It's time to remove regulatory and legal barriers to energy storage solutions

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We have been discussing the same thing for many years now: all the energy storage solutions we need to implement the energy transition are there. Only the elimination of old energy economic regulations that stand in the way of energy storage is still missing. We need to adopt appropriate legal and regulatory frameworks to get energy storage solutions into business. This article will consider these long known requirements from a slightly different angle.

In Germany, the coal exit commission, or commission on "Growth, structural change and employment" has just submitted its final report. There is no politically implemented decision, but at least this report shows a viable way out of what we want and need to get rid of (electricity generation by coal). This consensus has hardly evoked any emotions in me. On the one hand, it represents a way to end coal-fired generation which has even started relatively quickly at a low level, well ahead of the previously agreed 2045 date. On the other hand, the exit path is also not very ambitious; especially if one considers studies like those of the IAEW [Moser, Albert: Bewertung der Netzsicherheit bei einem „Fuel Switch" von Braunkohle zu Erdgas in Deutschland in 2020], showing that a lignite withdrawal would be possible by 2020 without endangering grid stability. But the compromise is probably what is currently possible in the societal controversy in Germany between insistence and departure.

Energy played only a marginal role during the last Bundestag election campaign. The issue of energy has returned with the work of the coal commission to the centre of society. Now as we have at least a way out, it is even more important to get the debate back on track how we will achieve what we want: the success of the Energiewende.

For this, we finally need again a serious expansion of renewable generation capacity, which has come to a bad halt since 2012. And secondly, we need energy storage, and not just in laboratories and in pilot projects. We need energy storage as an important pillar in the energy industry.

„We have no energy storage"

While the coal commission held meetings for months, the topic of the energy transition and coal withdrawal came back into the everyday discussion. The newspapers were full of reports on the subject of energy, the comment columns were filled with glowing coal indispensability statements and immediate coal withdrawal statements, letters to the editor filled – at least here in the Rhineland – whole pages. On a regular basis, energy and coal withdrawal were topics of talk shows such as "Anne Will", "Maybrit Illner" or "Maischberger".

Hardly any of these formats worked without phrases like "we have no energy storage", or "as long as we are not able to store energy…". Never-ending statements of the non-existence of energy storage, certainly often against better knowledge, pointed out that such an industrialized country as Germany will not be safe to be provided with power.

In mid-March 2019, as every year, the energy storage community will meet at the ENERGY STORAGE EUROPE trade fair in Düsseldorf. More than 160 exhibitors will present their – supposedly non-existent energy storage solutions. Parallel to this, the participants of the INTERNATIONAL RENEWABLE ENERGY STORAGE Conference IRES will discuss their scientific results for three days.

We have energy storages – but they are not allowed to play

The readers of SOLARE AGE are, of course, aware that we have energy storage solutions – and plenty of it [Sterner M., Stadler I. (Hrsg.): Energiespeicher – Bedarf, Technologien, Integration]. But why don't these energy stores bear fruit?

All the energy laws and regulations of the energy industry are still dating back to a time when energy storage played hardly, at least a minor role. Because energy storage systems do not have their own place in the energy industry, various laws affect their application: the German Energy Industry Act (EnWG), the Renewable Energy Sources Act (EEG) and the Combined Heat and Power Act (KWKG). In addition, regulations of public law, provisions of the Federal Immission Control Act (BImSchG), the Building Code (BauGB), the building codes of the federal states, the Federal Nature Conservation Act (BNatSchG), the Spatial Planning Act (ROG), the Water Resources Act (WHG), the civil law (BGB) and the German Commercial Code (HGB) [Thomas, Henning: Rechtliche Rahmenbedingungen für Speicher in Deutschland. In: Energiespeicher - Bedarf, Technologien, Integration].

It should not be denied that efforts have been made in recent years to eliminate individual, particularly absurd barriers to energy storage, which has brought improvements for a few storage technologies and storage applications. In general, however, little has been done to advance the role of energy storage as part of the energy economy. It still does not have its own place in the energy industry. Energy storage is not included, but more or less tolerated.

When will the entry into sector coupling be? Or why it will not come like that!

The concept of sector coupling is omnipresent. It is to be found in any discussion on the energy transition. First of all, we will briefly explain what the term sector coupling means. The historically grown, near-to-separate energy systems for the supply of electricity, the supply of heat and the provision of mobility will in future be growing together and merging into a single system.

Only a few advantages of this sector coupling should be mentioned here again or justify their necessity, moreover, again refer to [2], see also Figure 1:

- Power-to-power storage still has low implemented capacity today and is expensive compared to energy storage solutions in other energy sectors.
- In the natural gas sector, huge energy storage capacities already exist today, which can be harnessed via power-to-gas processes. Gas storage is inexpensive (the conversion technologies itself are still expensive and lossy).
- Energy storage systems for storing heat and cold are very cost-effective and power-to-heat processes can be used to shift storage tasks into this sector.
- At least individual mobility has never been grid-connected, and to decarbonise this sector, electricity storage (or possibly the Power-to-Liquid or Power-to-Gas paths) is necessary. Not for the purpose of power storage, but to provide operating power. But even here, storage tasks can be postponed from the electricity sector.

Sector coupling is tirelessly demanded, the necessary technologies are available, so why it is not

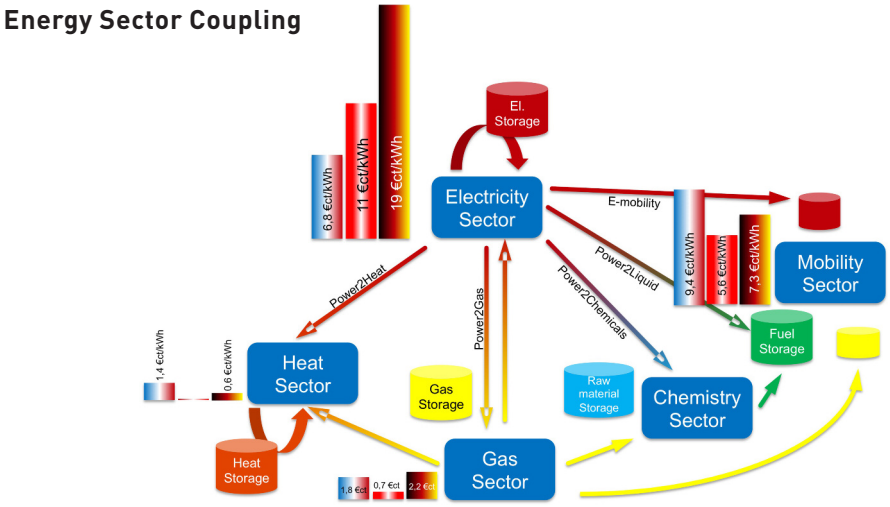

Figure 1

implemented? To answer this question, one could go deep into the above-mentioned legal texts, but that is not necessary. At this point, we only demonstrate the nature of energy taxation in order to see that sector coupling without the implementation of new policies, will not occur, regardless of how efficient and cheap the technology solutions could be.

In this regard, we consider the right-hand bars in Figure 1, which are shown next to the sectors. These represent the tax burden on energy sources in the individual sectors in Germany. In the heating sector, the tax is less than one cent per kilowatt hour (e.g. heating oil). For natural gas, it is already more than two cents per kilowatt hour. If we use – sometimes even the same – fuels in mobility, taxes and duties are many times higher, at over seven cents per kilowatt hour. In the electricity sector, the presentation of taxes and charges literally goes beyond the scope. Even without grid charges, taxes and duties are not much less than 20 cents per kilowatt hour.

In disparate sector operation, these differences are not tragic, and any amount of taxes and duties can be justified by historical needs and intentions. However, these extremely different levels of taxation mean that there may never be a market-driven sectoral coupling and, if pathways for sector interconnection opened up, this will lead to the implementation of energy storage technologies that cannot lead to a most economically attractive solution. As we talk today mainly about the use of electricity from sun and wind in other sectors, if that e.g. cannot be transmitted due to grid bottlenecks and must be shut down, we consider here only briefly the path from the electricity sector to other sectors, i.e. Power-to-X. Even if we reduce the cost of power generation to zero, and even put network charges to zero, the tax burden in the electricity sector is so high that it has no chance of being used in other and much lower taxed sectors.

This one example makes it clear that there is no lack of energy storage solutions, but of necessary political decisions. If we want sector coupling for the energy transition, there is no way around a change of the taxation system. Solutions would either be

1. a uniform tax or levy on all end energy, or
2. a tax that reflects emissions of greenhouse gases from end energy.

Only in this case a coupling of energy sectors will develop and different energy storage solutions can

compete fairly. The fact that the imbalance between taxes and levies is not a purely German problem – even though it is particularly large here – is illustrated by the other two bars in Figure 1. The middle bars represent taxes in Austria, the left bars the taxes in France.

To conclude this consideration, I would like to compare the situation to my sport idols from the 1980s: There was the dominating sprint star Carl Lewis, the 110 m hurdler Colin Jackson and the pole vaulter Serhij Bubka. Who was the best athlete? This could be ascertained at the very most, by having a contest with FAIR and EQUAL conditions. A competition in which the former sprints along a flat track (with minimal heat taxes), the second gets hurdles in the way (gasoline, diesel) and the latter needs to jump over a 6 meter high obstacle with a bar almost five meters long in his hands (electricity), you can hardly describe as fair and equal.

Unbundling: making banapples and pearanas from bananas

When "unbundling" was introduced in 1998 to implement the EC Directive on the internal energy market, special regulations for energy storage were still far from the order of the day. The term "unbundling" is understood to mean the legal requirements for a separation of grid operation and distribution in energy supply companies. The goal of this separation was to get more competition in the energy market.

Today, the unbundling and division of the energy world into production and distribution is one of the barriers to the market entry of energy storage systems. An energy storage can be active both in the energy market and e.g. doing its refinance via arbitrage transactions. An energy storage device can also take over tasks in grid operation. However, due to the unbundling, a storage operator is not allowed to take on tasks in both areas, even if this would be technically possible and would be in the nature of implementing the energy transition. This obstacle has been discussed for years without a solution. Man-made regulation is considered as God-given. The regulator, however, gives generously to storage operators: while there may be no storage, the storage may disguise itself either as a generator of electricity or as a network element. It's like an EU regulation would only allow apples and pears as a fruit. The newly introduced fruit "banana" must not exist. What is tolerated, however, are

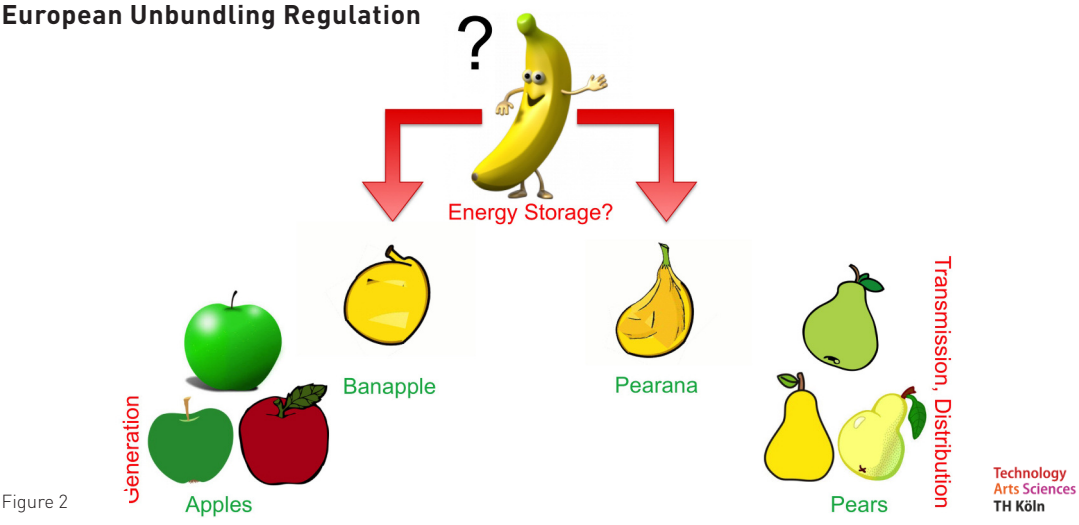

Figure 2

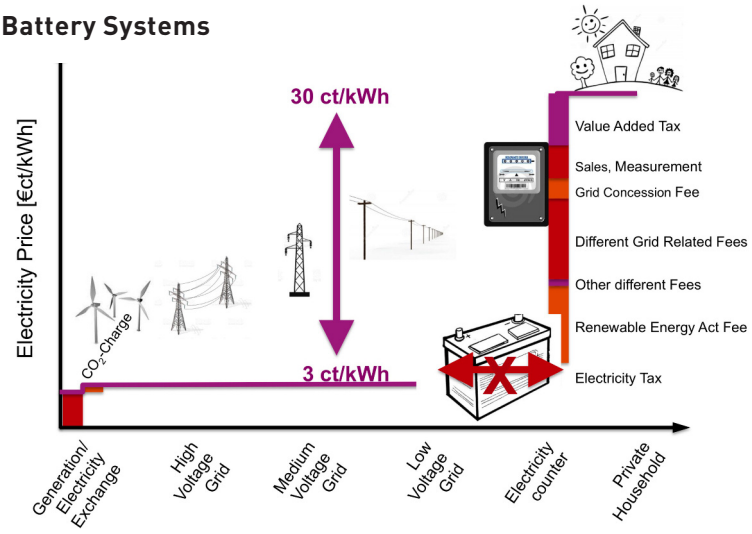

Figure 3

camouflage as „banapples“ or “pearanas” (see Figure 2).

For the energy transition, we need a new pillar in the energy industry: energy storage.

Wrong regulatory incentives do not lead to the best macroeconomic energy system

Finally, it should be shown that regulatory frameworks can also drive energy storage solutions. This is to be supported, even if such an impulse in turn leads to competitive distortions with regard to alternative storage solutions in other sectors and thus ultimately to an energy system with energy storage systems, which may be far from optimal economics.

The example of the electricity price composition and battery storage in combination with photovoltaic systems is intended to clarify this. By the end of 2017, more than 80,000 PV storage had been installed in Germany [Sauer, Dirk Uwe, et. al.: Wissenschaftliches Mess- und Evaluierungsprogramm Solarstromspeicher 2.0, Jahresbericht 2018]. This is finally a success story for energy storage.

Why PV battery storage systems are so successful, will be explained with reference to Figure 3. The figure shows the composition of the electricity price and where the individual components are produced. In electricity generation (and the trading of electricity on the stock market) electricity is still very cheap, here in addition to the price negotiated on the stock market only a small carbon tax is added. In the further course of the transmission network and the distribution networks further costs occur, but costs are not charged at the point. Only when the electricity passes the domestic electricity meter, this experiences an explosive increase in value. In addition to the upstream network fees, all taxes and duties are added at the place of the consumer counter. As a result, there is a jump in value of well over 20 eurocents at the location of the electricity meter.

If there is a PV system on the other side of the electricity meter, it is of great interest for the owner to keep the self-generated electricity behind the meter. If the electricity is fed into the public grid, it will suffer a large loss of value (in reality, not as large as shown in the figure, but at least to the level of the EEG feed-in tariff). With the help of a battery storage, it is possible to increase the share of solar power that is used by itself and thus avoids

having small payments for electricity fed into the grid and, at the same time, having to pay high electricity prices for grid connected electricity delivery at other times. The jump in the value of electricity at the electricity meter thus creates an incentive to install a PV system together with battery storage.

For the market introduction of battery storage this is a stroke of luck. How dependent the business model is on regulation, however, is shown by a simple thought experiment: assumed that government revenues from taxes and charges as well as grid charges should be maintained at the same level. However, it would be decided to introduce some kind of "withholding tax" and all the costs would be added on production or at place of the stock exchange. Then the price of electricity would not change, but the price jump at the domestic counter would have disappeared and with this the incentive to build a home battery storage together with the photovoltaic system.

This concluding example should not be a plea against battery storage in combination with photovoltaic systems. It is good that we come at least in this area to an introduction of energy storage. But finally, it should be emphasized once again:

Barriers to energy storage need to be removed and we need a legal and regulatory framework that allows for fair competition between energy storage devices in all energy sectors. Technology is ready to be implemented. What is still absent is the political support and the required regulatory framework.

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