On the crest of a wave: the geographic trajectory of wave's energy technology emergence and development.

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The socio-technical transitions literature has turned an increased attention to the role played, in development and diffusion of new sustainable technologies, by the established structures - technological, organisational and institutional - within which these technologies emerge (Bergek et al., 2015; Markard & Hoffman, 2016). However, there is still a limited understanding of the impact of the emerging technologies upon these contextual structures (Fontes et al, 2019). This is namely the case for the territorial impacts of these processes, despite the growing attention to the spatial dimensions of sustainability transitions (Hansen and Coenen, 2015; Boschma et al, 2017) and the contributions of the literature on regional industrial path development (Martin and Sunley, 2006; Trippl et al, 2017).

In this paper we address this question by examining the trajectory of emergence and development a new sustainable energy technology and investigating: (i) whether the activities conducted along that trajectory increasingly engage companies from established sectors with complementary competences (Markard & Hoffman, 2016), whose activities can be influenced and eventually transformed by their involvement with the new technology (Fontes et al, 2019); (ii) whether these processes are simultaneously territorially anchored and connected to more international innovation systems (Binz & Truffer, 2017), with potential impacts on regional diversification (Fornahl et al, 2012; Coenen et al, 2015).

For this purpose we analyse the process of emergence and development of a renewable energy technology – wave energy. The analysis draws on an exhaustive database of all wave energy research, development and demonstration projects supported by the European Union, from 1992 to 2019 (from CORDIS database), enabling an assessment of 25 years of technology geography evolution, including its very early stages. Social network analysis methods support the identification of the composition and structure of the networks formed along different periods, which are territorially localised with the support of GIS tools.

Wave energy is still in a pre-commercial stage. However, experimental activities, which require the construction and sea deployment and operation of conversion systems (from prototype to full scale), have been conducted from early stages, requiring complementary resources and competences present in existing industries. The technology development have also been characterised by the interplay between the activities conducted in transnational networks and the actors' territorial embeddedness (Fontes et al, 2016). The evidence of interaction with the industrial context and the multi-scalarity make this technology a relevant empirical setting.

This paper contributes to understand how the geographies of energy innovations are structured along the process of emergence and development of sustainable energy technologies, namely whether windows of opportunity are opened to the involvement of local/regional actors from established industries in the international technology development networks. This can create conditions for the transformation of their activities, with impact upon the regions where they are located.

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