRE integration including offshore wind**	
Output indicator		State-of-the-art grid codes adopted by CERC and CEA[11] [combined quantitative and qualitative analysis].	
Baseline	Year	2019	Indian electricity grid code regulations are in place but not optimised for future technology integration (e.g. offshore wind) and higher share of renewable energy. Key stakeholders, barriers and existing grid code regulations have been identified as part of baseline analysis.
Target	Year 1	2020	Comments delivered on two key current grid codes for connecting and operating. Consultation workshop increases knowledge transfer, and identifies area for future work in grid code collaboration.
Target	Year 2	2021	Initiation of collaboration under specific identified area (e.g. BESS, offshore wind, approach to connection guidelines, etc)
Target	Year 3	2022	Grid codes and compliance testing and verification guidelines are submitted for approval.
Target	Year 4	2023	Grid codes and compliance testing and verification guidelines are approved.
Target	Year 5	2024	Grid codes and compliance testing and verification guidelines are implemented
Output 3.2		**Enhanced flexibility of the Indian power system for integration of RE, security of supply and cost (through market development and operational improvements in integrating RE).**	
Output indicator		Implementation of joint flexibility and integration measures that develop capacity within key Indian institutions to make continuous improvements in the cost-effective integration of RE that has an impact on curtailment (YES/NO updated and adjusted annually)[12] [combined quantitative and qualitative analysis].	
Baseline	Year	2019	A key feature of the Indian power system is that there is capacity to undertake market operations that: are day-ahead but not yet translated into real time energy trade framework; technical minimum operational load of 55% for thermal power

[11] The indicator for this output measures progress in developing grid codes integration of RE – a sequence of activities from year to year are identified and progress measured against reaching the planned sequence. CERC is named as the specific organisation in charge of regulation.

[12] The joint workplan for regulation comprises a number of elements: i) market development; ii) flexibility in the operation of power plants; iii) scheduling and dispatch operational strategies and tools. The indicator is chosen to measure a combination of progress in all these areas (and or updated priorities) year by year. The annual update is a further indication of the relevance and demand driven nature of the programme interventions for the Indian partners. The use of a "joint" workplan also allows for harmonisation of all relevant national and international interventions.

			plants; transmission planning methodologies are limited in terms of scenario development, stakeholder engagement and variable renewable energy profiles.
Target	Year 1	2020	Analysis of opportunities and constraints for enhancing cost effective integration of RE. Identified key barriers addressed and process initiated for power market enhancements. Baseline established on flexibility and operation of thermal power plants. Working groups and plans identified for key areas, such as market design, market monitoring, and flexibility of thermal power plants.
Target	Year 2	2021	Working groups have initiated work towards key challenges facing each group. Targeted workshops/internships in each country are undertaken for each working group. Initial recommendations are given in draft form for increasing flexibility, transmission planning and market liquidity.
Target	Year 3	2022	Recommendations are agreed on in terms of how to move towards target of increasing flexibility in the system.
Target	Year 4	2023	Recommendations are implemented for how to move towards target of increasing flexibility in the system.
Target	Year 5	2024	A higher power market liquidity is achieved. Flexibility of thermal power plants is enhanced. Recommended transmission planning methodologies have been adopted and institutionalised.
Output 3.3		**Improved forecasting and dispatching tools and procedures for VRE generation are implemented.**	
Output indicator		Forecasting accuracy has improved through use of the advanced strategies and tools [combined quantitative and qualitative analysis].	
Baseline	Year	2019	The base information for a baseline is prepared by NIWE.
Target	Year 1	2020	Mapping of current renewables forecasting and dispatching systems, including a detailed baseline of forecasting errors. Work plan for improving forecasting and dispatching, and comparison between procedures between Denmark and India and how synergies could be exploited.
Target	Year 2	2021	Training and workshops on focused topics and areas undertaken. Initial recommendations for improving renewables forecasting and dispatching processes drafted.
Target	Year 3	2022	Recommendations implemented and renewables forecast accuracy and dispatching procedures improved year on year and contributing to reduced imbalances proportional to total generation. .
Target	Year 4	2023	Recommendations implemented and renewables forecast accuracy and dispatching procedures improved year on year and contributing to reduced imbalances proportional to total generation.
Target	Year 5	2024	Recommendations implemented and renewables forecast accuracy and dispatching procedures improved year on year and contributing to reduced imbalances proportional to total generation.

7. Annex 3: Updated work plan