Photovoltaics merging with the active integrated grid: Grid integration white paper of the EU PV technology platform, working group on grid integration.

How much is too much? Asking this question with respects to photovoltaics would have seemed absurd just a few years ago. Yet from Japan [1] to Europe to the Americas, loud voices are claiming that Photovoltaics (PV) is reaching excessive levels on the grids or, at least, growing at excessive rates. Economic as well as technical issues are put forward. Indeed, PV power generation has moved in just a decade from a curiosity to a significant part of power systems around the world. Global investment in new PV generation capacity was US$ 173.6 billion in 2013, nearly two thirds of the gross investment in fossil-fuel power generation (US$ 270 billion) [2]. Solar PV is estimated to have provided 0.7% of the global electricity demand in 2013 [3]. The central point in Levelised Cost of Electricity (LCoE) at the beginning of 2014 was about US$ 150 per MWh; there is now a significant overlap between the LCOE ranges of PV electricity and conventional power generation (natural gas combined-cycle turbines, coal, nuclear) [2], which means that solar PV can be cost-competitive at the point of generation in some regions. As PV is essentially a distributed energy resource, it clashes with the centralised architecture of existing grids. Together with other renewable energy sources, it challenges the business models of incumbents in the power sector, be they network operators or power generators. Some of these incumbents may be tempted to exaggerate the negative impact of PV, and minimise its benefits. Others have already taken radical steps to adapt to this new situation [4]. The benefits of PV generation in terms of environmental impact and energy security are well documented [5]. This is why the European PV Technology Platform aims at enabling the massive deployment of photovoltaics into the power system. It acknowledges the technical challenges that come with it. We believe that these challenges are best addressed through rational assessment of the situation and co-operation between the power and PV industries. With this paper we set to clarify the terms of this discussion: how is penetration of PV into power grids evaluated? What are the current levels? Which barriers may prevent increasing these levels? Which concepts have been put forward to open these barriers? Which benefits can PV systems provide for existing and new grids? Immediate recommendations are formulated in this paper; we also expect that further collaboration with the power sector will lead to more robust knowledge and to a power system with PV at its heart.

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