W(h)ither the Solar Park?

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The tale of the Solar Park is a useful one to illustrate the function and dysfunction of the South African energy supply industry. When it was publicly announced in 2010, the project attracted much international media and investor attention, and was heralded as a move which could push South Africa to the cutting edge of solar energy technology. Now, a year and a half later, the project has foundered and it appears that progress is unlikely.

This story, like so many involving state-owned enterprises in South Africa, is one of a lack of coordination between the various government and non-government players in the industry. The aim of this paper is to outline the project and its initial promise, and then to attempt a partial diagnosis of the current state of affairs.

Development and Announcement

In October 2009 a Memorandum of Understanding was signed between the Department of Energy (DoE) and the Clinton Climate Initiative (CCI), a subsidiary of the William J Clinton Foundation. The aim was to investigate the possibility of developing a large-scale "Solar Park" in South Africa. The CCI's pre-feasibility study, produced in April 2010, explains the concept as follows:

> "A Solar Park is a concentrated zone of solar development that includes thousands of megawatts (MW) of generation capacity. One or more parcels of land in close proximity are designated and pre-permitted as a Solar Park. Individual solar plants developed by multiple power producers are constructed on the land in a clustered fashion and on a predictable timeline, sharing common transmission and infrastructure."[1]

The Solar Park is a government project, with infrastructure and services constructed and provided by the government - but the power generation itself rests in the hands of so-called Independent Power Producers (IPPs). These are private companies which own and operate power plants independently of Eskom. They connect to the national electricity grid and sell the electricity they produce to a division of Eskom. It then becomes part of the electricity supply consumers access every day. The CCI's study proposed an area west of Upington in the Northern Cape as ideal for the Park. Not only is it relatively flat and sunny, but the government owns land there and the site has access to water (from the Gariep River) and to the electricity grid. The site has an incredibly high level (2800 kWh/sq m p.a.) of Direct Normal Irradiance[2], an index used to measure solar power production potential, beating many of the best sites currently under development worldwide.

The Solar Park was planned to contain a mix of solar technologies. In the Clinton document the majority is envisaged as being Concentrated Solar Power (CSP), a type of power plant which uses an array of mirrors to focus sunlight onto a central receiver, sitting atop a tower. The heat from this sunlight heats water to drive a generator, which generates electricity. CSP is a relatively new technology which

is undergoing rapid commercialisation, and has the potential to achieve lower costs and higher energy efficiencies than the more mainstream "solar panels". One of the benefits of CSP is that it can utilise heat-storage to provide power even when the sun is not shining.

The Park would also include photovoltaic panels (PV), as well as a modification of this technology called concentrated photovoltaics (CPV) which uses various optical devices such as lenses to concentrate a large amount of sunlight onto a small area of high efficiency PV cells. Photovoltaic technologies convert sunlight directly into electricity, without the intermediate steps of heating water to create steam to drive a generator. These panels are either fixed or tilt/rotate to follow the movement of the sun. These technologies have seen wider implementation, with the largest plant currently in operation being the Perovo I-V plant[3] in the Ukraine, which produces 100 MW.

The idea behind developing a large park containing many smaller plants is that the infrastructure and development costs are shared. Therefore operating costs are far less than in a scenario where plants are geographically distributed, as economies of scale apply to purchasing and manufacturing of components. A central Solar Park Authority would be created to build and operate the site, providing serviced sites for private investors to install their solar plants. The large-scale infrastructural costs (building roads, supplying the site with water, plugging it into the grid) are borne by this body or the grid utility, thus bringing down the costs which individual investors face. It also allows for the central management of the critical environmental aspects of building a power station. The environmental impact assessment and associated impact-management costs would be investigated in the feasibility study for the Park as a whole, removing this significant cost to the investor and reducing the time required to reach the commercial operation date. A large park also concentrates the associated industries (providing, for instance, the materials needed to build the solar panels).

Downsides to this model are that it fails to capitalise on one of the popular selling points of solar power technologies — that being that they are modular and can therefore be built close to the demand (providing there is suitable space and sun). In addition, the Northern Cape site's distance from the major demand centres in Gauteng and Cape Town means that there will be inevitable "transmission losses" associated with long-distance power lines. The concentration of this much solar generation capacity in one location also amplifies the most basic problem preventing solar power becoming a core part of our power supply: the sun doesn't always shine. Distributing solar plants allows one to distribute the risk of an interruption in generation due to cloud cover or sandstorms.

The CCI study estimated that the Solar Park would cost a total of around R150 billion, with the original estimate for government spending on infrastructure estimated to be 10% of that. The electricity grid would have to be modified and expanded to deal with a new power production centre in the Northern Cape, where there is currently no production, with these costs borne by Eskom. The report concludes that "solar power can be deployed in South Africa in large quantities over the next decade at costs that become competitive with coal-fired power…" The initial timeline sketched a scenario in which stakeholder negotiations would occur in 2011, with the first plants ready to come online in 2012/13. As we shall see, on-the-ground progress has in no way met this optimistic forecast.

Upington and Beyond

In late 2010, the DoE announced the project publicly and convened an investor conference in Upington in October. This is when the Solar Park first captured the public imagination. It was announced as a 5 000 MW development, which would make it the single largest solar park in the world, and make South Africa a leading producer of solar power[4]. The announcement also immediately generated confusion about how this 5 000 MW fitted into other long-term plans for bolstering South Africa's 35 000 MW total generating capacity. The conference attracted 400 people, including investors from the United States, India and China. Despite this initial frisson, the content of the conference was relatively unexciting, as very little actionable information was released to the public[5]. The CCI presentation was largely about the technology to be used, with some estimations of the size of the demand the project would generate for component materials. It announced that 12 000 construction jobs would be created, with a further 3 000 ongoing jobs in the operation and maintenance of the Park. The first indication of a lifetime was given as 8 years, with the implication that the period in mind was 2012-2020.

Presentations were also made by the Department of Energy (DoE), the Development Bank of South Africa (DBSA), Eskom and others, but the majority of them contained little beyond high level discussions of frameworks of how various pieces of the project might unfold. The DBSA discussed its approach to funding projects of this sort. The DoE's Deputy Director-General's presentation mostly outlined the other work the DoE was doing, with a focus on the Integrated Resources Plan (IRP).

The Eskom presentation hinted at the first signs of trouble - raising issues which the still-to-be-conducted feasibility study would need to address. In particular Eskom outlined the grid capacity constraints in the area. In order to evacuate as (relatively) little as 150MW from the area, Eskom stated that it would need to strengthen the local distribution system - work which could complete at the earliest in 2012. By 2014 they could build a new transformer, allowing 170 MW to be evacuated. Further capacity evacuation would require strengthening the longer range transmission system. By earliest 2016, Eskom stated, they could build two new power lines, allowing for the evacuation of up to 900 MW. By 2017 at the earliest they might have another two lines up, allowing for 1 100 MW to be evacuated.

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In order to move significantly beyond the 1 100 MW level, Eskom estimated that significant investment would be required in new, higher voltage (765 kV) transmission lines and potentially in High Voltage Direct Current lines.

While not actively contradicting the predictions of the CCI, this information was certainly at odds with early CCI timelines to have the first 1 000 MW coming on stream in 2015/16. In response to questions at the conference, Eskom representatives indicated that the 756 kV lines could potentially be installed as early as 2015/16, allowing these larger amounts to be evacuated, but the costs for this would need to form part of the feasibility study. Despite these issues, the event was declared a success by the DoE, and in November the Minister announced[6] that the feasibility study had begun. In the 15 months since this speech, no report on such a study has been released.

Lack of Coordination

As early as the announcement of the conference, industry analysts pointed to various gaps in coordination which were likely to prove problematic[7]. To begin with, no mention of the Solar Park project was made in the first draft of the Integrated Resource Plan (IRP1), which is intended as a twenty year plan for South Africa's energy production. IRP1 allocated only 600MW of future capacity to solar, 12% of the announced Solar Park goal. When it emerged that the project's origin was in a 2009 agreement with the CCI, it began to look as if this project was not part of the long-term planning processes operating within the DoE. The second and final draft of the IRP does have a solar allowance theoretically large enough to encompass the full Solar Park capacity goal (it allocated 8 400 MW to PV and 1000 MW to CSP), but no specific mention of the Park is made and the timeline for building this new capacity is clearly independent of that envisaged by the Solar Park process.

The Solar Park also did not fit well into the (then) extant framework for the allocation of contracts for building power stations to private companies. This regulatory framework was developed by the National Energy Regulator of South Africa (NERSA), which is responsible for, amongst other things, the regulation of prices consumers pay for electricity. This system was conceived in 2009 and, while under development, was publicly discussed throughout the time period when the Solar Park was being conceptualised. The system was a feed-in tariff, under which power producers using any of a range of renewable energy technologies sell the electricity they generate for a fixed price, calculated to cover the costs of any technology and provide a reasonable level of profit. This renewable energy feed-in tariff (REFIT) would form the basis of bankable power purchase agreements between the state and the IPPs. As the South African grid is owned by Eskom, this framework forces Eskom to act as a single-buyer and redistributor, namely, to pay the REFIT price to the IPPs and to resell their electricity to the public.[8] The REFIT price was to be calculated in a manner which took into account all long term build plans, in order to cover their costs. The Solar Park was never an explicit part of this process, despite advertising a total capacity which would have significant impact on the REFIT process.

Door Closed on the Solar Park for at Least Two Years

In late 2011 the DoE abandoned the REFIT process and in November opened the first window of bidding for a tender to produce 3725MW of renewable energy by 2016. In this first round, over 700 MW of the solar power capacity quota was allocated, with around 150 MW of it planned for the Northern Cape. This was done without reference to the Solar Park, and did not make use of its site. As Eskom explained at the Upington conference, the area has limited grid capacity, and this allocation exhausted that capacity. Considering that a second round of allocations in terms of the IRP are due soon, it seems unlikely that the required two years of upgrading work on the grid will go towards the Solar Park. If doubt still remained, the recent allocation made it clear that the IRP solar production quotas are independent of any considerations of the Solar Park.

The Solar Park project now seems, in retrospect, to have been doomed to fail. Despite the central role given to it in government presentations[9], its development process did not and does not fit well with the large-scale plans governing the development of this industry over the next twenty years. What the story of the Solar Park demonstrates is a worrying lack of coordination - within the DoE and between the DoE and the other players which must be a part of any major change to how we produce power, Eskom and NERSA.

NOTES

1 Solar Park Pre-feasibility Study For South Africa ver. 2, Clinton Climate Initiative (unreleased), 2010.

2 DNI measures the amount of solar radiation received per unit area, and converts it to potential power produced per unit area. DNI is used to predict the output of technologies like Concentrated Solar Power, which track the sun's movement in order to maximise energy collection. The 2800 kWh/sq m should be compared to the sites of Spanish CSP plants, which average between 2000 and 2200 kWh/sq m. It is higher even than sites in North Africa proposed for solar development. See http://www.greenbusinessguide.co.za/northern-cape-solar-resources-among-the-best-in-the-world.

3 See http://www.pvresources.com/PVPowerPlants/Top50.aspx for the largest solar PV developments as of 2011.

4 There were many reports of this. See, for example, http://cleantechnica.com/2010/10/26/worlds-largest-solar-park-to-be-in-south-africa/

5 See http://www.engineeringnews.co.za/article/solar-park-conference-draws-interest-but-more-clarity-sought-2010-10-29

6 http://www.polity.org.za/article/sa-peters-address-by-the-minister-of-energy-at-the-launch-of-the-turning-on-science-improving-access-to-energy-in-sub-saharan-africa-somerset-west-09112010-2010-11-09

7 For example, see the beginning of http://www.boell.org.za/downloads/Trollip_FINAL.pdf

8 See www.nersa.org.za for details.

9 As recently as at COP17 the DoE was highlighting the Solar Park as a flagship project. See http://www.energy.gov.za/cop%2017/DoE%20Programme%20Presentation%20V2%20FlagShipProjects%20.pdf