INTRENEX

International Renewable Energy Grid

A funding proposal:

Renewable energy faces one severe limitation slowing down its otherwise rapid adoption - inclement weather. Inappropriate weather drives down production in the power producing regions. This problem can only be economically and ecologically overcome when wind and other weather dependent renewable installations are spread over a distance of several thousand kilometres. It therefore follows that renewable electricity for Europe should be at least partly generated in the regions of Northern Africa, the Middle East, and vice versa. A transmission system needs to be built to transport the vast amounts of electrical energy harvested from reasonably selected sites in each region.

Intrenex plans to build both the energy harvesting installations as well as the transmission system, called the International Renewable Energy Exchange (Intrenex).

Key facts:

- → The Intrenex electrical power system is based on a scientific study which uses numerical computational optimisation strategy based on weather and consumption patterns for a region of 69 countries and 1.1 Billion inhabitants, as created by Dr. Gregor Czisch.
- → The Intrenex power system aims to supply power year-round from 100% renewable sources for the whole region.
- → Energy transmission is to be provided through a system of redundant high voltage direct current (HVDC) lines, a proven technology being used around the world, for example in Germany to transport power from north to south and via sea-link to Norway and other Scandinavian countries.
- → HVDC lines have a very low loss rate of typically below 3 - 4% per 1000 km at full capacity, and even lower at transmission below rated power.
- → With an appropriate HVDC grid, 100% of the electricity required can be supplied without need for additional battery storage, H2-electrolysis, or micro-grid management. This ensures that our solution will be of superior cost-competitiveness in comparison to the technologies used within EU countries.
- → The Intrenex grid structure means it does not need to be built all at once. It can be constructed step by step and by different participants. It can connect single countries, or a group of countries first - for example countries in North Africa, reducing costs their for fossil-based energy generation and removing the need to use foreign currency financing to buy fuels on the world market.
- → From an environmental standpoint, it does not matter where greenhouse emissions are reduced first. A start can be made anywhere. Countries with a very arid climate might more urgent than others want to reduce desertification by a heating atmosphere and not loose precious agricultural land.
- → The IPCC climate change models clearly indicates that the later we begin reducing emissions,

the more we have to reduce in a shorter time span.

→ It seems plausible to use solar power in desert regions of Northern Africa but the study Intrenex uses, as well as others, clearly shows that using predominately wind power is much more effective, leading to a much lower final price for electricity.

→ Several countries in North Africa have a wind potential available to oversupply the annual European and African demand for power, and one country alone could even do it 4 times over. Naturally, the Intrenex system will include both redundant energy generating installations, and a grid designed to ensure that failure in one area does not affect the reliability of the entire system.

→ The sale of electricity to the European continent does not necessarily need to be the first priority at the beginning. When significant quantities of energy can be exchanged across North African and Middle Eastern countries, a connection to the European grid can be established as a second step. Such a move presupposes that both European policy makers and customers are prepared to rely on foreign energy supply (something they have been reliably doing with fossil fuels for a long time, as seen with the gas pipeline network spreading from the middle of the Sahara over Europe up to Siberia over roughly 8000 km distance).

→ If the North African and Middle Eastern counties switch their local grids to renewable power without interconnecting them, no very significant economic scale effects can be gained and the effects on local value creation are relatively small. Usually for the less electricity consuming countries no significant local production facilities would be established at that size, and wealth will flow out of the country to countries with existing external suppliers. Only when a connection to very large energy consuming markets is established, allowing for higher renewable shares, will substantial local production facilities be built thus adding significant value to each country involved. This has already happened in India and China where huge amounts of renewable installations made the step to local production viable and superior to imports.

→ It seems plausible to build up the system on a per-country basis and when supply reaches 100%, to deliver energy to neighbouring countries, thus requiring a grid infrastructure but the problems of that approach are tremendous . Only a large scale infrastructure commitment from many countries involved will bring about the positive effects also to the local GDPs.

→ When electricity is delivered to Europe on a contractual basis with fixed prices it will be possible to gain the positive effect that payment and financing the system in Euros brings about access to international financial markets and will result in favourable investment conditions.

→ Only a large scale infrastructure build-up will bring the needed long term growth in the countries involved especially the ones with relatively small consumption but huge and attractive renewable potentials. All these countries can substantially and sustainably boost their local industry and create persistent local value.

→ The Intrenex grid is designed including the European market but there is also the North

African and Middle Eastern market, and a connection to India or China could be envisioned without too many difficulties.

→ Investment sums are estimated to be around €1000 / kW for wind power and around €70 euro/kW×1000km for the above ground transmission lines that make up by far the largest part of the transmission system. A wind generator can last for around 20 years, the grid for many decades. Capacities could reach 100 GW.

→ The whole Intrenex region currently consumes about 4000 TWh of electrical energy in one year possibly more if further countries are included. We propose that each county involved analyses how much of that total it currently uses and how large the opportunities will be if all the countries involved came together and agreed on supplying large consumer markets via the Intrenex Supergrid.

→ Without the help of politics, the Intrenex system can not succeed. We first need to bring together as many countries as possible in Northern Africa and the Middle East and/or Europe for a substantial long-term commitment. When a strong signal of progress is sent to the EU, politicians here will one day step in even if they did not take the lead. One thing we also need to push for is the acceptance of the build-up of the grid infrastructure. These projects currently have a very long planning horizon which is to be reduced. A substantial effort in the area of politics will be required but in the end, the very low achievable price for renewable electricity supplied by the Intrenex Supergrid will bring about public acceptance. That is a certain step as the decentralised approach the EU is currently focussing on will in the long run become quite expensive.

→ Germany has achieved a high rate of renewable power in Europe and often is praised for its "Energiewende". However in 2016 German greenhouse gas emissions rose by 0.5% and Germany already has the second highest electricity price in Europe of €0.30 /kWh (including taxes and fees; after Denmark at €0.36/kWh). Something went wrong with the decentralised renewable energy approach in Germany.

→ Electricity from a 100% renewable energy supply proposed by Intrenex has been forecast to cost less than €0.05 /kWh.

→ A dramatic change of both policies and prices may occur if greenhouse gas emissions cannot be cut significantly in the next few years. This poses a substantial risk of stranded assets to the current energy industry. An anticipatory transition away from existing sources of energy supply should be high priority for countries relying on the sale of fossil fuels. The largest investment funds globally have already come to the conclusion that investing in fossil fuels has become a long term risk for global business.

→ Intrenex is based in Europe but it is not legally bound to any industrial corporation, financial organisation or to any political party or person. Intrenex can decide freely which supplier it wants to chose in a certain region or for a certain technology. This includes manufacturers from China and India or all over the world.

→ The Intrenex model can be applied to any continent. When certain structures exist, a true

inter-continental global energy exchange can be established.

→ The Intrenex model's effect on greenhouse gasses will be most significant in industrialised countries involved but contributions can come from all countries connected. Of course many countries want development and Intrenex can help, but the focus must remain on maximum reduction of greenhouse gas emissions in the shortest possible time.

→ It must be understood that Intrenex is neither a agency offering employment for all nor a wealth-making machine. The goal is to deliver the cheapest price of sustainably produced electricity possible for the lowest amount of demand thus resulting in the smallest installation size possible. Many people may find a job but it will not solve a chronic unemployment problem in the world. Nor will Intrenex promote the use of ever more energy. The best energy is that which does not need creating in the first place.

→ Financing the Intrenex system will not work best on a traded share basis. Shareholders continue to demand higher profits every year thus resulting in increasing unit price or selling more. Anyway there is a lot of growth possible and necessary until a fully renewable electricity system like the Intrenex system is erected and therefore investors are welcome. There might also be some sort of a green fund/bond applicable for the system. When stakeholders come together on this issue, it is likely that one or more solutions for all participants will be found.

→ There is no need for either additional general research or development. Dr. G Czisch's study has a long record of being irrefutable and many other research centres have done similar research and achieved similar results. All the key hardware components for the system exist and have both long record of reliability and a well established cost decrease curve over the last decades.

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What is the actual Plan for Intrenex ?

The Intrenex Supergrid is a long-term enterprise delivering substantial local value creation for all the countries involved. The more countries, the better. The desired effects can only come to full fruition when all parties involved tap into the large consumer markets for electricity including the EU. Electricity is a product in strong demand with a long-term future.

- ✔ Intrenex aims at establishing an "embassy" based in Vienna, Austria where work can be concentrated and meetings and workshops held.
- ✔ The embassy should be supplied with well-informed, well-connected individuals from all countries involved to facilitate access to local industry, research and politics. We will need direct contact to those in the highest ranks possible in each country to really get things going.
- ✔ The office will operate as a networking hub inside the EU as well as in Northern Africa and the Middle East. We will have to coordinate on all levels to push hard on the public and on politicians. Intrenex will operate mainly in Euros, accessing international financial markets.
- ✔ The embassy will be run at a reasonable price compared to the benefits for each country when large scale industrial appliances take off. The ultimate goal is to build significant installations.
- ✔ The Intrenex enterprise will not function well if there is not significant progress in a relatively short period of time. That is why Intrenex wants to re-evaluate the status for further operation on 31.12.2022. This is our five year plan.
- ✔ The five year plan should at least get a significant amount of wind power (5GW) and some connectivity to the European grid off the ground.
- ✔ There will be two workshops being held before summer this year:
  1. The Q&A Rally
  A Workshop open for all kind of engineers, scientists, bankers, ambassadors, ministers and interested people. Everyone is invited to ask any question related to the INTRENX enterprise and for networking between the parties involved. This workshop will be held on
  Monday, April 9th 2018 09:00 to 13:00 at
  Exnersaal, Paials Eschenbach, Vienna

  2. The Funding Workshop
  The Funding Workshop is for every person that is entitled to underwrite funds to run the INTRENEX Embassy for a period of five years. This workshop will be held at
  Wednesday, June 20th 2018 09:00 to 13:00 at
  Exnersaal, Paials Eschenbach, Vienna

- ✔ Please forward this information to anybody that you think might be interested and feel free to mail any question you might have to office@intrenex.com. Registration under this email address for one or both of the workshops is greatly appreciated.

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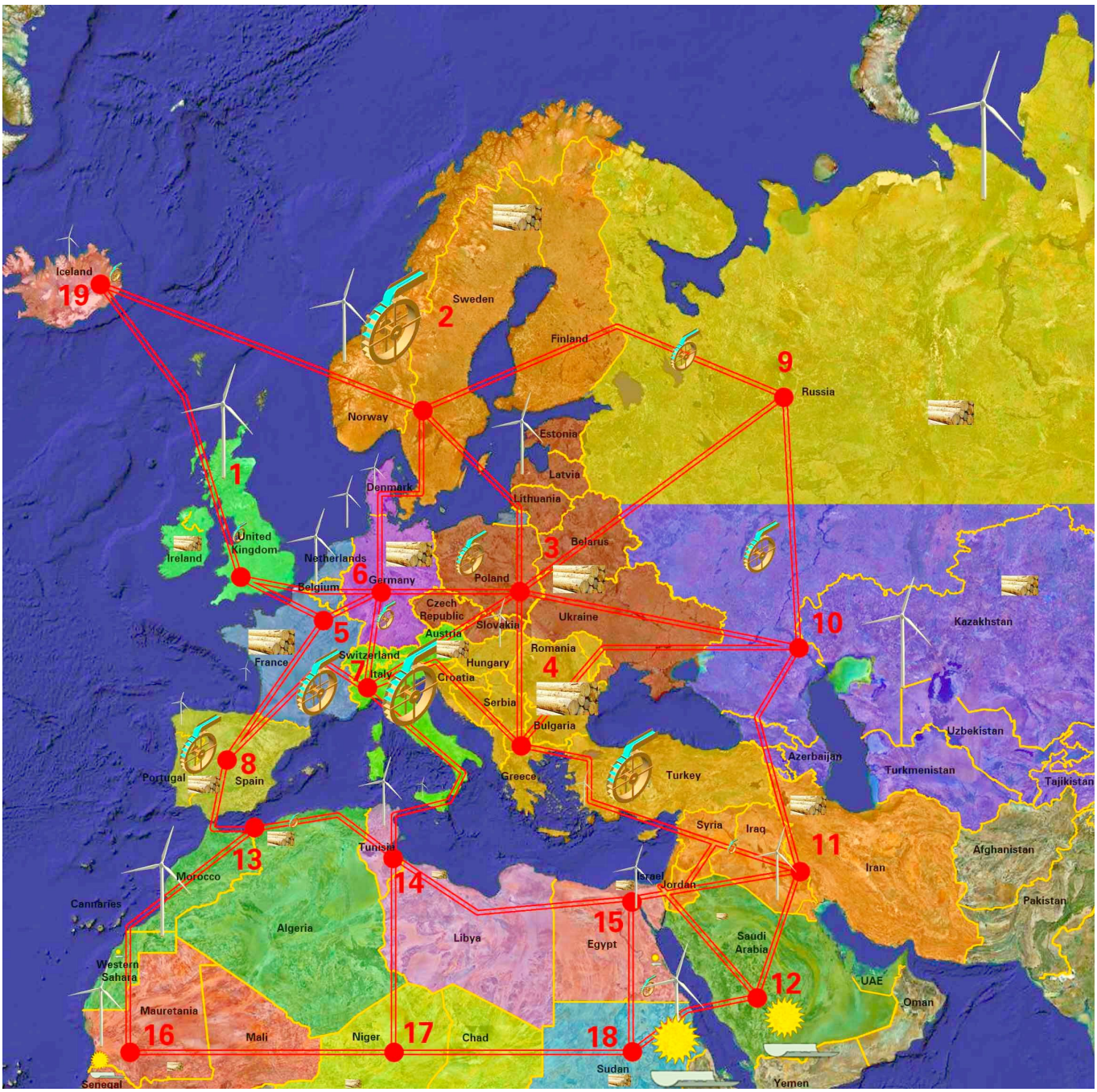
A possible layout of the European part of the Intrenex grid

(Please note that there exist numbered nodes that can operate independently)



(image by Dr. G. Czisch)

Legend:

Wind turbine	: possible location for wind energy
Sun	: possible location for solar energy
Water Wheel	: possible location for hydro-power
Wood	: possible location for biomass

Icon Size resembles location profitability.

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Recommended reading:

A comprehensive two-part interview with Dr. G. Czisch about energy policy in Germany, Europe and beyond can be found here:

http://www.intrenex.com/?page_id=687

The Link to this document in electronic form is:

http://www.intrenex.com/download/es2017.pdf

Vienna, 10.10.2017

Dipl.-Ing. (FH) Marc Muncke