

Rural Sector WinGen Ltd (RSWL) - Full Plan

A BHAG (big hairy audacious goal) for the rural community

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2. A principle objective

The principle objective of this initiative is to challenge the rural sector to take ownership of the planning and the implementation of land based wind generated electricity and so deliver a major part solution to the unfolding energy and environment challenges facing our world.

3. The plan

This is a plan that delivers to stake holders of the rural community the chance to take substantial initial ownership of the wind generating potential of its own land and vistas. A new energy company '**Rural Sector Wingen LTD**' '**(RSWL)**' is envisaged that within twelve years could be one of the biggest power suppliers in UK, the EU, even in the World!

Part of the plan will be that rural stakeholders will have first priority and financial incentive to take up share issue as they come on offer. Further the first shares will be "green" shares which will deliver to rural investors, first call on subsequent investment rounds, substantial discounts on domestic electricity bills.

Think big. 90,000 three megawatt windgens will have an average delivery of 90 Giga Watts (**see section 9**). The current generating capacity of the UK is circa 85 Giga Watts. 90K is mega, and certainly the top end of the doable (on average, a windgen per sq mile), but so is 20K and everything in between!

But we need to get our act together, fast, before the city and big business steal our show!

A second stage would be to engage in direct retailing, and downstream production activity such as hydrogen production, and other new energy storage systems.

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4. Rural participation

The key to delivering this project is an early big buy in by the rural sector in general, and in particular, farmers and landlords, large and small.

Wide scale rural participation is important as it will deliver crucial backing for politics to tackle the serious planning issues currently stemming progress. It is intended to market share issues of the company in modes that clearly favour rural sector participation, and deliver to rural sector "green" share holders useful discounts on their electricity bills!

Note that rural sector participation is certainly not restricted only to persons with suitable sites. Uptake of 'green' shares will be encouraged and discounted to all of the rural community.

However landholders participation is a "sine qua non". They will be asked to second to **Rural Sector WinGen Ltd**, first call on potential wingen sites. It will be the seconding of this formal first call on sites that will deliver to **RSWL** the strength to secure the massive financing required for the project. There are numerous substantive financial and operational advantages for potential site owners to so participate. (see **section 6**)

5. The benefits to Landowners of participation

1. No hassle other than the signing of a first call on, then should site be suitable, a 50 yr lease of sites to RSWL
2. Individual initiatives are fraught with planning permission, grid connection, financing, installation and continuing service hassles. The company will be responsible for all of that. It will have all the expertise in house required to plan deliver and install the generators.
3. An assured income for live sites. £15K/yr for a 3 mega mill is currently budgeted. (see **section 14**). But the new company will simply pay the going rate. A more likely/better plan would be to arrange payment as a percentage of individual generator output.
4. Farmers/landlords who consider financing own generators have to deliver loan security for any borrowings. RSWL will be responsible for securing all share and loan capital. Farmers and landlords totally free to choose their own level of investment in RSWL.
5. Will receive a goodwill allocation of green shares. And of course further investment in green shares will deliver the bonus of increasing discounts on electricity use.
6. The company will have the substantial benefit of its massive buying and selling and political power, so it is very likely to deliver better investment returns than individual go it alone initiatives. The company will control everything from post wind to final consumer! (Control of wind not yet planned!) Currently farmer investors are price takers. RSWL will be such a major player as to be a price maker.

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6. The wider political rationale

Ameliorating Climate change is indeed a challenge. But this challenge pales into insignificance compared with that of the energy crisis now upon us. We are at the beginning of the end of the fossil fuel era. (see **section 17**) Massive investment in new environmentally friendly energy sources is required now - before the old energy sources run out. You cannot make the new if you don't have the old with which to make it. **Distributed wind power generation** can/will be a big part of the solution.

Further "we eat oil". Half the World's food comes from Ammonium Nitrate fertiliser, which itself almost totally comes from oil and gas. The current huge rise in the price of fuel and food is not a blip. It is the reality of the beginning of real scarcity. To deny and procrastinate spells doom for the majority of the peoples of the World. Hungry people are angry people. Armageddon is no longer a figment of imagination.

The politics and commerce of the World must now focus on shifting trillions of pounds worth of our current assets and activities into delivering massive new energy sources. These are Nuclear and geo-thermal particularly for base load, and direct solar, tidal, and wind power on both land and sea. We do not have the luxury of choosing. We need all of them and fast. Crucial to this plan is that land based distributed wind power is by far the most cost effective and fastest to deliver, of these solutions. (see **section 9**)

7. The planning issue

Need to recognise that this issue is the biggest blocker, perhaps the only blocker, to delivering this initiative. Individual applications are taking an average 16 months to process regardless of outcome. It is not possible to over emphasize the requirement for immediacy in finding solution to the energy crisis. Politicians national and local have to fully address this issue.

A large scale rural "buy in" to the initiative would give strong backing for our politicians to tackle the politics of planning head on. If offered fast delivery of such a massive, very green, very real, least expensive, rural **sector participating** solution to the impending crisis duo of energy and climate, politicians, national and local would be hugely irresponsible not to seriously try to put on fast track, resolution of the present stultifying planning procedures.

Required is legislation dictating to councils that fast delivery of distributed land based wind generators, on this scale, are a crucial part of the future. National government could steer that Councils may proactively determine very limited no go areas - eg S.S.I.s, identified real beauty spots, and airport approaches. Beyond that permission should be a formality anywhere out with say 500 meters of residence. They need to deliver a promoting rather than a restricting, prohibiting culture. Crucial to appreciate that nimby-ism is not an option. Anyway are they so bad? See Murdo our neighbour's poem below under Mackie's Experience (see **section 11**)

Note that a solution that also delivers meaningful hydrogen manufacture gives us a start also to delivering alternative "green" fuel for transport, and importantly, a source of nitrate fertilizer, so beginning to address the concomitant emerging food crisis.

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Further, government needs to note that the clearing of this initiative puts on a fast track the potential of an annual injection of multi-billions, £27 Billion for the full mote, into manufacturing in the home economy, and with an eventual on going annual £1 to £2 Billion servicing spend. (£2.7billion for the full monte)

8. Current level of wind generators investment in UK (2008)

	Onshore	Offshore
Turbine capacity installed	2143 MGWs	403 MGWs
Under construction	1044 MGWs	629 MGWs
Consented	3437 MGWs	3414 MGWs
In planning	6556 MGWs	6556 MGWs
	13180 MGWs	11002 MGWs
Equiv. to 4400 3 mg wind gens		

Note that the electricity delivered averaged throughout the year is only 1/3rd the capacity. Thus the above onshore, fully operational, will on average, deliver circa 4.4 Giga watts. Note also, there is no reason why the land owners of the generators not yet constructed could not join this game!

Current application planning time - 16 months

9. Land based distributed wind generation issues

Wind generated power is now proven performing technology. Of all the alternative energy crisis solutions, this is, by far, the least expensive. Important though to note that to deliver our world from potential apocalypse, we need the full capacity of all the solutions, including nuclear. But the more we invest in wind, tide geothermal and direct solar the less nuclear we need. This last is still fraught with fearsome world wide safety problems.

Much of the generation will be taking place near where power is required. Distributed geographically throughout the UK, generators will feed direct into the current grid network so minimising investment in grid enhancement. Sure, some areas will need enhancement and that cost needs to be accounted for. (**see section 14**) But clearly this will be considerably less that that required to deliver from totally new massive offshore and onshore wind farms.

Wind generators are only at full capacity in strong winds. Experience shows that on average they deliver about 1/3rd of their rated capacity over the year. Hence the 90,000 three mega watt generators in this plan could deliver 270 gigawatts at full wind power, but will only average 1/3rd of that. - 90 gigawatts. (Note that most current schemes quote their theoretical capacity not their average expected delivery).

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There is nearly always wind somewhere so distributing the capability throughout the UK ensures best use of the UK wind resource. However, clearly the generating capacity has to be backed by base line conventional capability to cover low wind speed weather. (see "**Mackie's experience**" section 11)

Minimising factors for this requirement are –

- > Wide geographic spread.
- > Other renewable sources on stream - offshore wind, wave and particularly tide.
- > Geo-thermal.
- > Hydro power maximised complete with enhanced pump storage systems that can respond to high wind days.
- > A crucial element is the development of a smart grid that can automatically switch on and off non time dependent house and business appliances, as power supply availability allows.
- > Development of ability for business and households to store heat energy, and a capability, in conjunction with a smart grid, to wind down to only essential operations when/if necessary.
- > Development of hydrogen and other energy storage capability (The tech of this in its infancy).

Given political will to solve the planning process problems, we can fast deliver a very very meaningful part solution to both the energy and the climate change crisis.

10. Scale issues

Think big. A physical limit is far away. 90,000 3MW windgens is a potential target. Agreed, it is at the top end of the doable, so why not target it! At that level, RSWL on average will generate 90 Giga watts, a touch over the current total generating capacity of the UK, equivalent to 67 Sizewell B nuclear plants, or of future importance, enough power to make enough hydrogen to replace all the fuel needed currently for all our UK public and private road transport. Note anyway that 20K upwards would still be a massive contribution.

It would only be lengthy and restrictive planning procedures that would prevent the delivery of 90,000 3MG windmills in the next 12 years. Say 9,000/year from year 2 onwards. You can be sure that Teesside Humberside and Clydeside would be delighted to tool up to make them! 90,000 is on average circa one every sq mile, though to be practical, for both aesthetic and efficiency reasons, they would need to be grouped on the best hill riser sites.

Energy storage technology of which hydrogen in one answer, is in its infancy, but will no doubt develop. And the growing company could play a meaningful role in such development.

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The power of scale and the economies of scale are important. -

- > Imagine ordering 9,000 windgens every year for 10 years!
- > Imagine the deals to be made with power users, including special deals for original rural community RSWL investors! Within the limits of Competition Commission regulations, RSWL would be a price maker not a taker.
- > Scale allows the employment of the best technical, financial and administrative expertise.
- > Politics at all level would have to pay attention, and facilitate resolution of planning blockage.

11. Mackie's of Scotland Ltd experience

The progenitor of this initiative is Chairman of the above family company (see www.mackies.co.uk), now totally managed by the new generation. Under the leadership of Mac Mackie they have recently invested in three .85 megawatt wind generators, now powering the farm, estate and ice cream business. The substantial surplus feeds back through their transformer automatically to the local grid network. It is sold to 'Good Energy', a 100% renewable energy retailer.

The knowledge gained has much contributed to the thinking behind this initiative. Some of the experience is shared below.

Margaret (Apr 05) Matilda and Mirabel (Jul 07)



The Three Muses

When viewed in line
Their arms entwine
Three maidens clad in white
Upon the hill
So seldom still
In motion day and night

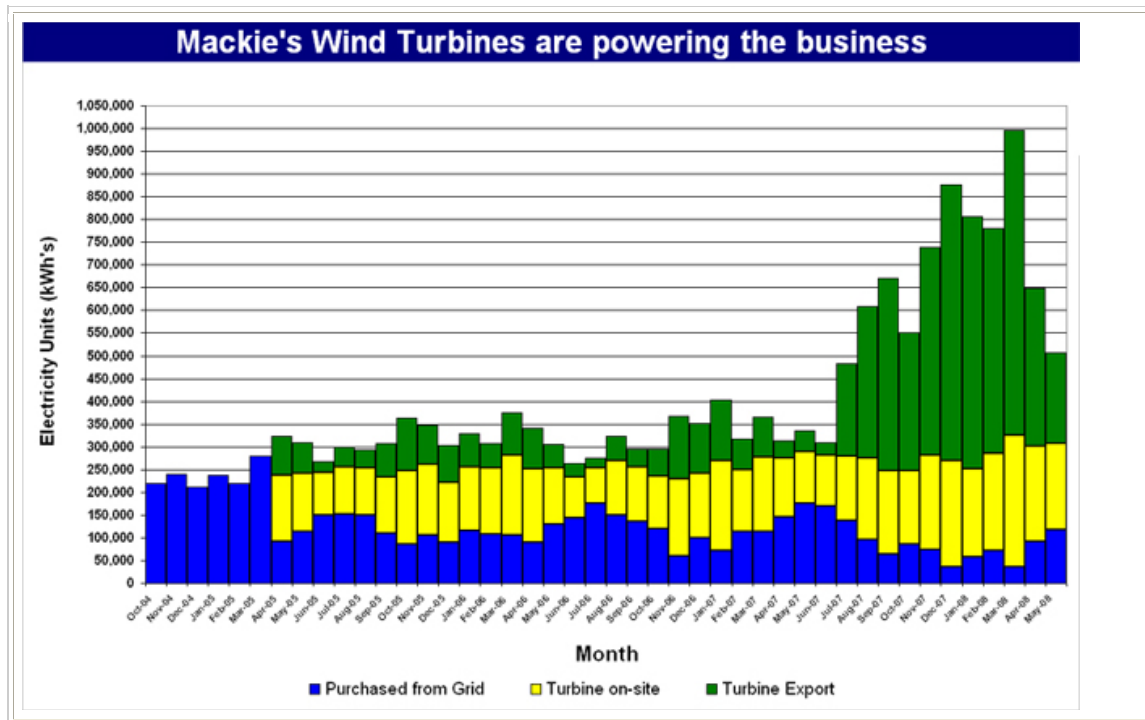
Why dance they so
I'd like to know
What music do they hear
Day after day
In Harmony
With movement crisp and clear

Sweet Zephyr's song
Urges them on
In whispers calm and soft
So tireless till
Coffers they fill
They swing their arms aloft

**By our neighbour
Murdo Stewart**

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Physical performance is detailed in the chart below. Margaret performed alone till twin sisters arrived July 07



Being insignificant in the market, we are of course price takers. But even so it's the best investment we have ever made. We are a price taker. RSWL as a major player would be a price maker.

A touch of imagination allows extrapolation of this chart to depict a similar for UKplc. The blue would depict base line back up requirement for light and no winds. Blue and yellow normal industrial and domestic requirement. Green as available surplus for private and public energy storage capability - electric cars, heat storage, hydrogen manufacture etc.

12. Rural Sector WinGen Ltd ownership and share structure

Ownership and share structure is very much at a preliminary "idea" stage, and will be subject to change as idea, opportunity and necessity dictates.

A major objective will be to ensure this company (RSWL) clearly favours dwellers of the countryside, villages and, small townships, and small investors anywhere. The plan would be that the rural sector will have priority, i.e. first call in investment opportunities, and early rural investors, holders of original "green" shares, could benefit from substantive discounts on domestic electricity, proportional to their share holding.

However it is not proposed to elaborate here on the imaginative ownership ideas, for this is a complex legal area that will be professionally and formally tackled, if enough interest is shown by the rural sector to pursue the initiative.

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13. Management structure & governance

Initial management will come from the Mackie's of Scotland stable (the progenitors of the plan)

Chairman - Dr Maitland Mackie CBE. BSc Agri. MA hons econ. FRAgS. DBA

Managing Director - to be appointed

Marketing Director - to be appointed

Financial Director - to be appointed

Technical Director - to be appointed

Site procurement Director - to be appointed

3 directors to be appointed from early participators

Governance to be articulated in the company constitution and articles

Current think tank advisory and development team

Several members of Mackies management team

Colin Anderson (Technical guru)

Pat Machray (Financial guru)

Jennifer Crow (Business development guru)

Dr Richard Birnie (Macaulay Land Use Research Institute)

Professor John Hillman (Director (Rtd) Scottish Crop Research Institute - Energy guru)

14. Financial potential - A P & L speculation on full 90,000 3MW windgens (12 years)

Please note that the figures in this section come solely from the 'Mackie's of Scotland' three years direct experience. It needs to be made clear that they have not been subjected to third party assessment and risk analysis. This will be another first priority task to be undertaken should enough interest within the rural community be generated to encourage formal incorporation and pursuit of the initiative.

Capital required

Mills - £270B (£1m per MW)

Grid connections - £25B (Likely an overestimate since windgens to be distributed over UK)

Start up costs - £5B (planning, delays, admin & office costs, contingency)

Total £300B

Output (wind patterns deliver an average output is 1/3rd potential capacity)

@ 33% of capacity - 1000KW x 24hrs x 365days = 8.7m KWs per windgen

Price tricky to estimate. Assume a renewable order certificate of 4.5p, and a retail price of 7.5 p give 12p/KW less 1P grid charge - say 11p (in an energy crisis situation price can only rise.) 8.7 M KWs @ 11p = £957k per windgen

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P & L

Income 90k windgens x £975k	£86.13 billion
Service say £30k per windgen	£2.7 billion
Depreciation (15 yrs)	£18.0 billion
50 Admin & Tech staff, and office costs	£0.005 billion
Interest on £300B @ 6%	£18.0 billion
Site land rentals 90k @ £15,000	£1.350 billion
Contingency	£1.0 billion
Total Expenses	£41.055 billion
Entrepreneurial return (net after 6% int on total capital)	£45.075 billion (15.025%)

Notes

1) This speculation is a static of the completed project 12 yrs away, at today's prices. The dynamic will be very different. **(see cash flow speculation below)** The analysis will be very sensitive to price movements of both inputs and outputs. However It is likely though that both will follow the rising costs of energy. Further, it is likely that energy (power) price rises will precede windgen price rises.

2) P & L interest charges will be considerably less than above, probably half, as the first windmills will start delivering income in year 3. Shareholder capital **will** further reduce this outgoing. **(see cash flow speculation below)**

3) The dynamics will also change if RSWL starts to invest in further downstream activity before year 12 - eg in hydrogen production by water hydrolysis, and fertilizer manufacture from hydrogen.

4) The analysis is sensitive to the 'renewable order certificates' (currently circa 4.5p per kw unit). It is in place overtly to stimulate such investment. Realistically fast removal would be politically difficult and dependant on being replaced by market place power price rises.

5) This analysis takes no account of taxation, potential grant and other government support possibilities other than the current R O C arrangements.

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15. Financing Rural Sector WinGen Ltd

Cash flow dynamics covering principle activities.

Some assumptions

- > Electricity price inflation to cover cost inflation, and removal of the R.O.C. The £100 million year 2 shareholders funds will cover all staff, planning, office, business development and marketing overheads in following years.
- > Current experience is that the £1M per megawatt cost includes ground work, installation, commissioning and local grid modification.
- > The cash income streams forecast are practical extrapolation from the P & L forecast above. The finance charges are gross - ie 6% on full investment cost, as if all capital finances were bonds or bank loan.

Yr 1

Start up finance - from **Green** share investors - landholders and the wider rural community

Say 10,000 investors at 1000 £1 shares - **£10 million** - to finance -

- > Office & initial driving team and initiate -
- > Full financial assessment including - exploration of financing alternatives
- > Engage rural sector financial participation
- > Market assessment
- > Geographical/wind assessment to establish UK wide best sites
- > Grid capability assessment
- > Windmill supply potential
- > Prepare PR & political sell brochures
- > Tackle political and planning issues
- > Engage and train installation control team

End Yr 2

Challenge to achieve rural sector **Green** share ownership > £100M as core development finance. But no limit, for if we target for 80% gearing we need as much as possible Green (A) share ownership to keep ownership, initially at least, in rural sector hands.

£100M green share sourced fund could/should cover Head office team and admin, developing installation control team, and ad hoc overhead development costs. For the following years.

The principal tasks would be more of the above plus-

- > Identification of first 9,000 windgen sites c/w planning permissions
- > Arrange finance for them - £27B through-
Offer of A shares to original green shareholders (at a discount of any perceived premium?)
A ordinary shares thereafter to investors worldwide
B (non voting) 6% preference shares worldwide
Company fixed interest bonds
Bank long term loans

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End Yr 3 - Principle task

To install 1st 9,000 windgens	
To agree finance for 2nd set of 9,000 generators, as per above, perhaps with an incentive for above A ord share holders	£27.0 billion
Buy 1st 9,000 windgens	£27.0 billion
Interest at 6%	£1.62 billion
Service and site rental (9,000 @ £45k)	£.41 billion
Cash flow	£29.03 billion

End Yr 4 - Principle tasks

To install 2nd set of 9,000 windgens	
To arrange finance for 3rd set of 9,000 windgens	£27.0 billion
Buy 2nd set 9,000 windgens	£27.0 billion
Interest at 6% on £56.03 billion	£3.36 billion
Service and site rental (18,000 @ £45k)	£.81 billion
Yr 3 (9,000 windgens) cash income	£8.6 billion
Yr 4 cash flow	£22.57 billion
Cumulative cash flow	£51.60 billion

End Yr 5 - Principle tasks

To install 3rd set of 9,000 windgens	
To arrange finance for 4th set of 9,000 windgens	£27.0 billion
Buy 3rd set 9,000 windgens	£27.0 billion
Interest at 6% on £78.6 billion	£4.72 billion
Service and site rental (27,000 @ £45k)	£1.22 billion
Yrs 1 & 2 (18,000 windgens) cash income	£17.2 billion
Yr 5 cash flow	£15.74 billion
Cumulative cash flow	£67.34 billion

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End Yr 6 - Principle tasks

To install 4th set of 9,000 windgens	
To arrange finance for 5th set of 9,000 windgens	£27.0 billion
Buy 4th set 9,000 windgens	£27.0 billion
Interest at 6% on £94.34 billion	£5.66 billion
Service and site rental (36,000 @ £45k)	£1.62 billion
27,000 windgens cash income	£25.8 billion
Yr 6 cash flow	£8.48 billion
Cumulative cash flow	£75.82 billion

End Yr 7 - Principle tasks

To install 5th set of 9,000 windgens	
To arrange finance for 6th set of 9,000 windgens	£27.0 billion
Buy 5th set 9,000 windgens	£27.0 billion
Interest at 6% on £102.82 billion	£6.17 billion
Service and site rental (45,000 @ £45k)	£2.03 billion
36,000 windgens cash income	£34.4 billion
Yr 7 cash flow	£.8 billion
Cumulative cash flow	£76.62 billion

End Yr 8 - Principle tasks

To install 6th set of 9,000 windgens	
To arrange finance for 7th set of 9,000 windgens	£27.0 billion
Buy 6th set 9,000 windgens	£27.0 billion
Interest at 6% on £101.59 billion	£6.1 billion
Service and site rental (54,000 @ £45K)	£2.42 billion
45,000 windgens cash income	£43.0 billion
Yr 8 cash flow net surplus	£7.48 billion
Cumulative cash flow	£69.14 billion

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End Yr 9 - Principle tasks

To install 7th set of 9,000 windgens	
To arrange finance for 8th set of 9,000 windgens	£27.0 billion
Buy 7th set 9,000 windgens	£27.0 billion
Interest at 6% on £93.72 billion	£5.62 billion
Service and site rental (63,000 @ £45K)	£2.84 billion
54,000 windgens cash income	£51.6 billion
Yr 9 cash flow net surplus	£16.56 billion
Cumulative cash flow	£53.00 billion

End Yr 10 - Principle tasks

To install 8th set of 9,000 windgens!	
To arrange finance for last 18,000 generators	£54.0 billion
Buy 8th set 9,000 windgens	£27.0 billion
Interest at 6% on £77.16 billion	£4.63 billion
Service and site rental (72,000 @ £45K)	£3.24 billion
63,000 windgens cash income	£60.2 billion
Yr 10 cash flow net surplus	£25.33 billion
Cumulative cash flow	£27.67 billion

End Yr 11 - Principle tasks

To install last 18,000 windgens	
Buy last 18,000 windgens	£54.0 billion
Interest at 6% on £74.43 billion	£4.71 billion
Service and site rental (90,000 @ 45k)	£4.05 billion
72,000 windgens' cash income	£68.8 billion
Yr 11 cash flow net surplus	£6.04 billion
Cumulative cash flow	£21.63 billion

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End Yr 12 - Principle tasks

Service and site rental (90,000 @ £45k)	£4.05 billion
90,000 windgens' cash income	£86.0 billion
Yr 12 cash flow	£81.95 billion
Cumulative cash flow	£60.32 billion

16. Next stage and milestones (preliminary)

1. Explore for farmer/landowner/wider rural interest -target 10,000 positive responses, 1,000 in Scotland
2. Press conference
3. Formalise advisory/development team
4. Appoint Board
5. Explore for SE help for start up and development
6. Professionalize strategic and business plan
7. Follow up on initial farmers/landowners/wider rural expressed interest
8. Prepare approach to Governments at all levels
9. Prepare Mackie's to handle initial enquiries and/or fund a temp secretary
10. Establish minimum (10,000) farmer real interest (£10M in promises)
11. Appoint CE FD & MD with Admin back up
12. Identify sites - Could start in Scotland?
13. Explore supply issues
14. Get on with it!!!

17. Some facts and figures on the energy crisis

We are now all concerned about climate change and the huge challenge to effect substantial carbon emission reduction.

However this challenge is dwarfed by the enormity of the looming energy crisis facing the world. Though the good news is that solving this last could go a long way to solving the former.

The crucial point is that we have plumbed the depth of the world's oil supply. Serious cognoscenti now confirm that oil output has peaked. Most major oilfields are in their mature output reduction phase. And we are close to plumbing the depth of gas reserves.

Some stark facts: - Note figures come from intuitive averaging of various varying sources. They are correct in scale, but may be wrong in insignificant detail. In last five years the World oil consumption averaged 27 Billion barrels per year New finds averaged 3Billion. That is one barrel found for every nine barrels of known reserves used.

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And there is little likelihood of any **major** new oil and gas finds.

It is likely that in the secondary & tertiary periods of an oilfield's exploitation, high and expensive tech can, for a wee while, increase oil flows and recovery rates. And A few fields can certainly ramp up production somewhat, but not nearly enough to replace the annual reductions in the current major oilfields and satisfy increasing demand. (daily output reduction is circa four million barrels per day per year)

Demand is steadily escalating. And will shortly accelerate massively. And impossibly. **700 Million** Americans and Europeans each consume circa 22 barrels per year. **2.5 Billion** Chinese and Indians currently each consume 1.6 barrels per year.

Our current production globally delivers less than 5 barrels per person per year. It does not take a degree in economics to see the impossibility of satisfying the legitimate energy aspirations of these developing economies, without really colossal investment in nuclear, even coal, and new renewable technologies

Today's demand, (and production) is 85 million bpd.

The International Energy Agency (IEA) estimates a 2030 non accelerating demand of 118 million bpd. Such modest increase is equivalent to 4 new Saudi Arabias. To put increasing demand into perspective, if all in the world used oil as per America we'd need a daily production of 450 bpd!

Certainly we can be far more efficient in our energy use. And we have to learn fast so to be. But 6 Billion people using each a modest 10 barrels per year would still require doubling current output!

We have to grasp that the oil and gas to so supply is not there. It is not there even to supply the status quo.

World reserves are circa 1200 billion barrels, equivalent to 40 years supply at current consumption.

The point however is not that we have oil for 40 years then we suddenly run out. It is that the increasingly massive imbalance between supply and demand will cause imminent astronomical and permanent price rises. \$130 oil is just the start. Every 2 years a doubling is not unlikely, until massive real alternatives are delivering. - nuclear, geothermal wind, wave and tidal for electrical energy, and hydrogen production for power storage and for independent locomotive power. (This does assume that another Einstein is not lurking in a garage somewhere!)

Importantly, we need to note there is no big role for Bio fuels other than that from waste products. All the World's fertile lands will be required for food production. To give a flavour of the enormity of the problem. To replace our UK current road fuel usage only, by hydrogen, produced by hydrolysis, would require-
67 Sizewell B Nuclear plants, or-
90000 of the biggest 3 MW land windmills, or
Wales or Yorkshire covered in solar panels.

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Note that transport only accounts for circa 1/3rd of our Oil and gas energy requirements. Thus as these fossil fuels fast reduce, the replacement challenge is 3 or 4 times greater.

Look around you - near everything you see, is 50 to 90% oil. Scary.

One estimate is that it would take 30% of N America's wheat, maize and soya crops to deliver energy and raw material for its plastic product annual usage alone. It would take 20% of Europe's cropland to replace 5% of its current petrol and diesel usage!

Of fundamental concern is that half the food of the world is oil. We eat oil. Without bag N, food production will be near halved. Ammonium Nitrate, through the Haber-Bosch process, is totally dependant on oil and gas. 1% of world's energy is required to produce its 500M tons. Without it we can only feed ½ the World's current 6.1 B population, and that at 1900 diet levels. This nitrogen fertiliser supply is the principal reason for the 1950 population of 3 billion managing to explode to its current 6.3 Billion!

We have Armageddon, unless new energy sources are soon available also, for production of fertiliser.

We need to realize that an Adam Smith "invisible hand" demand/supply approach to the challenge is unlikely to work. The absolutely colossal and immediate investment's in new energy delivering structures that is now required, requires an equally commensurate amount of energy to build and commission them. Demand and supply price economics works through price rises stimulating increased supply. But you cannot stimulate supply of something that becomes permanently out of stock. If we run out of the old energy before enough of the new is created, we cannot create the new supply, and Armageddon ensues.

A huge worldwide political drive is required to effect the crucial massive shift of resources needed to create such colossal new energy delivering structures. It can be done. But we must begin now. And it probably has to start with driving the proverbial coach and horses through the myriad of stultifying planning procedures! The very good news is that such a massive shift of energy resources into nuclear, solar (wind, waves and tide are solar) and hydrogen production goes a long way to meeting the challenge of effecting substantive reduction in atmospheric carbon. Indeed much much more than the "edge tinkering" that is the current vogue. But we should note that, unless Einstein the Second appears, energy will never be cheap again.