Energy Systems in Transition - Economic, Policy and Social Challenges

The 'Energiewende' is in full swing fuelled by rapidly advancing technology and a change in mindset leading to policies unleashing the full potential of renewable energy (RE). While the technical aspect is a very straight forward one – product innovation and manufacturing cost reductions are implemented at a record pace – public awareness, acceptance and unfavourable policies create barriers impeding progress.

In this context, 30 young people studying related domains (Engineering, Management, Law, Social sciences) in universities from all over Europe congressed to discuss and share with experts in these fields and propose strategies.

The ECE

Institutions and Experts

A major part of the school was lecture based at ETH Zürich and Hochschule St. Gallen. A big focus was set on how technological disruption and policies affect the implementation of renewable energy throughout lessons given by experts such as Volker Hoffmann and Rolf Wüstenhagen, to name but a few. At the University of Lucerne we were introduced to legal challenges of the transition and how the implied risk affects the pricing.

Technical aspects such as construction and operation of these systems were shown and discussed at the highest weight dam in the world Grand-Dixence, the Energy-region Goms with a wood-pellet central district heating, solar-thermal reactors the Paul-Scherer Institute, wind parks in the tourism-dependent canton of Valais and at a waste incineration plant in St. Gallen. Learning from the

respective engineers or experts on-site set the emphasis not just on the technology itself but also the current operation problems, safety implications, growth challenges and put its size into context.

Topics more related to psychology such as negotiation and behavioural studies gave fantastic insights in what drives humans' decisions and complemented the core topics. Dr. Roth's public lecture about 'The Brain and the Energy Turnaround' and Dr. Ambühl's workshop about 'Negotiation Engineering' touched on sometimes overlooked aspects of the transition.

Figure 1 The chapel bridge in Lucerne

Life at the ECE in Switzerland

Summer in Switzerland is unexpectedly hot. Sheltered from climate-balancing oceans, heat accumulates far inland bringing glaring sunshine. We did our best keeping a cool head by spending free time at lake Zurich in the shades of willows. Performing artists presented their skills at a temporary art festival at the beach. Dancers, singers and jugglers put on an amazing show every night, spicing up the atmosphere. Other forms of entertainment came in forms of sports, sightseeing and a bold, omnipresent, often meme-based humour.

Obviously, one cannot get past Switzerland's famous delicacies. An extensive tour through Maison Cailler, the country's oldest chocolate manufacture, was followed by copious amounts of cheese over pasta at the Fromagerie d'Alpage. Self-organised BBQs allowed us to get as close to nature as possible, utilising the public grilling spots at lake Zurich and on the hills of St. Gallen. Sausage, steak and salad while watching the sun set, gave the ultimate summer kick. But also on campus, no one had to compromise on quality not quantity as the canteens of ETHZ and HSG served the best dishes a student could wish for.

Figure 2 St. Gallen as seen from the Freudenberg

To burn all these calories, we had to cover a few miles extra. An extensive hike in the Wallis region led us up to the glaciers from where we could enjoy the view of Mont Blanc massif. Creamy turquois lakes fed the gigantic dam of Grand-Dixence. The Ütli mountain overlooking Zürich was less of a track, but stunning nevertheless and gave a good overview of the area. Running up, down and across power stations, dams, wind parks and universities did their part too in helping to reach a daily exercise goal.

Figure 3 Hiking at Grand-Dixence

Students

The friendly and diverse bunch was made up of keen students from all over Europe studying a range of subjects, from engineering to economics, full of ideas and ready to innovate and accelerate the energy industry. This attitude lead to a lively exchange of ideas and opinions about technical or socio-economic aspects of the issue at hand but also a strong cultural exchange.

This exchange formed the basis for a solid future network of enthusiastic individuals setting foot in the energy industry. In a pitching session, we already critically evaluated some ideas of the more entrepreneurial-minded fellows. This ranged from a moss-based facade to a database comprising India's farming efforts for optimisation purposes.

Everybody came with the future in mind, but we do live, chat and celebrate in the present. Every day was accompanied by lots of laughter, sport and conversation over a glass of wine. Professional opportunities aside, we all left as a group of friends and so far, have met up multiple times and continue to share ideas which inspire us through social medias.

This is only emphasised by the alumni association which was again strongly represented this year. Then students now returning as young professionals shared tips and experiences and could connect to the newest generation who will continue the tradition.

Issues and Learning Points

The Public – Awareness and Acceptance

In a democracy, the people decide; in capitalism, the consumer decides. The decisions you and I take affect our policy makers and set demand for products. To be able to make a conscious, well informed decision, a certain awareness has to be established. Awareness about the effects of climate

change, pollution and rising sea levels drive people to lobby their governments and pick suppliers of sustainable energy as their utility providers.

And the effects can already be seen. Big utility companies such as Centrica, RWE/Innogy or E.On/Uniper started major restructuring processes. Products of companies like Tesla are attractive to customers even though the technology has not matured yet. Governments push for exiting coal and nuclear and agree together on clear goals, such as during the COP21.

The "not-in-my-backyard" mindset is still hindering progress, especially with installing wind turbines. But with the big white pillars around for 50 years in some areas, people get used to them and even find them attractive after some time.

The Governments – Politics and Policies

Governments representing the whole nation have powerful instruments to guide the energy industry. On the one hand they can directly invest into technologies and implement them into their existing infrastructure. On the other hand, they can affect the private sector with incentives such as carbon penalties, feed-in-tariffs or tax incentives.

The government is obviously trying to ensure a certain degree of energy security and enact their strategy on foreign policy as oil, gas and coal reserves but also knowledge capital and production capacity is held by other nations. The resulting actions however often go against the public opinion or are misguided due to corruption. Political tension or public disobedience are not uncommon.

Short-term thinking or unawareness of voters can also, however, lead to regressive political actions. Labour intensive fossil based sources are often favoured as they provide jobs and resources can be exported lucratively. Also, factors leading to Trump's success whose future policies are expected to be positive for the coal and oil industry.

The Private Sector – Business and Risk

A big driver for adaption of renewable energy is business and risk and return have to be in balance to attract any kind of investment from the private sector. On paper it looks simple: pick the investment with the lowest risk to return ratio and with increasing tax burden on carbon or advances in efficiency, REs have placed themselves at the top of the playing field – and that a while ago. But how come the investments from private companies have been so sparse?

Bounded rationality such as Status Quo bias, affective influence or peer effects, argues Prof. Wüstenhagen, holding the chair of Management of Renewable Energy at the renowned business school of St. Gallen. These elements lead to a path dependence in which decisions made are limited by decisions made in the past – and top CEOs from Shell to RWE seem to be bound by them.

$$\text{Choice} = \frac{\text{Risk}}{\text{Return}} + \varepsilon$$

Equation 1: Other factors (ε) have much more effect on decision making than normally thought

That the RE technologies are able to compete is no secret, underlined by the rising costs of nuclear and fossil fuels, as safety implications linked to drilling in extreme conditions or nuclear energy are costly.

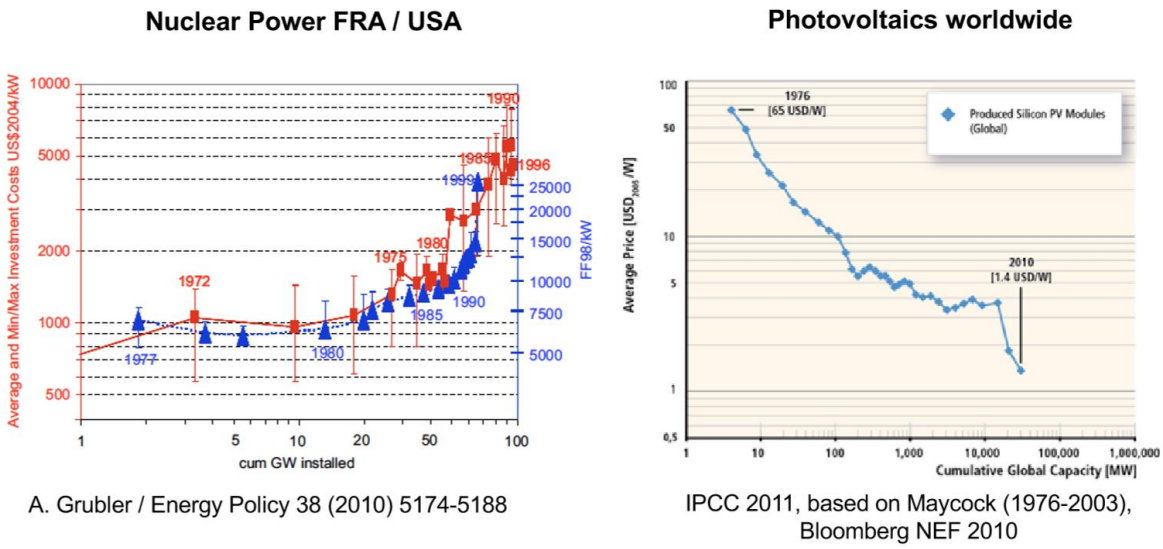

Figure 4 Learning curves for nuclear and solar PV

The future of renewable energy is bright, accessible and cheap!

Outcome of the ECE

During these three weeks, we were able to acquire the interdisciplinary approach needed to bring effective progresses in the energy domain in a near future. There is absolutely no doubt that this experience will serve use in our future careers in energy related industries in which we will face unprecedented environmental challenges that humankind are facing nowadays. Within this unique and stimulating environment, we had a unique chance to learn and share proficiencies with highly qualified researches and scientists. Last but not least, this summer school left us each with 29 new colleagues and dear friends which brings us hope in the idea that the world is filled with young people ready to take part in the tremendous task that represents the Energy Transition.