

Energetic communities for community energy: a review of key issues and trends shaping integrated community energy systems

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Abstract— Energy systems across the globe are going through a radical transformation as a result of technological and institutional changes, depletion of fossil fuel resources, and climate change. At the local level, increasing distributed energy resources requires that the centralized energy systems be re-organized. In this paper, the concept of Integrated community energy systems (ICESs) is presented as a modern development to re-organize local energy systems to integrate distributed energy resources and engage local communities. Local energy systems such as ICESs not only ensure self-provision of energy but also provide essential system services to the larger energy system. In this regard, a comparison of different energy system integration option is provided. We review the current energy trends and the associated technological, socio-economic, environmental and institutional issues shaping the development of ICESs. These systems can be applied to both developed and developing countries, however, their objectives, business models as well as composition differs. ICESs can be accepted by different actors such as local governments, communities, energy suppliers and system operators as an effective means to achieve sustainability and thereby will have significant roles in future energy systems.

Index Terms— Distributed energy resources; Local energy systems; Energy systems integration; Self-organized energy communities; Smart grids; Flexibility

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Citation:

, ; Koliou, E.; Friege, J.; Hakvoort, R.A. ; Herder, P. M.; "Energetic communities for community energy: a review of key issues and trends shaping integrated community energy systems", *Renewable & Sustainable Energy Reviews*, vol.56, pp.722-744. April, 2016.