January 9, 2014

Response from IBRD—Approval by Mail: CTF Turkey: Renewable Energy Integration Project

IBRD's responses to Trust Fund Committee members comments and questions on the project proposal entitled***, Turkey: Renewable Energy Integration***

- Why is concessional finance required with a 10 year grace period given that the project is expected to start making returns after 5?

CTF offers two specific products - softer terms and harder terms. This project is availing the harder (less conccessional) terms of CTF funding.

The project team has identified five specific challenges in greater and faster integration of wind energy in Turkey, as described in Annex-6 on page-52. These are:
(a) Need for up-front transmission investments - especially as these assets would remain under-utilized over the short to medium term as the wind energy capacity is gradually developed,
(b) Limitations of load despatch and control systems - especially in context of less predictability of wind energy generation, and potential difficulty in handling large volumes of wind going forward,
(c) Limited transmission corridors vis-a-vis geographic location of wind energy - in view of geographical concentration of wind energy resources around the Sea of Marmara,
(d) Inadequacy of existing transmission networks to cater to growing demand for electricity being supplied from wind as well as other energy sources, and
(e) Market and Regulatory Aspects - including strengthening and streamlining the licensing process, as well as cumulative planning process from technical as well as safeguards perspective.
CTF financing is helping address these challenges in four ways: (i) Drawing greater attention from TEIAS and Government of Turkey to addressing the above challenges through specific measures, (ii) Providing attractive funding for investments that help strengthen the long-term wind energy connection and absorption capacity of the grid, (iii) Leveraging funds from the World Bank and private sector for creating the necessary capacity for wind energy generation and transmission, and (iv) Introducing latest technologies on smart grid and wind desk at the load despatch center as well as various substations for maintaining grid stability in face of higher wind energy intake.

Many of the above-mentioned challenges involve investments that would yield benefits over a longer period of time, and are specific to greater absorption of wind energy. Such investments include smart-grid systems, wind energy desk, under-sea transmission cable and sub-stations catering mainly to wind energy. Sub-stations are expected to be loaded to the extent of less than 50% over the first few years of transmission line operation. Similarly, the under-sea cable would be utilized at a relatively low level for the first few years - and would support higher power flows only as the envisaged wind power plants are gradually implemented. The smart-grid components also would be

utilized over a longer period of time. Concessional CTF funding is helping draw closer attention to these investment needs and pushing them to a higher level of priority within TEIAS's overall investment plan. It also makes these investments more attractive in view of likely under-loading of these assets over the short to medium term. Such up-front investments are premised on faster expansion of wind energy and entail greater risks for the transmission company - especially from the perspective of deploying scarce capital resources towards assets that would be under-utilized in the beginning.

□□□□□□□□□□It isn't clear how the cost-effectiveness was calculated, the decision agreed at the committee meeting was for the methodologies and assumptions to be clearly defined. The investment cost/tonne hasn't been presented. The section on cost effectiveness should also explain why the marginal-abatement cost effectiveness wasn't calculated.

Calculation of Cost Effectiveness: Calculation of cost-effectiveness is based on GHG reduction/avoidance estimated in Table-3 of Annex-6. The estimate has been prepared for impacts over short and medium-long terms as well as in terms of CTF additionality (with and without CTF funded interventions). The short term impact estimate is premised on 600 MW of wind energy capacity being added directly as a result of CTF intervention on sub-stations. The medium-long term impact is premised on faster integration of wind energy due to availability of better transmission facilities, including smart-grid and wind desk. The CTF additionality is premised on the difference between with CTF investments and without CTF investment cases. In each case, the annual wind power generation is calculated based on a capacity factor of 33%. The lifetime carbon emission reduction/avoidance is calculated based on carbon intensity of grid of 400g/kWh and plant life of 15 years. Cost effectiveness is then calculated by dividing the CTF funding by the estimated lifetime carbon emission reduction in each case.

The calculation of Cost Effectiveness over the entire cost of the intervention (and not just the CTF funding) including generation and transmission investments is as follows:

	Short-Term Impact	Medium-Long Term Impact (by 2030)	CTF Additionality (by 2030)
Total GHG reduction/avoidance (MTCO2)	10.42	300	108.4
Cost Effectiveness w.r.t. CTF Funding (USD/TCO2)	4.8	0.17	0.46
Expected Total Investment across Generation* and Transmission (million USD)	959	25950	9850
Cost Effectiveness w.r.t. Total Investments (including private investment in WPPs) (USD/TCO2)	92	86.5	90.9

* Generation Investments assumed at USD 1.5 million per MW of installed wind energy capacity. Please note that co-financing estimates assume a conservative USD 1 million per MW in wind investments.
Also, the GHG Reduction calculations conservatively assume a useful life of 15 years as against expected 20-25 years.

Reason for not calculating MACC: According to the CTF committee decision from October 2013 meeting "*A threshold for CTF eligibility may be established at the marginal abatement cost of USD 200 per ton of CO2-equivalent reduced. Since the technologies supported by the CTF are typically far below that threshold, it is suggested that instead of requiring every project/program to undertake marginal abatement cost analysis, the country is requested to provide information on the estimated marginal abatement cost only for projects/programs for which the marginal abatement cost is likely to exceed USD 100 per ton of CO2-equivalent.* "

Since the cost of reducing a ton of CO2 -the project cost effectiveness based on total investment costs varies between $86.5 to 92, one can assume that MAC, which is calculated as net incremental cost of reducing CO2, is less than $92 per TCO2. Further, EBRD report of October 2011, titled "*The Demand for Greenhouse Gas Emissions Reductions: An Investors' Marginal Abatement Cost Curve for Turkey*" indicates that marginal abatement cost of wind energy, which is the major part of the total project cost, in the status quo case (most conservative) in 2030 is zero or less.

□□□□□□□□□□Could you provide evidence to show how the capacity factor for wind was determined to be 33%?
The capacity factor has been obtained from the feasibility reports for individual substations submitted by TEIAS for World Bank review. The number was cross-checked by the World Bank team by examining actual data for installed capacity and generation in 2012. As per statistics available on TEIAS website, Turkey had 2260 MW of installed wind energy capacity in 2012, from which 6760 GWh of electricity was generated, which indicates a capacity factor of 34.14%.
□□□□□□□□□□It seems like the TA component that hasn't been agreed yet might be quite key to the success of the wind developments. Please could you provide further information about the process and timescales for this.

The TA component is being explored by the World Bank team to address potential need for longer term support for continued strengthening of market and regulatory aspects, as well as technical capacity, safeguards and system planning aspects. It may be pointed out that there are existing mechanisms within TEIAS as well as at other relevant agencies such as EMRA and Ministry of Environment to address these aspects, and these existing mechanisms would be used to cover these aspects for the purposes of investments proposed under the REIP project. However, from a longer term perspective some of these aspects may need further strengthening. Some of these - especially some aspects relating to TEIAS and EMRA - would be addressed through the EU-IPA

2012 program. Efforts at such strengthening any remaining aspects would need to be preceded by an agreed program of technical assistance to serve all concerned agencies. The World Bank team proposes to prepare and deliver such Technical Assistance as a separate project, which may be funded from CTF or other suitable sources of funding. It is likely that such a program would be devised and delivered over the next one year.

□□□□□□□□□□Please could you provided more information regarding the number of employment opportunities that will be created as a result of this project, if possible, disaggregated by gender.

Employment opportunities from wind power projects may comprise of three different types: employment in manufacture of equipment, employment in construction, installation, and O&M, and employment from power generated. All these three can vary with the specific country context. The European Wind Energy Association (EWEA) estimates that every megawatt of installed wind capacity creates about 60 person-years of employment and 15-19 jobs, directly and indirectly. The World Bank team would solicit such information for Turkey during the appraisal of the project and reflect the results in the final project appraisal document. The team will also try to obtain such information for the wind power plants at hand during the course of project implementation. Reporting on employment opportunities that will be created will be done at project completion.