European Commission (https://ec.europa.eu/info/index_en)

Feedback from:

Bioenergia ry - the Bioenergy Association of Finland

Feedback reference
F524249

Submitted on
08 June 2020

Submitted by
The Bioenergy Association of Finland

User type
Business association

Organisation
Bioenergia ry - the Bioenergy Association of Finland

Organisation size
Micro (1 to 9 employees)

Transparency register number
174042620514-51 (http://ec.europa.eu/transparencyregister/public/consultation/displaylobbyist.do?id=174042620514-51&locale=en)

Country of origin
Finland

Initiative
Strategy for smart sector integration (/info/law/better-regulation/have-your-say/initiatives/12383-Strategy-for-smart-sector-integration)

Electrification is already ongoing. Replacement of oil, natural gas and coal with clean electricity is a welcome development. It is an ambitious goal to achieve. At the same time two other aspects should be considered in the equation: the total efficiency and carbon balance of the desired energy system and the embedded costs.

We would caution against replacing biomass-based fuels with clean electricity without looking carefully at the overall context. Many uses of biomass fuels are supply-constrained and electrification can provide the needed additional capacity to replace fossil fuels in the energy system. In other cases, a certain amount of biomass fuels is produced to the market every year since they are residues and by-products from other activities, such as agriculture, forest industry and forest management. Replacing residues and by-products in the energy system is not an efficient means to cut GHG emissions unless there are new innovative uses for them. Residues left in nature are emission sources and over time remove short-term climate benefits.

Bioenergy could contribute to flexibility and sector integration in several ways; maintaining synchronous inertia, ramping up and down when intermittent RES varies, storing energy in different forms in longer cycles, converting biomass to gaseous and liquid transport fuels specially for heavy transport. It is very essential to include all sectors (including transportation and heating/cooling) into sector integration discussions and the policy framework. Some biomass heating plants can be operated with rapid (minutes) ramp-up and ramp-down cycles in scales up to tens of MW. These can complement energy storages and electrification of heating.

Bio-CHP-plants and biorefineries should be regarded as fundamental parts of the European energy systems. They can adjust the output of electricity and heat using more energy inputs for the production on low demand. In a high market demand they can delay or cut down some production. Plants can change their operation pattern during different seasons. For exampIe, the plants can use more energy to dry biomass to produce pellets. Within refineries, larger energy plants or industrial areas it is possible to balance excess electricity supply in various processes by storages, producing hydrogen etc. Bio-oil production can also be one new flexibility component of a CHP-plant.
Biomass gasification produces synthetic gas which can have a high hydrogen content, too. Syngas can also be used as feedstock to produce several chemical components, such as ammonia, alcohols and waxes.

A new piece in the energy system puzzle is the capture of CO_2. Carbon dioxide capture and utilisation (CCU) and/or storage (CCS) may be combined to serve balancing. When there is excess electricity and hydrogen may thus be produced, the captured CO_2 can be used to produce synthetic gaseous and liquid biofuels with the hydrogen. In a low supply situation, the CO_2 can be transported to the storage supply chain instead.

Production of carbon-negative biochar in smaller and semi-large facilities has similar seasonal, monthly and even daily flexibility characteristics, when condensates and gases from the production can either be used in the boiler, refined to be used as a transportation fuel or stored depending on the situation.

Sector coupling can create undesired effects in the system. Producing a high share of hydrogen with reformation from natural gas can have substantial carbon footprint and the whole natural gas infrastructure gets incentives. If the production is based on electrolysis, the total electric efficiency of the energy system can be less than 40 – 50 % due to energy losses.

It is advisable to critically compare different types of energy storages and look at the total capacity required and the unit cost of capacity. Storing to large water tanks and district heating networks can offer a very competitive solution over electric batteries and electrolysis pathway.

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Responses to the Questions

1. *What would be the main features of a truly integrated energy system to enable a climate neutral future? Where do you see benefits or synergies? Where do you see the biggest energy efficiency and cost-efficiency potential through system integration?*

Energy system that reaps benefits from both demand and supply side flexibility and offers a great variety of energy use and production for companies, farmers and private people. That requires open information about the energy needs and price formation. Truly integrated system links heating & cooling, electricity and transportation sectors in a way that leaves market actors with widest possible flexibility. There must be clear and consistent political targets, which guide the operators' decisions without political tinkering and micromanagement.

Negative emission technologies, such as bioenergy carbon capture and storage (BECCS), biochar and direct air capture and storage (DACCS), should be part of the toolbox.

2. *What are the main barriers to energy system integration that would require to be addressed in your view?*

Lack of a political framework for consistent CO2 pricing that goes beyond the sector boundaries and provides incentives for negative emissions as well.

3. *More specifically:*

- *How could electricity drive increased decarbonisation in other sectors? In which other sectors do you see a key role for electricity use? What role should electrification play in the integrated energy system?*

Electrification as such should not be the main driver but CO2-intensity of the energy system. Electricity can and will be widely used in every sector, but it should not be approached as the only energy carrier in the future energy system. Economic activities, such as the pulp and paper industry and agriculture, provide high volumes of renewable sidestreams on a continuous basis that cannot always be utilised as raw material in high-value-added products. It would be very inefficient climate policy to aim at replacing these with electricity unless high-value-added material use is developed.

- *What role should renewable gases play in the integrated energy system?*

A significant role, on every sector. In transportation gases will play a major role in heavy and semi-heavy vehicles. There are also clear synergies in the gas system with negative emission technologies.

- *What measures should be taken to promote decarbonised gases?*

Ambitious targets for renewable and synthetic non-fossil gases of gas market need to be set; either as injected into the grids or off-grid.

- *What role should hydrogen play and how its development and deployment could be supported by the EU?*

Hydrogen can be new important energy carrier. It is often associated in combination with intermittent renewable energy but may also be produced in significant amounts on pyrolysis of biomass and on biogas production. Biomethane and synthetic methane has clear synergies with hydrogen on production, logistics and use.

- *How could circular economy and the use of waste heat and other waste resources play a greater role in the integrated energy system? What concrete actions would you suggest to achieve this?*

The potential of waste heat use is often limited by the location. Waste heat may best be used through industrial heating pumps and district heating (if applicable). There is still substantial amounts of waste heat to be utilised and this utilisation in industry may be in synergy with the production of new products or acceleration of new products. For instance, utilisation can be combined with the capture of CO2 if policy framework is favourable.

- *How can energy markets contribute to a more integrated energy system?*

Clear and consistent political targets are needed as well as large enough regional and cross-border energy markets. The Nordic-Baltic electricity market area is a good example to start with.

- *How can cost-efficient use and development of energy infrastructure and digitalisation enable an integration of the energy system?*

1. *Are there any best practices or concrete projects for an integrated energy system you would like to highlight?*

The Joensuu integrated CHP-bio-oil plant (Joensuu, Finland):
https://www.biopad.eu/wp-content/uploads/Case-study-of-Fortum-in-Joensuu.pdf

QPower's patented biomethanation process converts carbon dioxide (CO_2) and hydrogen (H_2) into methane (CH_4) with an unmatched process efficiency of 83 %. Feedstocks into the process are CO_2 and H_2, meaning the raw material base is practically unlimited. Difficult-to-utilize organic materials and sidestreams can be utilised:
https://www.qpower.fi/technology/

Helen city-refinery (Vuosaari, Finland): https://www.helen.fi/en/news/2019/city-refinery-vuosaari

Nordfuel biorefinery producing ethanol, biogas, electricity and heat from wood (Haapavesi, Finland): https://nordfuel.fi/en/front-page/

Carbofex biochar plant integrated in the District Heating network (Tampere, Finland):
https://www.carbofex.fi/biochar

Värtan CHP plant piloting BECCS, Stockholm, Sweden:
https://www.stockholmexergi.se/nyheter/delfinansiering-for-koldioxidinfangning-inom-rackhall-for-stockholm-exergi/

2. *What policy actions and legislative measures could the Commission take to foster an integration of the energy system?*

It is important that the Commission introduces an incentive framework for negative emissions in Europe. Likewise it is important to include utilisation, transfer and storage of CO_2 in the integration of the energy system.

In this context, it would be extremely useful that the Commission would clarify its thinking and intentions regarding such a framework (planned for 2023 according to the Circular Economy strategy) and the foreseen links to the enhanced 2030 energy and climate package already this year, when the 2030 climate plan is presented.