

Get it from the Sun: expanding renewable electricity

Keith Barnham, Imperial College London, outlines plans for an exciting new campaign to encourage continued expansion of electricity from renewable sources in the UK.

A proposal for a new campaign *Get it from the Sun* (GIFTS) is currently being circulated to interested parties. The aim is to maintain the expansion of renewable electricity in the UK despite the removal of most of the subsidies that in recent years had successfully stimulated an exponential rise in demand and supply.¹

The responsibility for maintaining this expansion now falls on the individuals, communities and companies that are primarily motivated by the imperative to halt climate change rather than a guaranteed income. At the local level, community energy and transition groups, schools, colleges, town councils and local authorities continue to strive to overcome the barriers that the government has erected in its attempts to halt the expansion of solar photovoltaics (PV) and onshore wind by 2020.² Additionally, all-renewable electricity supply companies continue to grow in strength and in number. Furthermore, some environmentally aware commercial investors can see beyond the loss of a secure income stream to the long-term growth of renewable power demand as the effects of climate change become more obvious and more severe.

GIFTS will aim to facilitate information exchange and cooperation amongst the local groups and between them and all-renewable supply companies and environmental investors. The Nuclear Free Local Authorities (NFLA) have already given support and advice to GIFTS. Discussions are underway with other campaign groups and local authorities.

The main proposal to stimulate new demand is a national challenge to identify the local region of the UK that is first to achieve a truly all-renewable electricity supply. There will be awards in several categories: for example, the first school, first town, first local authority or first home country to reach a certain percentage of renewable energy penetration. Below I sketch out how such a competition could be implemented and refereed.

What is an all-renewable electricity supply?

The German *Kombikraftwerk* project¹ was the first to demonstrate that the electrical power demand on the national grid can be met every hour of the day and 365 days a year with approximately 80% of PV plus

wind power, as long as the remaining 20% is provided by flexible power generators, ideally bio-electricity. Less than 5% storage power is necessary. In co-operation with the Centre for Alternative Technology (CAT), a spreadsheet (the GIFTS software) has been written that confirms this important result for the UK national grid.

Scotland has set a 2020 target to generate as much electrical energy in a year from renewable sources (in particular, wind) as the amount of electricity energy consumed in Scotland in that year. An hour-by-hour, 365 days-a-year, all-renewable electrical power target is more challenging. In fact, Wales and Northern Ireland could be first to achieve this stricter goal as Scotland is some way from its bio-electricity target. Also, Wales and Northern Ireland have higher sunshine resources (Northern Ireland through its new power link with Eire).



GIFTS: The Programme

The GIFTS software is based on, but much simpler than, the two German *Kombikraftwerk* projects. It is an 8,760 row Excel spreadsheet, one row for each hour in the year. One column contains the total electrical power demand on the UK grid for each hour. The next column contains the UK wind power resource for that hour followed by a column in which this wind resource is scaled to a chosen value for the total installed wind power capacity. The next two columns repeat this calculation with solar resource data, to give the UK PV power resource scaled to a chosen PV power capacity. The next column sums the wind and PV contribution and so represents nature's GIFTS of power to the UK hour by hour.

It is very impressive to see that, if the installed wind and PV power capacities are chosen to be appropriate to an all-renewable UK, how many hours of the year nature's gift of wind plus PV power is a reasonable first approximation to the electricity

demand. On most days in the year the PV contribution peaks around mid-day as does daytime electricity demand.³

The remainder of the spreadsheet performs calculations to determine how much storage and flexible bio-electrical back-up is needed to ensure that renewable supply is greater or equal to electrical power demand every hour of every day. If PV plus wind supply is greater than demand, the excess is stored, if there is capacity to take it. If electricity demand exceeds PV plus wind supply, the deficit is made up either from storage or by flexible bioelectric power. Hence the spreadsheet ensures electrical power supply equals (or surpasses) electrical power demand every hour of the year – and the lights stay on.

This relatively simple programme agrees with the much more sophisticated *Kombikraftwerk* analyses. The electricity demand of Germany and the UK can be met by around 80% wind power and PV. The ideal back-up is 15%-20% of flexible bio-electrical power and 0%-5% storage.

How to enter the GIFTS Challenge

The following suggestions for the rules of the competition are being circulated to a sample of potential competitors for their feedback.

The data required for the GIFTS software that will referee the competition is the cumulative total of locally owned PV and onshore wind power installations plus the amount of electrical energy supplied to residents and organisations generated by an all-renewable electricity provider in the current year.

Competitors responsible for waste collection in their area can also submit a figure for the electrical energy equivalent of the total of bio-degradable waste they have sent for anaerobic digestion to bio-methane in the year in question. Competitors not responsible for waste collection can submit the electrical energy provided by all-renewable electricity suppliers in their area as their flexible back-up to wind and PV.

In local areas where hour-by hour power demand is not measured, the demand of the larger region which includes this area can be scaled by the relative populations.

With this data the software will be able to issue certificates stating the proportion of their electrical

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power demand provided by renewables in that year. Awards will be made to the first competitor in each category to reach the 10%, 20%, 30%... levels of renewable penetration.

How soon can we expect a winner with 100% renewables?

Given data for earlier years, *GIFTS* software will be able to predict how long it will take to reach the all-renewable target. It may be that the 100% target is closer than expected. Before renewable subsidies were cut the renewables were expanding exponentially in the UK. PV and wind power were expanding so fast that, had the subsidies not been cut, they would have achieved their individual targets by 2022.¹ Bio-electricity was expanding more slowly, but an all-renewable electricity supply could have been achieved in the whole of the UK by 2025. Given the cuts, this is now very unlikely. However, pessimistic assumptions about future expansion rates suggest it should still be possible by 2030.²

In local regions of the UK it could be much earlier, particularly as the *GIFTS Challenge* rules allow the power contributions from all-renewable electricity suppliers to individuals and institutions in the area to count as flexible back-up. This is in practice the situation in households, schools and organisations with PV who have switched to an all-renewable supplier.

There will need to be three categories for schools: those that have installed PV; those where installation is in progress; and those who haven't yet started. To have a truly all-renewable electricity supply, all those in the former category have to do is to switch their back-up to an all-renewable supplier. There may be a winner out there already! The winners in the other categories will have to install their PV and probably switch back-up supplier. There could be two exciting contests in the next year or so!

What can be learnt from successful internet campaigns

Internet campaigns and NGOs played a major part in the success of the Paris climate negotiations. The *Keep it in the Ground* campaign (run by the environmental organisation, 350.com) has been successful in achieving large levels of divestment from fossil fuel companies. However, the UK government has ploughed on regardless, cutting renewable energy subsidies and boosting those for fossil fuels while planning a UK electricity supply system for 2030 with a carbon footprint above the recommendation of its own advisory body, the Committee for Climate Change, and certainly in no way consistent with the Paris Agreement.²

GIFTS will be complementary to *Keep it in the Ground* as it will concentrate on reducing the demand for fossil fuels rather than the supply. *Keep it in the Ground* could support *GIFTS* by encouraging the switch to an all-renewable electricity supply by institutions that have divested.

The *RunonSun* campaign supported by Friends of the Earth and the *SolarSchools* campaign of 10:10 played a major part in the extremely successful expansion of PV in schools when feed-in tariffs operated. *GIFTS* aims to step into the gap left by the winding-up of both campaigns. Local authorities will be encouraged to organise to bulk purchase electrical power for schools at lower rates freeing up more funds for teaching.

Scope for local participation

One of the advantages of the *GIFTS Challenge* is the scope for participation in monitoring local performance. For example, using real-time hourly output of local wind and PV generators would help to make targets and performance more realistic, particularly if local demand figures can be used as well.

School pupils will be able to compare the output of their PV (with the software usually supplied by the PV installer) and the school demand hour by hour. Students will be able to study how often daytime supply and demand have similar hourly variation. They can also work out in which months their PV system produces more electrical energy than the all-renewable flexible backup.

Interest in the renewables in junior schools can be enhanced by playing the games which demonstrate how solar cells and silicon chips work, described in the animation *Quantum Theory is Child's Play*.³ *GIFTS* could coordinate a competition to see which junior school could produce the best video of the final game, which explains how solar cells power electric cars.

Recent press reports describe artificial trees carrying many small vertical axis wind turbines. These are not only elegant but particularly suitable for the urban environment³ which surrounds most schools. For a school that already has PV and an all-renewable back-up, the addition of one of these trees would

enable them to study the complementary nature of wind and PV resources, and check for themselves whether they together can provide 80% of the power requirements of their own school.

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References

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Get involved

I would be interested in feedback on the planned campaign and suggestions for potential improvements. Contact: k.barnham@ic.ac.uk