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EDITORIAL

Contributing to sustainability: addressing the core problems

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Contribution of various activities and processes to sustainability of human development is difficult to quantify precisely. Every process produces a certain combination of environmental impacts, often expressed as footprints. The most widely known such indicators are the greenhouse gas footprint (also known as carbon footprint) and the water footprint, and researchers widen the footprints family continually.

Understanding properly the impacts and footprints of various processes is an important and necessary activity. The apparent intrinsic links among these footprints and the used resources are complicated. Strategic evaluation of the resources and footprints of industrial and business processes can be performed taking energy consumption as a basis.

An interesting indicator based on energy consumption nationwide, on the example of the USA, can be found in the regular compilation of resource consumption and losses by the Lawrence Livermore National Laboratory (Energy Flow Charts: Charting the Complex Relationships among Energy, Water, and Carbon, <https://flowcharts.llnl.gov/>, accessed 03/07/2018). The data compilation is published regularly in the form of energy flow charts. The latest edition for the year 2017 (Fig. 1) indicates above 65% energy losses and only a little above 31% useful energy delivered for services. The sourced primary energy is also surveyed, and the statistic shows about 11% renewables (including biomass, wind, geothermal, hydro), as well as about 9% supply from nuclear power, and the rest being supplied by fossil fuels.

Taking that structure of the energy supplies, useful energy services and energy losses as a representative indicator of the performance of the economy, allows identifying the achievements and remaining key issues for sustainability. A positive achievement is the 11% share of renewables in the primary energy mix. This certainly helps the US economy in achieving lower environmental impact. However, the footprint reductions are not automatic. The use of renewables is still associated with certain environmental footprints—including greenhouse gases, water and nitrogen footprints, which need further research for allowing sufficient quantification. Analysing the outputs of the economy, nearly 2/3 of the taken primary energy was lost and only 1/3 has reached the final users as services.

It can be concluded then, that although the goal of increasing the supply of energy from renewable sources is an important component in ensuring sustainable development, the structure of the outputs indicates a still very low efficiency of the economy for utilising the overall pool of primary energy supply, making the overall task of supplying renewable energy and emission reduction more difficult. As a result, the core of the energy problems—the low efficiency, has not been resolved yet. Directing active efforts towards improvement of the energy efficiency of industrial and business processes is expected to be necessary and important. In this regard, the ability to improve the thermal efficiency is limited by the Second Law of Thermodynamics (i.e. the Carnot efficiency). Solar photovoltaics and wind to electricity, being not thermally related, would not be so limited and may offer additional opportunities.

The current issue of Clean Technologies and Environmental Policy (CTEP) offers the readers research results on topics related to wind power and sustainability at regional level, production of biofuels, off-gas cleaning, carbon capture and sequestration (CCS), process pollution assessment—including on LCA basis, policy development for buildings in China, adaptation to climate change, water

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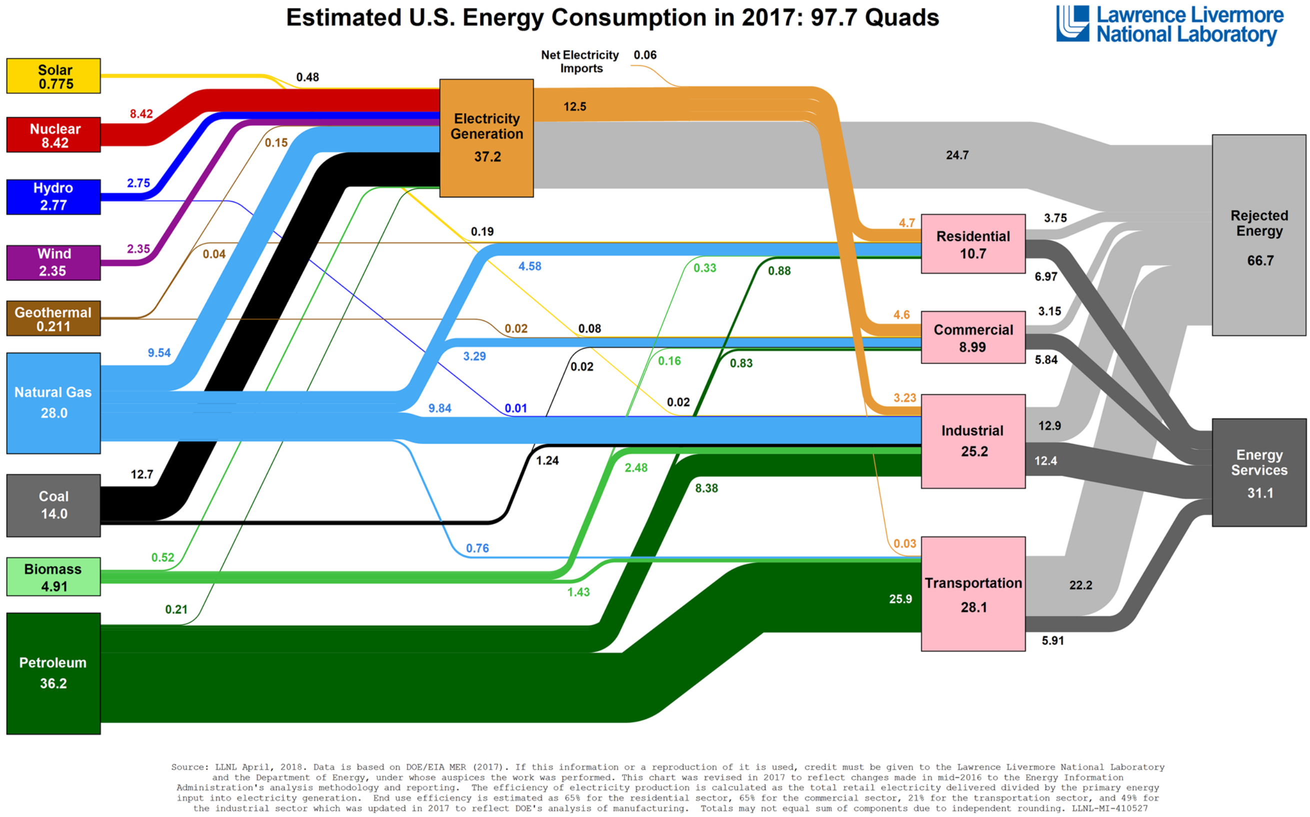

Fig. 1 The 2017 energy flow chart released by Lawrence Livermore National Laboratory

supply and distribution, waste minimisation and waste as a resource, materials and energy efficiency.

These topics provide a good spread over key knowledge areas, related to sustainability, describing the serious research efforts and interesting results. The publication of works dedicated to energy and material efficiency is a good step, complemented by waste reduction, using waste as a resource. However, for reducing the burden on the resource supply and emission clean up, more intensive research should be performed on improving the utilisation efficiency of materials and energy in the economy. For any additional percentage points of improved energy or water demand, at least equivalent percentage points on the fresh water or primary energy supply should be expected. If the nexuses between water, energy and materials are used as synergy mechanisms, then to achieve better results may be possible. Addressing the core system problems using more vigour and creativity is a key component in the solution toolset, leading to sustainable development.