



First Annual 'Sustainable Insights' Lecture

An Action Plan for Economic Growth and Security of Energy Supply

Wednesday 11 February 2009

Introduction

I am honoured at the invitation to deliver the First Annual "Sustainable Insights" Lecture.

I wish to express my gratitude to my Board colleague, Mark Brown, and to Barclay's Capital for acting as our hosts and for providing us with these splendid facilities.

The theme of the lecture is "*The Role of Renewables in an Uncertain Climate – An Action Plan for Economic Growth and Security of Energy Supply*".

My focus will be on the creation of an offshore Supergrid in North Western Europe. My express purpose will be to elicit your support for the concept and to invite you to become a "Friend of the Supergrid".

The time has come to garner all the support we can for this great venture from business and finance, from the policy community and academia, from energy practitioners and analysts, so that the construction of the **supergrid** can proceed apace. Many obstacles lie in its path. They must be overcome. That is why I seek your help. That's why we have set up the friends of the Supergrid

Background

Let me start with some background. The **supergrid** began life as a concept some seven years ago. It emerged from a number of propositions, each of which is simple in itself but, when combined with the others, adds up to a dramatic vision of the energy future we could create here in Britain and in the wider Europe.

I started with some facts about wind. I like facts. They have a logic that cannot be disputed.

Wind is abundant in these latitudes, especially in the seas around this island and North Western Europe. It is a free fuel. It is clean and, because it is indigenous, it can provide the answer to energy security.

The next fundamental fact I addressed is the correlation between wind and weather. The availability of wind is a function of atmospheric pressure. As weather patterns move the wind moves with them. I reflected on the fact that while wind may blow intermittently at any given point it is always blowing somewhere.

It occurred to me that if we would construct wind farms in the seas around Europe and join them together into one interconnected system that we would always have access to wind power. The key to capturing the wind as a dependable source of power clearly lay in creating a Supergrid that stretched from the Baltic to the North Sea and out into the Atlantic and could collect the electricity generated at sea, bring it ashore and deliver it into the various national grids

That is why I began the search for a technology which would make interconnection possible on a scale never previously envisioned. When I found the answer, the picture was complete and I then brought these simple propositions together into what I christened "**The supergrid**".

The concept began life as a 10 GW demonstration project in the North Sea that would connect wind-powered generation in British, German and Dutch waters and then transmit that power into each of these three markets.

I am happy to say that the **supergrid** concept got immediate support from the then Prime Minister, Tony Blair, whom I personally met in No. 10, and continues to receive the support of the government and opposition. Commissioner Piebalgs was an early supporter and the Commission has now advanced a policy for harnessing off-shore wind as one of the primary means of liberating us from dependence on carbon based fuels. **The supergrid** is put forward as the means of achieving our strategic energy objectives.

The 2020 Imperative

In short, ladies and gentlemen, this country and its European neighbours are embarking on a revolution that will transform the way energy is generated, supplied and consumed. By 2020 some 20% of Europe's energy must come from renewable sources.

Most of that renewable energy will come from onshore wind, but a significant portion will come from offshore wind, particularly in the UK, where this country is already a global leader in offshore wind development. And a growing proportion will be transmitted by **the supergrid**.

My original demonstration project of 10 GW has now been expanded by the Commission and the various national authorities into a target in excess of 100 GW as set out in the Adamowitsch Report. **The supergrid** has moved from being a concept to a concrete proposal. The next stage is to ensure that it becomes a plan for implementation.

Our task is to fashion a framework in which we – regulators, developers, generators, operators and consumers - will all work together.

Ladies and gentlemen, that is the background to this lecture this afternoon and to the launch of **"Friends of the supergrid"**.

Having given you the background now let me give you the vision of what lies ahead.

A Transformational Concept

The vision is based on a simple, but profound, proposition. Electricity is the foundation upon which contemporary civilization rests. It defines the way we live, determines our standard of living and underpins our quality of life. Without electrical power, life as we know it would be unlivable. It is what separates us from the pre-industrial age.

Quite literally, electricity is the life blood of the modern economy.

And the **Supergrid** will be the beating heart of the European economy.

When operational, the **supergrid** will transform the way we source energy, generate power, distribute electricity and manage markets. It is a transformational concept whose time has come.

Its time has come because there is a political imperative to source clean energy, to ensure security of supply and to restore our global competitiveness. Its time has come because we now have the technologies to hand which can meet each of these three objectives.

Its time has come because it is the only available guarantee that our children will enjoy low cost, low carbon and low risk energy supplies.

We have long known that the wind and the sun are infinite sources of energy but up to quite recently that energy was technologically and commercially inaccessible, except for small scale use. But now, new technologies are making it possible to harness wind and solar power on an industrial scale, thereby transforming the way we generate and transmit electricity. These renewables have become mainstream sources of power.

Importance of Scale

This is particularly true of offshore wind, which stands on the verge of take-off as a new power sector.

For success in business, scale is always essential and, in terms of wind, the achievement of scale must begin with both the size of the individual turbine and the number of turbines that can be deployed together to optimize output. Turbine size has grown over two decades from 0.2 of a megawatt to the current 3 to 5MW range. These will be replaced in the coming years by a 6 to 7.5 MW model with a blade span of over 126 meters.

The expectation is that this, in turn, will be supplanted by a 10 MW unit some seven or eight years from now, a giant of a turbine whose span at 160 meters will be two thirds of the height of One Canada Square here at Canary Wharf, the equivalent of an office block 33 stories high.

When mounted on its tower, the tip of the turbine blade could reach as high as a 40 storey building.

Scale will come also from simplifying the mechanics and electronics of the turbine and then combining large clusters into what are, effectively speaking, wind-fired power stations. That is why I no longer speak of wind farms when talking about the future of offshore wind or of the **supergrid**. I talk only of wind-fired power stations, each with a standard size of 500 MW.

These stations are the modules on which the **supergrid** will be built.

The efficiencies of scale resulting from larger turbines configured in 500 MW modules will reduce unit production costs over time in accordance with the cost curve common to all industries growing to maturity.

It also means that here in the UK we will take the lessons of Round 2 with us into deep water for Round 3. All that we learn from building 500 MW power stations in the current round will be directly transferable to the next.

The HVDC Breakthrough

The Supergrid's time has also come because a technological breakthrough by Siemens and ABB who have revolutionized our ability to link the generation and consumption of electricity irrespective of distance and without the power losses that are inherent in AC transmission systems.

As a result of High Voltage Direct Current technology, it is now technically possible to transmit electricity efficiently and cheaply from remote locations at sea or in the desert to the great urban agglomerations in which most of us live and work.

The full significance of a switchable HVDC innovation has not yet been appreciated by policy makers or by the business community. It is clear that a network incorporating a HVDC grid with the redundancy and reliability of the ubiquitous AC grids is now a reality and that the limits of what is technologically possible have been greatly expanded. Hence, we have the potential to transform the energy economy and to bring about major changes in society.

That is why I have incorporated this new HVDC technology into the design of the **Supergrid** as a fundamental and indispensable building block. It is a breakthrough in technology which will do for the energy sector what the coming of passenger railways did for 19th century trade – it will open up markets for our electricity across vast distances which were previously inaccessible to AC transmission.

Definition of supergrid

When these three elements are brought together - advances in turbine technology, the concept of the wind-fired power station and the potential of HVDC - then we can define the **supergrid** as follows:-

An electricity transmission system, mainly based on direct current, designed to facilitate large scale sustainable power generation in remote areas for transmission to centres of consumption, one of whose fundamental attributes will be the enhancement of the market in electricity.

There can of course be many forms of Supergrid. I am concerned here this afternoon with an Offshore Supergrid based on the seas around this island and North Western Europe. But in Europe there will be other supergrids, such as a Solar Supergrid in the Mediterranean. Undoubtedly all these regional grids will eventually be linked into one megagrid.

But we must start with what we have and where we are. Hence, my focus on offshore and the ambition to start building in the North Sea.

Turbine Innovation

In order to realise this ambition, the principal task ahead is to slash investment costs through a whole series of innovations, beginning with the turbine itself and starting with voltage source technology. The turbine of the future will simply be a voltage source and its defining characteristics will be simplicity and reliability. Primarily, it will be a collector of energy and, consequently, Operation and Maintenance costs will be minimized and reliability maximized.

Because the new turbine will simply be a voltage source we can incorporate the right number of such voltage sources into a standard power station. The size of the offshore wind fired power station has a commercial rationale behind it because it is a trade off between the need to achieve scale and the timescale needed to construct a standard unit offshore. Ideally it would be desirable to build the wind fired power station in a single season. This would minimize the dead time from when capital begins to be deployed to when commercial operations begin.

There will be great scope for innovation in circuit breakers, links, ever higher voltages, cable insulation, the design of the DC substations and of the of DC system configuration.

One of the most exciting challenges ahead will be to design floating turbines capable of being sited many hundreds of kilometres out to sea, and so availing of wind speeds and capacity factors that are beyond those available nearer in-shore or on land. Floating turbines will be a technological innovation almost on par with HVDC for opening up access to previously untapped reserves of energy.

For those who say “it cannot be done” I would simply point to the North Sea oil and gas industry, which took existing onshore and near-shore oil extraction technology and adapted it to survive and prosper in one of the most hostile environments in the world – the North Sea in winter.

Marine Transport

If we are going to build hundreds of Gigawatts of wind in the oceans around us then we need to master the sea. Previous generations understood that such mastery was the essential precondition for economic survival, business expansion and international trade. The same is true for our generation. The whole area of marine transport is one where the technical frontiers will have to be pushed out and redrawn.

Of the innovations needed the following stand out. We will need a fleet of special purpose vessels to transport the very large turbines I mentioned earlier, to lay the foundations on which they will be erected, to build the towers and turbines *in situ*, to maintain and repair them when in operation and to lay thousands of kilometers of HVDC cable on the sea bed.

In addition, we will need service submarines, helicopters for moving men and materials, floating cranes to erect the towers and turbines, living quarters at sea for the O&M crews, fast all weather craft to provide a shuttle service criss-crossing the matrix of turbines and power stations stretched across thousands of square kilometers of ocean, to name but some of the innovations that will be required in marine transport.

The supply chain for Round 3 in the UK is already expanding to meet anticipated demand and the East-Coast ports and harbours are competing to bring these new North Sea industries to their regions. We know of real innovation already underway across the supply chain, of new orders for vessels and cable, and of the first contract for helicopter maintenance for an offshore wind farm.

Much of this work has already been done in Britain, quietly and under the radar in Lowestoft, in Great Yarmouth at NaREC in Northumbria, in the Fife Energy Park and in scores of other locations up and down the coast. I want to salute these innovators and risk takers. Without them, we could not get into the deep waters of the North Sea.

Looking forward ahead, one of the most urgent commercial requirements will be the design of ships that can operate in rough seas. The current weather window is a mere four months. This can be extended but it will need new generations of much bigger craft which can geo-position themselves and work in the kind of mid-level gales we experience in the North Atlantic.

Apprentices

In the light of this exciting new future, a number of the traditional ship building communities along the Baltic and the North Sea are gearing up for the re-birth of an industry that had all but died in Europe. The same preparations should be underway here in this country, with particular emphasis on training and educating the workforce that will be needed to resource the off-shore industry.

I foresee a huge demand for skilled craftsmen and, for that reason, **Mainstream Renewable Power** embarked some months ago on creating a centre of excellence in Lowestoft for training apprentices in engineering and marine technologies. The **supergrid** will need support and logistical services on a scale that will match North Sea oil and gas.

It can be taken that skilled human resources will be key to this country winning significant market share in what will be one of the exciting industrial sectors of the Greentech Economy. That is why I particularly welcome the emphasis placed by the Prime Minister on apprentice training and I pledge here this afternoon that we in **Mainstream Renewable Power** will be to the forefront in promoting his policy. Our distinguished Board Member, Sir Roy Gardiner, is playing a key role in the effort to promote the national apprenticeship scheme in his position as Ambassador for Apprenticeships and we, as his colleagues, are committed to assisting him in every way possible.

It is hardly surprising the government has taken this welcome initiative on upskilling the labour force because it has been a global pioneer in making the low carbon society the overriding policy goal for 2050 and in initiating the policies that will make it achievable.

Re-engineering the British Economy

The **supergrid** is one of the best examples of how the Greentech Economy can be built by reviving and adapting the engineering skills and business culture that made this country the manufacturing centre of the world. This renaissance will re-power the British economy, literally and metaphorically, re-engineer its industrial base and restore coastal communities as great centres of commerce and provisioning.

In presenting the **supergrid** to you this afternoon as a venture worthy of your support I am driven, in the first place, by an innate respect for past traditions, skills and achievements because they act as the foundation for the future.

But the future must be different from the past. Indeed, it must be profoundly different. It must be based on the transformational technologies I have outlined and, specifically for the **supergrid**, it must be thoroughly modern in its fundamentals. It must be way ahead of its time.

For me, it is essential that the **supergrid** at sea must have the same reliability as a grid on land, and be smarter. But, our current grid network is the last great survivor of the age of machines. In contrast, the **supergrid** I envisage is a smart grid which, by using the latest developments in Information Technology, will incorporate real time management of both the supply and demand for electricity so as to optimize the output and consumption of power.

To that end, I can foresee that, as a matter of course, the HVDC network linking the power stations at sea will be paralleled by a similar network of fibre-optic cable handling vast amounts of data on electricity production and consumption in real time.

The science of weather and wind forecasting, for example, will be transformed because the smart grid will provide a multiple of the number of readings presently available of atmospheric pressure at sea and of wave heights and speeds. This new stream of data will be complemented by satellite telemetry and GPS information systems to enhance our forecasting capacity.

This enhanced capacity to forecast will help change the nature of wind power generation and increase its value to the transmission system operators because of the longer lead times regarding forecasts on its availability. Simultaneously, the **supergrid** will be facilitating both the measurement and the management of demand in the electricity markets with the aim of minimizing peaks, thereby making enormous savings in production costs. This development will confer the benefits of greatly lower power prices on the industrial, commercial and domestic consumer.

Customer- Centred Market

The consumer must always be at the centre of all we do in business, at least if we are serious about success. I am convinced that one of the great spin-offs from the **supergrid** will be the utter transformation of electricity markets by putting an end to market unfriendly power monopolies – all monopolies are hostile to the market for their end goal is the exploitation of the consumer- and ushering in the era of a customer-centered market.

Because of its geographic spread across thousands of kilometres, **the supergrid** will be able to supply electricity to separate national and regional markets operating in different time zones and, hence, at different phases of the daily demand cycle. When allied to the smart grid, this will result in the creation of products fine-honed to the specific requirements of customers in respect of time of day and end use.

This is as exciting proposition as I can think of since, if we can liberate markets from the strangulation of monopolies and oligopolies, and thereby unleash their creative power, there is almost no limit to the potential for product innovation and, hence, for lower costs and better service to the consumer.

That is why I can foresee trading in Renewable Energy Futures and the emergence of sophisticated markets in all forms of energy products. As the markets evolve there will be a stream of innovations benefitting the consumer. In short, and in contrast to the present situation, the customer will be put at the centre of the market.

If we define a paradigm as a bunch of traditions, practices, customs, and even myths, then we can safely predict that the future electricity market will be a customer-centered paradigm in place of the generation-centered paradigm which currently dominates the markets.

Continental Market

At the heart of this paradigm shift will be the transition from isolated national markets to an integrated continental market embracing the states that border the seas of North-Western Europe. It is intriguing, I believe, that the great Internal Market programme initiated by Lord Cockfield in the mid eighties still lacks a single electricity market twenty years later. It is the missing piece of the jigsaw as envisaged by that visionary British Commissioner who understood so well the liberating power of free markets, a philosophy I share with a passion the equal of his own.

We must stop thinking of electrical grids as a national resource. They are international corridors of trade. We have a lot more marine renewables in Northern Europe, more than we can consume. So we must build new trade routes in the form of new grid corridors to take these resources to the markets of Central and Southern Europe. That will require cooperation between EU Member States for a common benefit.

A grid that straddles a number of national markets will, of necessity, require a transnational governance system based on the participating national Transmission System Operators, or TSOs. The national TSOs will constitute a Board, to include the European Commission, and which will be responsible for planning, designing and managing the **supergrid**.

The Charter for the Board would be drafted by the Commission and adopted by the participating states, perhaps under the provisions for Enhanced Cooperation as laid down in the Treaties. The Board will be the Governance part of the Offshore Transmission System Operator, a newly created body which will oversee the planning, construction, funding and operation of the Supergrid. The OTSO will be staffed by professional executives and would be empowered to set tariffs, which would be used to remunerate the capital invested in the grid.

Political Benefits

When presented in this fashion the **supergrid** can be seen not only as a spectacular technological breakthrough, and as a profound transformation of electricity markets, but also as a means for ensuring energy independence.

Only last month, the Conservative Party in a Green Paper on the Low Carbon Economy said that green technologies would free Britain from dependence on imports of carbon-based fuels coming from potentially unstable parts of the world, like the Middle East, North Africa and Russia.

So they will.

Marine-based wind power, as exemplified by the **supergrid**, will contribute substantially to the energy independence now sought so urgently by political leaders of all persuasion.

It will also enhance the freedom of the participating states to run their economies and manage their societies in accordance with the wishes of their own people rather than at the dictat of any foreign gas or oil supplier. The recent threat to European gas supplies, the second in three years, was a chilling reminder of our collective vulnerability to suppliers willing to play politics with our wellbeing and livelihoods.

Freedom from outside threats of this sort, or from actual constraints on supply, is the prize awaiting the European states which participate in the **supergrid**. By taking wind not simply as a national but as a continental resource, and by pooling their capacity to harness it, they will secure energy independence for themselves, and thereby enhance their own sovereignty, both collectively and individually.

There is no conflict between national independence and pooling sovereignty in the exploitation of renewable energy. What is sovereignty without the freedom to exercise it? The distinction between nominal and real sovereignty is determined by the freedom to act as one wishes. It is self evident that the **supergrid** will enhance Europe's freedom in the sourcing and use of energy and it follows as a logical consequence that it will give substance to sovereignty by preserving the freedom to act in the economic sphere.

So, by pooling sovereignty over a continental resource we enhance the sovereignty of each participating country. This is but a reflection of the co-operative principles first enunciated in this country over a century ago in Rochdale. It is equally, a clear demonstration of Adam Smith's argument in favour of cooperation in markets in order to produce optimum outcomes.

For a country with a global reach and with corresponding military responsibilities, the **supergrid** has significant defence implications. It will eliminate the threat of blackmail over energy supplies but, at the same time, it will require considerable military resources dedicated to the protection of the power stations and the cabling network from sabotage. This is a role for which Britain with its great naval tradition is particularly suited.

Economic Benefits

Ladies and Gentlemen,

It is rare in politics for parties across the political spectrum to agree on major policy objectives that fundamentally affect the state, society and the economy. But that is the case with Climate Change Policy. That coincidence of objectives is to be found in this country, as well as in all the other Member States of the European Union.

In every case, the environmental imperative of an 80% reduction in the 1990 levels of Greenhouse Gas Emissions by 2050 has been accepted. The replacement of carbon based fuels by clean renewable energies will contribute substantially to that goal.

But if, in addition, we were to electrify surface transport, both personal and commercial, as I anticipate, then the contribution of wind power to the 2050 target will be even greater than forecast. It will be enormous because it would only make sense if the electrified transport system were to be powered by green electricity.

We can anticipate, therefore, that over the next three decades a vast transformation of society and the economy is in store. The economic potential of this transformation is accepted by all political parties. A 500 MW offshore wind powered station will require an investment of about £1.5 bn. Current UK plans for off-shore wind foresee somewhere between 20 GW and 25 GW of installed capacity by 2020 alone. That would amount to an investment of £60 to 75bn at a minimum, plus the additional investment in the grid and the support and ancillary services outlined earlier.

The employment prospects can be judged from the established ratio of three jobs created per megawatt installed. At 25 GW by 2020 this would indicate new direct employment of some 75,000 people. There would, of course, be a multiplier effect throughout the rest of the economy and the conservative estimate used by economists is that of one additional post for each directly created job.

As a rough guide it could be said that we are looking at the creation of about 150,000 to 200,000 highly skilled jobs by 2020. That figure would rise to over half a million by 2050. These tie into the UK government's own studies in their "Renewable Energy Strategy" and is underpinned by work carried out by Bain and Co. and SQW for the BWEA last year.

In addition to these new jobs there would clearly be significant potential for the export of green power. It is impossible to put an estimate on this at present but every MWhr exported would have considerable economic value. As a country which has traditionally lived and prospered on its exports, this prospect has to have a special attraction and resonance.

There are, of course, macro economic benefits also in prospect. Reduced imports of hydrocarbon fuels and exports of renewable energy will transform the balance of payments and reduce the exposure of the economy to energy price peaks and disruptions in supply. In short, the **supergrid** will add to the stability of the economy as a whole.

I have previously identified the value of wind in an analysis I published two years ago using the portfolio effect first identified by my friend, the late Shimon Awerbuch. The introduction of wind onto the generating system lowers the average cost of generation by reducing risk exposure. The economic aspect of wind can be explored in full at another time but suffice it to say now that the combined benefits of wind, including carbon abatement, are quite dramatic and still largely unrecognized by analysts.

Financing

But reference to risk introduces a series of interesting questions on which I would ask you to reflect. Given the inherent risks of going offshore, risks which increase the further out you go, why should anybody expose themselves to the challenge of taming the sea? And who are these people willing to take on this task?

The answer as to why we should take on these risks is that the alternative is infinitely worse. A "Business As Usual" scenario, that is, the indefinite burning of fossil fuels, such as coal, oil and gas, is not a sustainable option. In the case of oil and gas it is limited in time and quantity. In the case of coal it is limited by the amount of Greenhouse Gases we can emit.

Hence, the funding of this venture has to be up to the challenge of the risks to be mastered. Basically what we will be doing is swapping the uncertainty of a fossil fuel future for the certainties of secure, clean and cheap electricity. And the financing must reflect this swap.

In a fossil fuel future, the risks to electricity supply are geo-political, physical, environmental and financial. The risks include the malign or perverse policies of energy-rich neighbours, and in an extreme scenario, the threat of resource wars and all that this entails.

In these circumstances, the answer to the question as to why we should go for offshore wind is clear cut. We are swapping political, economic and environmental risks for a set of new risks associated with the weather. These can and will be technically overcome. Engineers are never short of solutions. But the financing must rise to the challenge of funding the engineering responses. And so must policy making. Public policy and private financing must go hand in hand in providing the financial instruments we need for the task ahead.

The Future

Nobody needs reminding, Ladies and Gentlemen, that we live in what the Chinese call interesting times. The Great Depression of 2008 will continue on throughout this year, and beyond, with the credit crunch as its biggest impact on business. The aversion to risk is palpable and the preference for liquidity is back to levels which first interested Keynes when elaborating his General Theory in the 1930s.

But electricity is truly the life blood of the economy, and it has to be kept pumping if society is to survive. Neither the economy nor society can function without electrical power. It is not a fashion accessory. It is not an option to have or not have electricity. By the same token, Greenhouse Gas Emissions have to be reduced rapidly. There is no alternative. And energy security has to be secured as an overriding national priority. It is an imperative.

These propositions are facts; they can neither be denied nor avoided. They remind us why investment in green electricity, such as offshore wind, will accelerate rather than decline in the period ahead and why the capital, public and private, will be made available to fund the necessary investment.

The lesson to be drawn is that the funding problems associated with other industrial sectors will not impinge on renewables. Neither will the particular difficulties of an individual project detain the rest of the offshore wind sector from proceeding with its plans. Based on my own experience to date I am completely convinced that offshore wind will be developed at the pace anticipated by the government.

Big Infrastructure

Neither have I any doubt that the UK can do big infrastructure on the scale envisaged for 2020. This enormous development, Canary Wharf itself, is proof of the vision, the skills and financing expertise that can be brought to bear in this country on the very biggest of infrastructural projects.

The outside world shares this confidence. After all, London was awarded the 2012 Olympics in the universal belief that Britain could deliver on the biggest and most public of mega projects. It is one of those coincidences of history that the River Lee which flows through the Olympics site had more tidal and wind mills on it than any other river in Northern Europe. To paraphrase the Mayor: "Wind is coming home".

As an engineer myself, I am aware of the great engineering culture on which this economy was built. The names of Brunel, Bazalgette and Baker resound through the engineering world to this day. These geniuses brought communication, transport and social infrastructure to London and many other British cities during the 19th century. May I be so bold as to suggest that latter day equivalents are ready to emulate them?

In the 19th century the great imperatives were to deliver clean water, sewerage and transport. In the 21st century, the challenges of climate change, energy security and global competitiveness are even greater, but so is our ability to meet them.

We have already embarked on a revolution that will transform the way energy is generated, supplied and consumed. The **supergrid** is central to that revolution.

Conclusion

I trust that this afternoon I have given you some inkling of the role the **supergrid** can play in bringing this new future into being. I hope I have excited your interest and elicited your support for a project worthy of this country's ambitions for 2050.

If you share our excitement and commitment then I invite you to subscribe to the "**Friends of the supergrid**" and to support us in promoting its benefits to British society and to the economy at large.

But let me place the global challenge ahead in its widest context. Greenhouse Gas Emissions have got to be reduced over the next four decades to levels which many currently believe in their heart of hearts to be unachievable.

The current US per capita emission of 20 tonnes per annum of carbon will have to be reduced to one tonne at a maximum.

And the current UK per capita emission of ten tonnes per annum will also have to be reduced to one tonne at a maximum.

In addition, the current per capita emissions in China and India will have to be reduced.

Failure to do so will result in cataclysmic climate change bringing unimaginable devastation to nature and widespread destruction to the built environment.

This realization has driven my commitment to the rapid expansion of renewable energies as the main means of avoiding global warming. It is the reason why I believe the **supergrid** is the most practical response that can be constructed here and now to the threat that faces us in common.

It is practical in terms of engineering, it is robust as a business model and it is financially rewarding as an investment in sustainable future.

It offers an action plan for economic growth and it charts the way towards security of energy supply.

In short, the **supergrid** outlines a visionary and exciting role for renewables in an uncertain climate.

It is a vision I hope you will share. And I hope you will inspire you to become a **Friend of the supergrid**.