The Electrified Future: A key Role for Plasma Chemistry?

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Abstract: The next 20 years will mark a fundamental shift in the way energy is generated, stored, delivered, valued and purchased. Renewable energy generation by means of photovoltaics or wind, will form a significant part of the energy mix. In view of the intermittency as well as the temporal variation and the regional spread of this energy source, this will lead to significant inbalance in the electricity grid. Only by diverting renewable electricity into other parts of the energy system powered by oil, gas, coal or chemicals, can this limit be overcome. Therefore a scalable renewable electricity driven chemistry will be a *non-regret key enabling technology for the future.*

The chemical building blocks nitrogen and carbon dioxide, next to water, will be important ingredients in a renewable energy driven society to provide high energy density fuels and chemicals. Yet both molecules provide challenges and are difficult to activate by conventional chemical processes for further processing. Alternative non-fossil routes for e.g. the Haber-Bosch process for ammonia production, but based on renewable energy input, are urgently required. Moreover, when fossil fuels resources dry up, ways of carbon dioxide re-use to provide platform molecules will be needed. In this presentation plasma chemistry, positioned as a key enabling technology to convert renewable electricity into fuels and chemical feedstock, will be discussed. In particular an overview about the latest developments using non-thermal/non-equilibrium pathways, the role of charge, internal excitation, nonequilibrium phenomena, etc., key in plasma chemical pathways, will be highlighted.

Keywords: Non-thermal chemistry, plasma chemistry, electricity driven chemistry.