CSIR Response: Tobias Bischof-Niemz, Head of Energy Centre

http://www.engineeringnews.co.za/article/csirs-frightening-attitude-towards-renewables-2016-07-15

Terry`s statement	CSIR's response
There is something frighteningly sinister about the CSIR's attitude to renewable power. A recent media release from the organisation contains the following statement: "Individual solar photovoltaic (PV) and wind farms exhibit strong short-term (intrahour) variability. However, the portfolio effect of aggregating the power output of several farms spread over a wide area leads to the disappearance of intermittency and short-term fluctuations. The aggregated wind portfolio power output exhibits intraday variability with changes over several hours. This level of variability is more manageable from a system operator's point of view." For those of you who cannot digest sentences of such appalling grammatical complexity, simplified, this means: "The sun doesn't shine at night and some days are windless."	The author's interpretation of our statement is wrong and it shows that the essence of it was not understood. What we are saying is: 1) An individual wind farm or an individual solar PV plant are indeed intermittent, which means their power output can change within a very short space of time without being able to predict it (the wind speed changes quickly at a particular wind farm's site, a cloud appears quickly above the solar plant) 2) This short-term variability in the sub-hour-domain (i.e. 90% output change in 15 minutes or less) disappears if one aggregates the output of several wind farms and solar PV plants that are distributed over a large area and are connected to the same interconnected electricity grid. 3) I.e. if the wind suddenly stops blowing in Cape Town, it doesn't do the same in PE at the very same time. The probability of that happening is marginal. 4) Hence, a wind farm in Cape Town might reduce its power output within 15 minutes from 100% to 10%, but a second wind farm in PE, running at 50% output, might increase its output to 60% in the same 15-minute period. 5) Assuming both wind farms are of same size, the portfolio of both therefore changes its aggregated output from 75% (average of 100% and 50%) to 35% (average of 60% and 10%). That's still a significant reduction of the power output within 15 minutes, but it's only 40% of the wind farm portfolio, and not 90% as for the wind farm in Cape Town alone. 6) This effect is even stronger for PV. 7) The more wind farms you install in distinctly different wind regimes, the less short-term variability

	you will see. 8) This is not just a theoretical exercise. In Germany, there are 46 GW of wind power operational, most of that onshore. The maximum gradients of the entire German onshore fleet are +/- 5% of the installed capacity within 15 minutes. 9) South Africa is 3.5 times larger than Germany, and therefore the portfolio effect is expected to be stronger here than there. 10) The German actual data is a real-world verification of what we found in our study: The more wind farms are distributed across the country, the less the wind fleet's output is variable and the more it is predictable. 11) The author's statement "no sun at night" and "at times no wind" has nothing to do with the gradients of the wind/PV portfolio profile, which is the effect that we are elaborating on. What the author refers to is an entirely different topic.
Further, the report says: "Wind and solar PV are complementary, with wind supply peaking in the evening and solar PV peaking at midday." Translating, once more: "The sun is hottest at midday and the wind blows mostly in the evening". Right?	1) Our statement is the statistical interpretation of simulated 15-minute solar PV and wind power production data for 5 years, covering the entire country in a high spatial resolution of 5 km x 5 km, based on verified numerical weather models. 2) The author's statement "Sun is hottest at midday" shows that it is not understood how sun energy is converted into electricity in a solar PV plant. It is not the ambient temperature (in degrees Celsius) that transforms the sun energy into electricity, but it is rather the intensity of the solar irradiation (in W/m^2). Heat is actually detrimental to the efficiency of the solar PV modules. The cooler it is, the more power output (ceteris paribus).
The Guinness book of records lists Pretoria as the least windy city in the world. It is quite sunny, particularly in winter. Thus, it is a good candidate for a solar farm. Unfortunately, the cost of property in Gauteng would never justify such a development.	The relevance of the location "Pretoria" and "Gauteng" in this context is not clear to us. In Gauteng one would obviously put solar PV preferably on roofs (which is already happening in large numbers) and only in rare cases as a ground-mounted facility.
Port Elizabeth is the windiest city in South Africa.	How one defines "windiest" is very tricky when it comes to wind power generation.

	1) Wind speed measured by SAWS is measured at 3-10 m height. For wind power generation one has to measure wind speeds at 100 m height and above. 2) The average wind speed is an important measure, but without knowing the details about the wind profile (time series), one cannot make any meaningful projection about the actual electricity output at a certain site. 3) Wind turbines reach their maximum output at a wind speed of approx. 8-12 m/s (depending on the design of the turbine). Any additional wind speed above 8-12 m/s doesn't lead to additional power output above the rated capacity. Hence, there is a strong non-linearity between wind speed and power output. This is why the average wind speed is only a first indicator for a wind energy yield prediction.
I do not know what the people at the CSIR are smoking but I know for sure that the wind in Port Elizabeth and the Western Cape does not, in my experience, “blow mostly in the evening”, but mostly during the day.	Our statement is not about specific sites in PE or Western Cape. Our statement is about the general average wind pattern across the entire country. And there we see a strong increase in wind power (on average) in the evening hours. That is what our simulated data for the whole country shows. But even the actuals of the operational wind turbines (1 GW) are supporting exactly that. Slides 22-33 of another recent study by the CSIR (link) show the actual wind power output of the already existing wind farms in South Africa. During most of the months in 2015 the average wind power output was indeed much more in the evening than during the day.
But let us assume, for the sake of argument, that, in Port Elizabeth, the wind blows mostly at night and in Upington the sun is hottest during the day. So what? The two places are 900 km apart. To suggest that these two generation facilities can support each other over such a distance is ridiculous. So, clearly, the answer is to build a PV farm and a wind turbine farm next to each other. Also ridiculous.	1) Our study does not suggest that wind farms will or should only be installed in the one windiest point in South Africa. Neither does it suggest that solar PV farms will or should only be installed in the "hottest" point in South Africa. 2) But if hypothetically this would be the case (one wind farm in PE, one solar PV plant in Upington), the author is probably aware that electric energy travels with the speed of light in a vacuum and with close to the speed of light in a copper wire (link) in an interconnected power system. That is 300 000 km/s. The energy therefore needs 3 ms for the distance from Upington to PE. That's the reason why the grid frequency is exactly the same anywhere in the South African grid. 3) Hence, of course a solar PV farm in Upington and a wind farm in PE support each other.

	4) At night, when demand in Cape Town is low, Koeberg sends its energy to Gauteng. That's even a bit more than 900 km. How could that possibly work if the author was right in his assessment that electrical energy cannot be transmitted over such distances? 5) Hence, of course one doesn't need to install wind farms and solar PV plants next to each other in order for them to "support" each other.
It seems to me that the CSIR is trying to reinvent itself as the brave champion of wind power – for what reason? Does it have a hidden financial interest? The German wind turbine manufacturers are facing hard times. Are they and the German Fraunhofer Institute using the CSIR as a vehicle to push their interests in Sourh Africa?	This is a defamatory statement without any supporting evidence. It is discrediting the largest applied-research organisations on the European and on the African continent with 25 000 and 3 000 employees respectively.
Further in the report the following gems: “A share of 50% wind energy in South Africa’s electricity supply does not increase the short-term (intrahour) gradients if the wind fleet is widely distributed; no negative impact on reserve requirements. “Up to a 65% energy share in electricity supply from a combined wind and solar PV fleet can be achieved without any significant excess energy.” Huh? “Without any excess energy?” What? Such a statement should not be regarded lightly. It should be framed as a supremely fine example of green energy jargon and should be shown to schoolchildren.	We do not understand the author’s "surprise". What does he mean?