

**Transformation of the Chinese Energy System
China National Renewable Energy Centre**

**Development Engagement Document
Annex E to
Energy Partnership Programme between China and Denmark
Development Engagement 1**

Draft March 30th 2017

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1 INTRODUCTION

The present development engagement (DE) document details the objectives and management arrangements for the development cooperation concerning “Transformation of the Chinese energy system” with China National Renewable Energy Centre (CNREC) for the period from July 2017 to June 2020 as agreed between the parties specified below. This DE with CNREC is part of the support provided through the Energy Partnership Programme between China and Denmark. The Partnership Programme with China is embedded in the Danish Energy Agency (DEA) Energy Partnership Programme (DEPP) supported by the Danish Climate Envelope focusing on four countries including also South Africa, Mexico and Vietnam.

2 PARTIES

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and

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3 DOCUMENTATION

The documents that support this intervention are:

1. The Boosting Renewable Energy Project Document.
2. Paper concerning renewable energy in the 13th FYP (Five-Year-Plan)
3. China’s Intended Nationally Determined Contributions
4. China Renewable Energy Outlook 2016

4 BACKGROUND

China submitted its Intended National Determined Contribution (INDC) on 15 June 2015 and ratified the Paris Agreement in September 2016. There are four components in the NDC: 1) a peak in CO₂-emissions around 2030; 2) a reduction of carbon intensity by 60-65 % in 2030 compared to 2005 3) an increase in the share of non-fossil fuels in primary energy consumption to 20%¹ and 4) an increase in forest stock volume by 4.5 billion m³ compared to 2005.

Renewable energy (RE) is one of the key areas that will enable China to achieve the targets in the NDC and an important emerging industry for China. Installed capacity of grid-connected wind power has reached 129 GW with annual power generation at 185 TWh and accounting for 3.3% of total power consumption throughout China, becoming the third largest power source nationwide. China has evolved into the largest market in the world in terms of newly-added photovoltaic capacity, exceeding a total of 43 GW by the end of 2015. These successes are due to government policies and targets, including those in the 12th Five Year Plan (FYP) that have been formulated in accordance with data and analysis from CNREC supported by the previous cooperation with DEA.

¹ The current share of non-fossil fuels in the primary energy consumption was 12% in 2015 and the goal in the 13th FYP is 15% in 2020.

Although the deployment of RE in China is progressing rapidly, efficient utilisation is still facing technical and institutional barriers that represent missed opportunities for CO₂ and other emission reductions as well as an economic loss for the Chinese society. The most immediate indication of this is the high level of curtailment of variable RE: nationally an average of 16% of wind power was lost in 2016, with losses reaching up to 46% in some regions.

On the technical side, the transmission network structures have not been developed to the level where they can cope with larger amounts of variable RE. On the institutional side, thermal power plants are prioritised before renewables due to contractual relations between the state and power plant owners that guarantee revenues based on a certain minimum number of operational hours.

Successful integration of renewable power in Europe and the US has shown that the implementation of a dynamic power market is the primary prerequisite. The lack of transparent and dynamic incentives seriously challenges the development of a modern, flexible power system.

In light of these issues, the Chinese and Danish Governments established the independent CNREC in 2012 with the vision of creating a sustainable centre with comprehensive RE research capacity and a professional information provider for the National Energy Administration (NEA)², the National Development and Reform Commission (NDRC³) and others.

The reputation and strategic position of CNREC has attracted international co-operation partners and CNREC developed the “Boosting Renewable Energy” (BRE) research programme – a five year program from 2015 to 2019. BRE is a partnership between CNREC, NREL⁴, DEA, and GIZ⁵ (from 2017), largely funded by the London based charity, the Children’s Investment Fund Foundation (CIFF)⁶, as part of its climate mitigation activities. The programme will continue to provide policy advice and inputs for the FYPs, as requested by the NEA on RE, including target setting for RE and for coal reduction.

DEA support was instrumental for paving the way for the BRE programme and for attracting the additional partners. Under BRE the co-operation between DEA and CNREC has been focussed around the development of 2050 energy system scenarios and the production of the 2016 China Renewable Energy Outlook (CREO), including scenarios for 2030.

The adoption of ambitious RE targets in the 13th FYP represented a major success for the BRE programme, but also a turning point. The challenge of the next few years is to help ensure that the RE generated is integrated into the energy system with minimal wastage and at reasonable cost, and CNREC requests DEA support for its research in this area. Danish expertise is highly relevant in these areas since Denmark has recently faced, and largely solved, the problems currently faced by the Chinese authorities. DEA’s expertise of particular relevance is the removal of barriers to integration of RE.

² NEA is responsible for formulating and implementing energy development plans and industrial policies; promoting institutional reform in the energy sector; administering energy sectors including coal, oil, natural gas, power (including nuclear power), new and renewable energy and etc.; taking charge of energy conservation, comprehensive utilization of resources in the energy sector etc.

³ NDRC is the crosscutting planning ministry.

⁴ National Renewable Energy Laboratory (USA)

⁵ Deutsche Gesellschaft für Internationale Zusammenarbeit

⁶ DEA and GIZ are not funded by CIFF

The structure and management of the BRE programme was developed based on the experience of previous DEA cooperation with CNREC and reflecting the lessons learned from a long and successful cooperation (for example the importance of continuous technical assistance (TA) presence, utility of peer to peer knowledge transfer, leveraging the credibility of DEA as a government organisation, extending influence by mobilising high-level participation, importance of reaching out to and involving other players in Chinese energy policy, importance of visibility in national and international policy forums).

The involvement of other partners in the BRE programme necessitated some adjustments to working arrangements and these were identified in the first annual review. Revisions included: defining focus areas for a small number of well-defined work packages; careful delineation of the main scenarios for the analyses, so that they deliver the main data input for the research and are common for all the work packages; ensuring that the experts involved have a hands-on approach to the modelling work; continuing to use "sprints" (essentially intensive 1-2-week residential workshops) as a working method; overcoming language barriers by a fluent work process where documents get translated successively and where resources at the international partners get activated; and, ensuring a firm and visible programme management with strict adherence to deadlines. The international partners have established a division of work reflecting their respective strengths.

5 DEVELOPMENT ENGAGEMENT OBJECTIVE

The objective of the wider Energy Partnership Programme between China and Denmark is “To assist China in moving to a less carbon-intensive energy sector including through increased share of RE and sustainable district heating”. This is in alignment with China’s stated ambition in their NDC. The objective of this particular DE is to help facilitate the development of a less carbon intensive energy sector, by working with CNREC to develop convincing RE policy and planning input for Chinese policy makers.

The DEA will base the actual support on progress attained in the implementation of the engagement as described in the documentation. Progress will be measured through CNREC’s monitoring framework for the BRE programme, the indicators for the Danish Climate Envelope, and some specific indicators developed for this DE.

6 THEORY OF CHANGE

The intended outcome of the DE is that RE energy policy assistance and analyses provided by CNREC to relevant policy makers (NEA and NDRC) is used to set ambitious RE targets in the 14th FYP.

The theory of change of DEA’s engagement with CNREC is essentially linked to the Centre’s strategic position in China and its ability to feed into policy development and planning, including power market reform and processes in China. CNREC is convincingly advocating the rationale behind increasing RE shares in the Chinese energy mix and is setting out evidence for sound RE development pathways to NEA and NDRC as the executing agencies. In summary, the change logic is, that if the DEA assistance is successful then the high-level decision makers will support increasing RE targets and other necessary policy adjustments to ensure effective integration of variable RE power in the next FYP, the main instrument in the Chinese policy making process at the national level. The resulting greater use of energy generated from RE will contribute directly to reducing CO₂-emissions. Though there may not be a straight line from policy recommendations to implementation, early results support the change theory. Hence, CNREC

has succeeded in generating support from top level political decision makers and is repeatedly being invited to provide input to the NDRC and the NEA.

To produce evidence for RE pathways CNREC's addresses current challenges and barriers in China using their energy system models. The energy system models currently show that it is technically possible to increase China's ambitions on RE shares in the energy mix. To create an even better basis for political decision CNREC's analysis should be extended to include: effects on stakeholders of full RE penetration, and scenarios including social, economic and environmental effects. This includes sector specific analysis based on the ongoing work in NEA and CNREC. The intended output in this regard is that such extended scenario and analysis are developed and the results published in CREO, CNREC's flagship publication on energy system development in China.

One of the main challenges in the current Chinese power system is integration of variable power produced by wind or solar generators. The losses, termed "curtailment", currently account for around 16% of the RE production in China. In Denmark by contrast, curtailment is virtually zero, even though wind power accounts for 42% of electricity consumption. Losses due to curtailment result in RE investments becoming riskier as producers cannot be sure that they will be able to sell their power. To address this issue, solutions on thermal power flexibility and grid flexibility need to be developed. For the thermal power sector this includes development of suitable incentive systems for thermal plants to manage their output so as to accommodate variable RE inputs; technological and management solutions available to thermal plants to increase flexibility; introduction to the technologies and systems used in Denmark and available from Danish companies. The second targeted output of the DE is accordingly that CNREC has elaborated convincing evidence for a power system that can accept variable inputs without curtailment and that results are presented to NEA and power companies, including through CREO publications. The third intended output is that CNREC's research methodologies and tools are utilized to develop tangible grid development strategies for grid companies to ensure grid flexibility to accommodate ambitious targets for RE in the power mix.

To ensure maximum effect of the analysis developed at CNREC in the BRE research programme it is necessary to strengthen CNREC's position both within China and within the international community. As part of this development CNREC is working towards becoming part of the energy policy think tank for China. The development of such a think tank is envisioned within the Chinese system. The think tank will have a special status within the Chinese system and it will thereby be the main authority on the energy development in China. To support this CNREC needs to continue to increase its impact in China and in various international fora. The fourth intended output for the Danish support is that CNREC is a recognized centre of excellence on Chinese energy sector transition and will facilitate this through presenting CNREC's research results in high level political dialogue in China and in international fora.

7 RESULTS FRAMEWORK

CNREC has established a set of "Key Performance Indicators" with yearly targets that are tracked, measured and reported annually by project management. For Danida's reporting purposes the following key outcome and output indicators have been developed based on these indicators to document progress:

Outcome		Energy policy assistance and analyses is provided to relevant policy makers (NEA, and NDRC) showing clear pathways for setting more ambitious RE targets in the 14 th FYP	
Outcome indicator		CNREC has delivered scenarios and sector specific analysis for the 14 th FYP for energy.	
Baseline	Year	2016	13 th FYP still in force
Target	Year	2020	Draft 14 th FYP due 2020

Output 1		Ambitious RE scenarios and sector specific analysis published in CREO Ambitious RE long-term scenarios for China are generated and published in the CREO that includes identification of main barriers and effects on stakeholders of full RE penetration such as social, economic and environmental effects, and sector specific analysis of main barriers for RE deployment (e.g. RE for heating, offshore wind etc.)	
Output indicator		CNREC uses robust energy models that provide strong evidence base to inform policy making around an increased share of RE	
Baseline	Year	2017	Use of CNREC's model suite extended to analyse longer term scenarios including effects on stakeholders of full RE penetration in China Renewable Energy Outlook 2017.
Target	Year 1.5	2018	Use of model suite extended to analyse longer term scenarios including social, economic and environmental effects in CREO 2018. CNREC analyses specific RE sectors in China and provide policy advice in CREO.
Target	Year 3	2020	CNREC's use of the model suites for long-term forecasts and definition of sector specific targets was included in draft 14 th FYP

Output 2		Thermal Power Flexibility CNREC has presented to NEA and the power sector convincing evidence for a power system that can accept variable inputs without curtailment including suitable incentive systems for thermal plants to manage their output so as to accommodate variable RE inputs; technological and management solutions available to thermal plants to increase flexibility.	
Output indicator		CNREC has additional capacity in analyzing thermal power plants flexibility	
Baseline	Year	2017	Thermal power plants flexibility is not yet a fully developed field of research of CNREC
Target	Year 1.5	2018	CREO 2018 describes incentive systems for thermal power plants to accommodate RE inputs
Target	Year 3	2020	CREO 2019 and 2020 describe technological and management solutions for thermal plants to accommodate RE inputs.

Output 3		Grid Development Strategies CNREC has established cooperation with grid companies and provides inputs to their grid development strategies using the research methodology and tools developed in the BRE-programme.	
Output indicator		CNREC and grid companies have established cooperation on development of grid development strategies for RE integration	
Baseline	Year	2017	CNREC's research on grid development is insignificant
Target	Year	2018	CNREC and grid companies publishes a joint research report

	1.5		on RE integration
Target	Year 3	2020	CNREC has established cooperation with grid companies on their grid development strategies

Output 4		Wider anchoring of research results CNRECs results, presented in the CREOs, are recognized domestically and internationally and CNREC is a recognized center of excellence for research on transition of Chinese power system.	
Output indicator		CREO is recognized as the key publication on RE development in China, nationally as well as internationally.	
Baseline	Year	2017	CNREC has presented CREO 2016 at the International Transition Dialogue in Suzhou in China and at the Berlin Energy Transition Dialogues.
Target	Year 1.5	2018	CNREC has presented CREO 2017 and 2018 at high level national, international and multilateral fora and cooperates with multilateral organisations.
Target	Year 3	2020	CREO 2019 has been accepted as the authoritative source on insight with regards to the development of the energy system in China.

8 RISK MANAGEMENT

Risk analysis using the Risk Matrix of the AMG identified no significant residual risks to the DE.

Risks identified included the following:

Partners withdraw from the BRE programme and CNREC has no funding beyond 2019

The BRE programme of which the DE is part is on-going and has operated as designed and met its targets. Several other partners are involved whose sudden withdrawal might constitute a risk to the BRE programme, but the likelihood of this is considered very low. All the technical partners are government entities who have entered into long-term co-operation agreements. The other partner is a well-established international charitable organisation that has committed funds through to the end of 2019. The risk associated with the programme period is also considered insignificant since it has a sound business model and a secure base of public funding. There is however risk associated with CNREC's financial situation after 2019. As part of the CIFF programme CNREC has to mitigate this risk by developing a plan for CNREC's long term economic sustainability. DEA will help mitigate the risk through facilitating that CNRECs results are presented in the Danish high-level dialogue with NEA as well as in international and national fora.

Poor coordination and lack of progress of the BRE programme

Technical input to CNREC is largely relying on the progress of the BRE programme and the success of the programme is also relying on coordination with and contribution from other partners and CNREC. The management committee coordinates effectively within BRE. DEA has a seat in CNREC's management committee, which meets twice a year and holds the responsibility for the overall progress and resource allocation. The management committee includes representatives for all donors and coordination between partners is therefore also the task of the management committee. However, there are limited resources available at CNREC for the direct and daily coordination with DEA. CNREC's programme manager/coordinator on the BRE programme is part of CNREC's management team. The programme manager also coordinates programme activities and coordinates with DEA. The risk of programme failure due to inefficient progress and poor coordination is therefore minor.

Staff turnovers and resource constraints with CNREC

Demand is high and the risk is minor and is mitigated through a flexible approach to provision of technical input in agreement with CNREC.

The Chinese government does not retain its commitment to low carbon development

This would negatively affect the longer term impact of the cooperation, but the risk is assessed to be minor. Multiple studies including CNRECs own analysis indicates that China's NDC is manageable and the cooperation is per se assisting China with identifying implementation routes for short- and long term targets.

There are no other major risks identified that have not been mitigated as part of the design, but risks will be monitored closely throughout implementation and measures will be carried out accordingly.

9 INPUTS/BUDGET

Outputs	Contribution with Danish funds	Partner Contribution in-kind
1. Ambitious RE scenarios and sector specific analysis published in CREO, in DKK '000	11,500	
TA travel costs etc. in DKK '000	930	
Delegations to Denmark in DKK '000	90	
Other costs in DKK '000	300	
TA from DEA in hours	9,620	
TA from other international experts in hours	2,250	
TA from LTA in hours	2,100	
2. Thermal Power Flexibility, in DKK '000	3,551	
TA travel costs etc. in DKK '000	400	
Other costs in DKK '000	150	
TA from DEA in hours	4,500	
TA from other international experts in hours	750	
3. Grid Development Strategies, in DKK '000	3,632	
TA travel costs etc. in DKK '000	400	
Other costs DKK '000	150	
TA from DEA in hours	3,100	
TA from other international experts in hours	1,500	
4. Wider anchoring of research results, in DKK '000	1,492	
TA travel costs etc. in DKK '000	400	
Delegations to Denmark in DKK '000	90	
Other costs DKK '000	150	
TA from DEA in hours	2,100	
GRAND TOTAL, DKK '000	20,177	

10 MANAGEMENT ARRANGEMENT

The parties have agreed to the following management arrangement with the aim to ensure adequate dialogue and timely decisions in regard to this development engagement.

The engagement will follow the CNREC implementation structure established as part of CIFF support. The CIFF project is guided by a Policy Committee, anchored in the Chinese energy administration. The Policy Committee is led by NEA (New and Renewable Energy Department) and includes high-level representatives from institutions involved in energy policy making in China (NDRC, Ministry of Finance, Ministry of Science and Technology); the Embassy of Denmark; and CIFF. The CNREC implementation structure also includes an Advisory Committee with key national and international experts. CNREC is responsible for project management, and a project team with participants from CNREC, NREL, GIZ and DEA implement the project with support from external experts.

The BRE programme is managed by a Management Group with the CNREC Director, Chief Expert and Chief Modeller from CNREC and Project Managers from each of the participating organizations (i.e., CNREC, NREL, GIZ, DEA). The group will meet 3-4 times a year to ensure optimal coordination and progress according to the timetable.

Further, the programme will be supported by the China Advisory Group, advising the Management Group; as well as a China Experts Group and International Experts Groups advising the Management Group with expertise in RE, power sector transformation, grid development and operation, and distribution generation both in China and internationally.

A halftime long-term adviser (LTA) will support CNREC on a daily basis. The LTA will: i) facilitate CNREC partners in the implementation of the DE; ii) provide high level advise and technical input to demands from CNREC related to RE for heating and energy efficiency, and iii) assist facilitation of the partnership between CNREC and DEA.

11 PROCUREMENT AND FINANCIAL MANAGEMENT

This development engagement will have no cash transferred or disbursed directly to the development engagement partner. The input from DEA is entirely TA in the form of visiting experts, arranging meetings, during study tours and exchange visits, a, and an international Long-Term Advisor sharing its TA equally between CNREC and NECC (for the Development Engagement between DEA and NECC). Hence, there are no requirements for accounting of funds and financial reporting at development engagement level.

However, based on the agreed annual work plan the international TA will be budgeted and agreed upon.

The cooperation includes a 10% contribution to a full-time International Advisor resident in China, contracted by CNREC to lead the BRE programme. This input is also given as TA, with DEA engaging the expert on a consulting contract for the appropriate number of hours.

Procurement of any other agreed international technical assistance (in any form) rests with DEA and will follow European procurement rules. The Development Engagement head submits notice of no-objection (based on CV of the TA) to DEA on the successful TA before DEA enters into contract/agreement with the international TA.

12 MONITORING AND EVALUATION

The DE covers the second half of the ongoing 5-year BRE-programme of CNREC.

For the BRE programme a set of Key Performance Indicators (KPIs) at impact, outcome and output level exists, against which progress is monitored. There is a half-year report on performance management and a full annual end-of-year report which includes progress against indicators and a discussion of challenges that have been encountered or which may lie ahead. The Policy Committee will receive progress reports and presentation of the main policy strategy recommendations from the BRE-programme to inform the key policy and planning processes impacting RE deployment.

Detailed indicators for each specific development engagement output will be revisited and potentially refined as part of the inception, where annual targets, in line with already defined targets will be adjusted with reference to the Danish Climate Envelope guidelines for monitoring. Monitoring towards these targets will be undertaken by the DEA and the CNREC coordinator and be reported to the advisory group in Copenhagen. This will be done through the bi-annual progress report using a “traffic-light system” where:

- “green” is on-track – implementation progresses as scheduled;
- “yellow” is partly on-track, which needs an explanation by the Implementation Group to the Management Group, including actions taken to get back on-track and closer monitoring of progress by the Management Group;
- “red” is off-track, which needs a detailed explanation by the Management Group to the Steering Committee with recommendations of changes to the implementation to get the engagement back on-track. If “red” in two consecutive reporting periods, the Steering Committee may consider reallocation between outputs within or between the development engagements as deemed relevant

Monitoring of actual time spent by international advisers will be reported in the bi-annual progress reports with updated work plan and projection of TA input for the following bi-annual will be stipulated. Similar reporting will be done for workshops and study-tours.

The Danish Ministry of Foreign Affairs (MFA) shall have the right to carry out any technical or financial mission that is considered necessary to monitor the implementation of the programme. After the termination of the programme support the Danish MFA reserves the right to carry out evaluation in accordance with this article.

Anti-corruption

No offer, payment, consideration or benefit of any kind, which could be regarded as an illegal or corrupt practice, shall be made, promised, sought or accepted - neither directly nor indirectly - as an inducement or reward in relation to activities funded under this agreement, incl. tendering, award, or execution of contracts. Any such practice will be grounds for the immediate cancellation of this agreement or parts of it, and for such additional action, civil and/or criminal, as may be appropriate. At the discretion of the Government of Denmark, a further consequence of any such practice can be the definite exclusion from any projects funded by the Government of Denmark.

Prerequisites

The DE is in accordance with a Memorandum of Understanding signed by the National Energy Administration and the Danish Ministry of Energy, Climate and Building. There are no further prerequisites.

Signatures

Partner/Danish Energy Agency