Grid connection

Process for Eskom IPP renewable energy grid integration

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The Department of Energy (DoE) opened up the opportunity for renewable energy generation in South Africa, by releasing a RFP on 3 August 2011. While it is a DoE supported program, Eskom needs to ensure the grid integration is made possible.

What consultation and advice is offered by Eskom to potential developers? What process is followed for costing and grid connection solutions? In this article the Eskom process is discussed to enable the grid integration of potential renewable energy projects to the Eskom grid.

The RFP from the DoE [1] covers 3725 MW of renewable energy from independent power producers (IPPs), of which 100 MW is allocated for projects in the 1 – 5 MW range. All of these projects will follow a standard process that was developed in Eskom for grid integration, to support the numerous requests for grid connection solutions and costing. The renewable energy (RE) IPP bidding process resulted in approximately 270 requests for cost estimate letters in Bid 1 and a further 180 odd for Bid 2. This resulted in an effective 10% success rate of the preferred bidders, namely 28 in Bid 1 and 19 for Bid 2.

This paper discusses the Eskom processes followed to service the industry needs for grid connections.

Grid connection process

The grid connection process addresses the need for consultation with IPP developers and their consultants, and to advise on potential solutions. It covers project costs and the associated agreements to establish the required grid infrastructure. The end state is the actual construction and connection of the IPP to the grid. This process is illustrated in Fig. 1.

Consultation and advising phase

Grid connection application

The Eskom Grid Access Unit (GAU) was formed to facilitate all generator connection requests to the Eskom grid, including IPP and Eskom generators. The IPP completes a grid connection application form which is forwarded to the GAU, who then initiate the Eskom internal processes with engineering. The GAU also facilitates the technical meetings between IPP representatives, consultants and Eskom engineering staff to clearly define requirements, discuss potential limitations and solutions. Network location data and future development needs are shared by distribution network planning and transmission grid planning with the potential IPP. The GAU monitors the whole process and liaises with customers and Eskom departments, handling all queries as required.

The application form contains contact information, location data and GPS coordinates and limited technical data such as technology and maximum export capacity in MW. The actual detail needs to be further discussed during the consultation stage. A reasonable assurance should be provided that the project will be developed, e.g. land owner consent and EIA has been initiated.

Please note that an IPP who needs to connect into a municipal network, needs to apply to the applicable municipality itself. The Municipalities will make their own processes available to such potential clients. The request should also be send to Eskom GAU to consider overall capacity in larger area and impact on grid in total. The Municipality needs to consider if its supply agreement is still sufficient to allow for changed import/export requirements. This will be handled via the Eskom Customer Services executives.

Engineering interface

The initial technical analysis is done by distribution network planning and forwarded to the transmission grid planning where capacity or extra feeder bays are required from the transmission network. The planners interface with the substation and line design engineers to motivate suitable solutions. This is extended to the Lands and Rights groups to support potential line routes and suitable sites, in consultation with the IPP. Due to the large volume of applications and a limited capacity on existing or developing networks,
the projects are addressed on an individual basis, as if only that one project had applied. Once projects are granted preferred bidder status, they are regarded as connected to the system for further analysis, and use previously available capacity for such assessments. Any non-successful projects or new projects will be treated singularly as a new project on its own.

The IPP’s initiate the EIA for their project when required, to meet the DoE submission requirements. Such an EIA should include all aspects related to the project, including the Eskom line route(s), substation site(s), own facility layout, road access, etc. Eskom will only undertake an EIA for own proposed projects, or for customer projects after acceptance of the budget quote by the customer. The RFP requires the IPP developers to complete the EIA at their own risk. It means that line routes can only be properly optimized once more clarity on DoE preferred bidders has been received. This will require EIA consultants to consult with Eskom, especially where the line routes and part of site needs to be transferred to Eskom in future. If this is ignored, the IPP places the grid integration at risk and could be burdened with additional EIA work, with the resultant delays and cost escalations.

In almost all projects thus far, the IPP has not formally appointed an EPC (Engineering, procurement and construction contractor) at this stage, which has resulted in limited interaction between Eskom and the IPP EPC to formalize such connection details.

The developer also provides basic information about the proposed generation plant (as provided in the generation application form) such as:
- Location maps
- Maximum export capacity
- Auxiliary and/or construction supplies required
- Technology
- Potential schedule considerations

Cost estimate letter (CEL)

The IPP requests a cost estimate letter from Eskom. It may include several alternative options but is mainly based on the preferred solution, as discussed with the developer. It only gives a high level technical solution. At this stage there is no selected line route and site(s). Availability of resources and even lead times are unknown. The costs are therefore a best estimate based on information available. The projects are taken through internal governance structures of the planning review forum, technical evaluation forum (TEF) and the investment committees in Eskom. Costs are then checked by the pricing department and the documentation by the legal department. The final cost estimate letter is then issued by the GAU.

The IPP is at this stage required to have clarity of a preferred solution, to determine whether it will continue with the project, and needs to determine if it wants to consider a self-build infrastructure option at distribution level (≤132 kV). Should the self-build option be preferred, the IPP consultant will then need to present such a technical proposal to the TEF, to help guide the IPP internal design process. The consultant that designs the Eskom grid infrastructure needs to be an Eskom approved consultant.

Department of energy evaluation phase

The IPP renewable energy generation programme is controlled by the DoE, and a fully closed and controlled evaluation process is followed. Eskom does not participate in the evaluation or scoring, but may answer technical questions in support to the technical evaluators. A decision making tree is compiled, based on applications, and actual grid topology and associated capacities available. This will meet the 1:1 capacity available as discussed during consultation with IPP’s. The DoE then announces the preferred bidders and their associated maximum export capacity (MEC). This MEC might be lower than the initial value applied for to Eskom.

Quotation, contracting and connection phase

Design phase

The IPP needs to accept the cost estimate letter and pay the commitment fee to obtain a budget quote. The IPP also needs to apply formally for the distribution self-build option of the Eskom connection works, as per the Eskom distribution self-build policy. The self-built option requires the IPP consultants to fully interface with Eskom, define the design parameters and ensure seamless grid and control integration. The requirements shall be documented as per the self-build agreement (SBA) procedure. Not all these details will be
shown in the SBA. Therefore it is important to note that the IPP needs to do the required engineering work, obtain servitudes, etc.

The RFP allows, in sections 14, 10 – 14, 12, the following options to establish the grid infrastructure:

- The grid provider (Eskom or municipality) is responsible for and undertakes the connection works, and the bidder is responsible for the costs.
- The IPP may use the self-build option to provide the connection works for distribution infrastructure, as agreed with the grid provider. The connection works are then transferred to the grid provider at no cost.
- The IPP may build its own grid connection works, but will require a transmission or distribution license from NERSA.

The designs are technically evaluated; therefore both Eskom and IPP consultants shall present their full designs at the TEF. Any outstanding requirements shall be resolved, as required. Eskom design engineers and the TEF.

Eskom shall design and construct shared networks, as per the grid code. Any shared networks must be as per a network development plan and approved through the required governance structures in Eskom. Developer contributions for shared infrastructure shall form part of the budget quote. The IPP has the option of building its own dedicated Eskom grid infrastructure under the Eskom self-build agreement. The Eskom connection works shall be done by an Eskom approved contractor and with Eskom approved equipment. Eskom will however still provide the substation equipment in existing (live) substations to enable the grid connection which does not form part of the SBA scope.

Budget quote phase

Eskom will prepare the budget quote for preferred bidders in the RE IPP programme. The technical solutions are checked across the budget quote, self-build agreement and the customer use of system agreement (CUOSA) (for transmission or distribution). The full details of the scope of works are not repeated in these documents and are only reflected at a high level. The SBA allows for the detail to be ironed out in the design phase and documented accordingly. The operations agreement will only be completed before commissioning, once the IPP has completed its own operating procedures.

Eskom will prepare the budget quote for the Eskom connection which does not form part of the existing (live) substations to enable the grid connection works. The IPP has the option of building its own dedicated Eskom grid infrastructure under the Eskom self-build agreement. The budget quote acceptance, as the IPP has completed its design. It should form part of the IPP requirements to meet the Eskom effective date. Unless the IPP has already compiled the report, it risks a design that might not be grid code compliant and add risk to the project and schedules. NERSA grid code exemptions can be avoided in this way.

Financial close

DoE will announce the formal financial close, once all agreements are signed. The power purchase agreement (PPA) is signed by Eskom and managed by the single buyer office (SBO). This is also applicable to an IPP that connects to another licensed distributor (mostly municipal networks). Eskom needs to amend the electricity supply agreement of the licensed distributor to allow for the energy purchased under the PPA to be wheeled to Eskom.

The IPP now needs to accept the budget quote and complete the required project schedules. The IPP shall make the associated project payments to Eskom, managed by the GAU. The GAU will ensure all criteria have been met and the effective date achieved.

Construction phase

The construction work is released for Eskom and/or IPP contractors. The Eskom connection work may only be executed by Eskom approved contractors with Eskom approved equipment. Eskom approved consultants do have access to the Eskom standard equipment and designs. Any further detail designs or design changes of the Eskom connection work shall be approved by the Eskom design engineers and the TEF.

Eskom is to perform at least the following during the construction phase:

- Eskom will appoint a clerk of works to monitor the quality of the construction as well as the quality of material.
- Eskom will appoint a project manager to do site inspections and also monitoring of workmanship and materials/equipment.
- Eskom will monitor the customer’s environmental management in respect of the contract works.

Grid connection and commissioning

The grid commissioning shall be arranged well in advance with Eskom, to ensure the required resources are scheduled and existing customers are notified of the planned outage. This shall include at least the following:

- Eskom will commission the metering, protection and the supervisory control and data acquisition system (SCADA).
- Eskom will monitor installation of the contract works and will commission the contract works.
- Eskom will manage any outages required on the distribution system.
- Eskom will monitor the process of registration of the servitudes in the name of Eskom.

The grid code section 16 asks for “Provision of data and electrical dynamic simulation models” and section 3.b.i. requires that the IPP provides the generic test model and dynamic modeling data per unit. It is therefore important for the IPP to meet the requirements to enable the commissioning to be completed and final connection to be fully compliant. The IPP needs to ensure technical data is available well in advance (~3 months) to ensure updating of power system study models, protection settings compiled, SCADA systems updated and operational requirements agreed (e.g. switching and control procedures).

Operations phase

Daily operations

The daily operation of the IPP is monitored, including voltages, power flow, status via SCADA and weather conditions. The
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maintenance and operations department is required to ensure the reliable and safe operations of the grid. The IPP will also work closely with the Eskom control centre and monitor the resource (e.g. wind, solar), in order to allow for grid stability, voltage control, etc. Any planned and unplanned outages will be coordinated by Eskom, to ensure proper operation of the renewable energy generation facility and associated grid infrastructure. Outages are planned on an annual basis, therefore the IPP’s need to negotiate their planned commissioning dates well in advance to help minimise network impact on all associated customers. The daily operations and outage planning will eventually also be affected by the end of life or major refurbishment events. This will be managed as required in such instances.

Billing

The SBO will liaise with the Eskom distribution operating units, transmission and the GAU w.r.t. the metering data and quality of supply aspects as measured at the point of connection (POC). This will enable the SBO to react to billing errors, data accuracy, deemed energy payments and ensure the industry PPA requirements are met. The IPP needs to measure its active and reactive power imported and exported just beyond the POC to ensure comparable measurements. The GAU is the official customer services entry point for IPP’s. The GAU will monitor the industry on a continuous basis and help ensure Eskom meets its requirements.

Conclusion

Eskom has developed a formal process to manage the renewable energy industry application and grid connection requirements. This includes the upfront project negotiations, the cost estimate letter and then the budget quote for preferred bidders under the RE IPP programme, or with other generators that have successfully negotiated a successful project to this level. The Eskom distribution self-build agreement is available that gives the IPP more control over its own program schedule should they choose such an option. The operational agreements are still under development and will be formalised with each IPP close to commissioning, once the IPP operating procedures are also available. Eskom is currently processing about 450 cost estimate letters for bid 3, which offers 1065 MW. This very large number is still putting strain on existing resources. It is thus clear that the IPP’s need to develop their own projects at risk and obtain preferred bidder status. Eskom certainly cannot develop fully committed grid connections upfront for all of them. The process and grid infrastructure will be further developed and enhanced as the process unfolds and projects are realised.

References


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