



Framing and reframing  
sustainable bioenergy pathways:  
The case of Emilia Romagna

Bianca Cavicchi and Adrian Ely

# Bioenergy Pathways

## Framing and reframing sustainable bioenergy pathways: The case of Emilia Romagna

This paper addresses the case of bioenergy development in Emilia Romagna, using and building on a 'pathways to sustainability' approach (Leach et al 2010). It represents the first attempt to apply the 'pathways' approach to a European context, investigating the dominant narratives and system framings that led to particular pathways of bioenergy development in the Italian region from 2000 onwards. It then explores how alternative framings emerged as a result of material system changes, and documents how these served to re-frame debates over the preceding decade. The paper points to a tentative result of this reframing – a redirection of pathways to smaller-scale bioenergy development that addresses the socio-economic needs and environmental concerns of local farmers and communities. The paper makes a concrete contribution to the 'pathways' approach by providing a detailed analysis of how framings evolve dynamically as a result of feedbacks between different situated knowledges, framings and the material properties of the system.

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**STEPS Working Paper 88**

Correct citation: Cavicchi, B. and Ely, A. (2016) *Framing and Reframing Sustainable Bioenergy Pathways: The Case of Emilia Romagna*, STEPS Working Paper 88, Brighton: STEPS Centre

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ISBN: 978-1-78118-331-1

### **Acknowledgements**

This working paper was enabled by a Eu-SPRI Forum PhD Circulation Award, which supported Bianca Cavicchi's stay at SPRU in 2015-16. The authors wish to thank Rob Byrne, Science Policy Research Unit (SPRU), University of Sussex and John Bryden, Norwegian Agricultural Economics Research Institute (NILF) for their helpful reviews of this paper and Jan Boyes for her skillful copy-editing.

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## Abstract

This paper addresses the case of bioenergy development in Emilia Romagna, using and building on a 'pathways to sustainability' approach (Leach *et al.* 2010). It represents the first attempt to apply the 'pathways' approach to a European context, investigating the dominant narratives and system framings that led to particular pathways of bioenergy development in the Italian region from 2000 onwards. It then explores how alternative framings emerged as a result of material system changes, and documents how these served to re-frame debates over the following decade. The paper points to a tentative result of this reframing – a redirection of pathways to smaller-scale bioenergy development that addresses the socio-economic needs and environmental concerns of local farmers and communities. The paper makes a concrete contribution to the 'pathways' approach by providing a detailed analysis of how framings evolve dynamically as a result of feedbacks between different situated knowledges, framings and the material properties of the system.

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## Acronyms

AEEG	Autorità per l'Energie Elettrica e il Gas
ARPA	Regional Environmental Agency
ASTER	Emilia Romagna High-Technology Network
CAP	Common Agricultural Policy
CIB	Italian Biogas Consortium
CISE	Centro per l'Innovazione e lo Sviluppo Economico
CHP	Combined Heat and Power
CNR	National Research Centre
CRPA	Centre for Animal Research
ENEA	National Agency for new Technologies, Energy and Sustainable Economic Development
ENEL	National Entity for Electricity
ERVET	Territorial Development Agency of Emilia-Romagna Region
EU	European Commission
GSE	Energy Services Manager
RES	Renewable Energy Sources
IAL-FIT	All-inclusive feed-in tariff scheme



# 1. Introduction

This paper explores pathways of bioenergy development in Emilia Romagna. It represents the first attempt to apply the 'pathways' approach (Leach *et al.* 2010a) to a European context and to span the domains of agriculture/natural resources and energy, bridging silos that are often treated separately in other work. Beyond this, the paper makes a concrete contribution to the 'pathways' approach by providing a detailed analysis through which framings evolve dynamically as a result of feedbacks between different situated knowledges and the material properties of social-technological-ecological systems.

The paper draws on a previous study of causal processes that unfolded within the Emilia Romagna bioenergy system (Cavicchi in press). That study applied a triple bottom line sustainability perspective (Elkington 1997) to analyse why the bioenergy policy was not delivering on the expected sustainability outcomes. It used qualitative systems dynamics (i.e. causal loop diagrams) as a method to shed light on how objective (for example, regulations, biophysical conditions, geographical and institutional boundaries) and subjective elements (i.e. people's mental models, visions, perceptions) interrelate and shape bioenergy development in Emilia Romagna (Italian region). However, the triple bottom line is a general and normative framework, which does not attend to multiple contextual understandings of sustainability. As much science and technology studies and environmental governance (including STEPS) work has illustrated, stakeholders are likely to hold different understandings and perceptions of sustainable bioenergy development and this will affect the associated policies, practices and resultant pathways of change. Understanding which framing is dominant, and which alternative framings interact with, or counter, the former (and how they do this) can help to explain the development of pathways over time (Leach *et al.* 2010a).

This paper thus proposes to explore how the interrelations between different framings of sustainable bioenergy development have shaped the material pathways of change in Emilia Romagna, a northeastern Italian region, which has experienced a rapid and pervasive diffusion of biogas plants in recent years. Therefore, this study is interested in:

- Which framings of sustainable bioenergy development exist, which are dominant and which are alternative/ marginal in the case study?
- How does the unfolding of feedbacks influence the former framings and pathways of change over time?

From this, we hope to explore how addressing dominant and alternative framings of bioenergy development might contribute to processes and outcomes that are more accommodating of rural communities' goals, values and needs.

The paper is structured as follows. Section two outlines the pathways approach and the methodology adopted in the study. The paper then moves on to introduce the background to the case study and to present the empirical findings in three sections, structured around feedback relations between dominant and alternative framings and the system's development. Finally, it discusses the key policy and theoretical implications of the study

## 2. Exploring Feedbacks Between Framings and Pathways

### 2.1. Theoretical Framework

This paper builds on the pathways approach developed at the STEPS Centre and applied previously to domains such as energy and agriculture (Byrne *et al.* 2011; Leach *et al.* 2007a; Leach *et al.* 2010a; Leach *et al.* 2010b; Smith and Stirling 2010; Stirling 2014; Thompson *et al.* 2007; Leach *et al.* 2007b; Scoones *et al.* 2007; Stirling *et al.* 2007; van Zwanenberg *et al.* 2011). Leach *et al.* (2010b: 3) define pathways as, 'the particular directions in which interacting social, technological and environmental systems co-evolve over time'. The pathways approach rests on the idea that the world's problems are dynamic and complex, i.e. they are made of multiple interdependencies and include both objective and subjective dimensions. It also takes a constructivist approach, namely it considers complex systems as socially constructed, something that people '[...] design or experience in relation to an event' (Scoones *et al.* 2007: 20) rather than entities that exist by themselves.

This approach originates within the systems thinking tradition, and especially resonates with soft systems thinking (Checkland 1981; Senge 1990). The idea held within this tradition is that thinking in terms of systems allows learning about complex and non-linear causal relations that link several events together. This complexity is difficult to discern for the human mind:

According to a soft-systems view, people appreciate the same context in different ways based in line with their experiences and worldviews and purposes. What result is a number of different 'systems' (constructions of situations), which are relevant to the stakeholders concerned, but not necessarily to all the stakeholders, in the sense that they relate to their various purposes and worldviews.

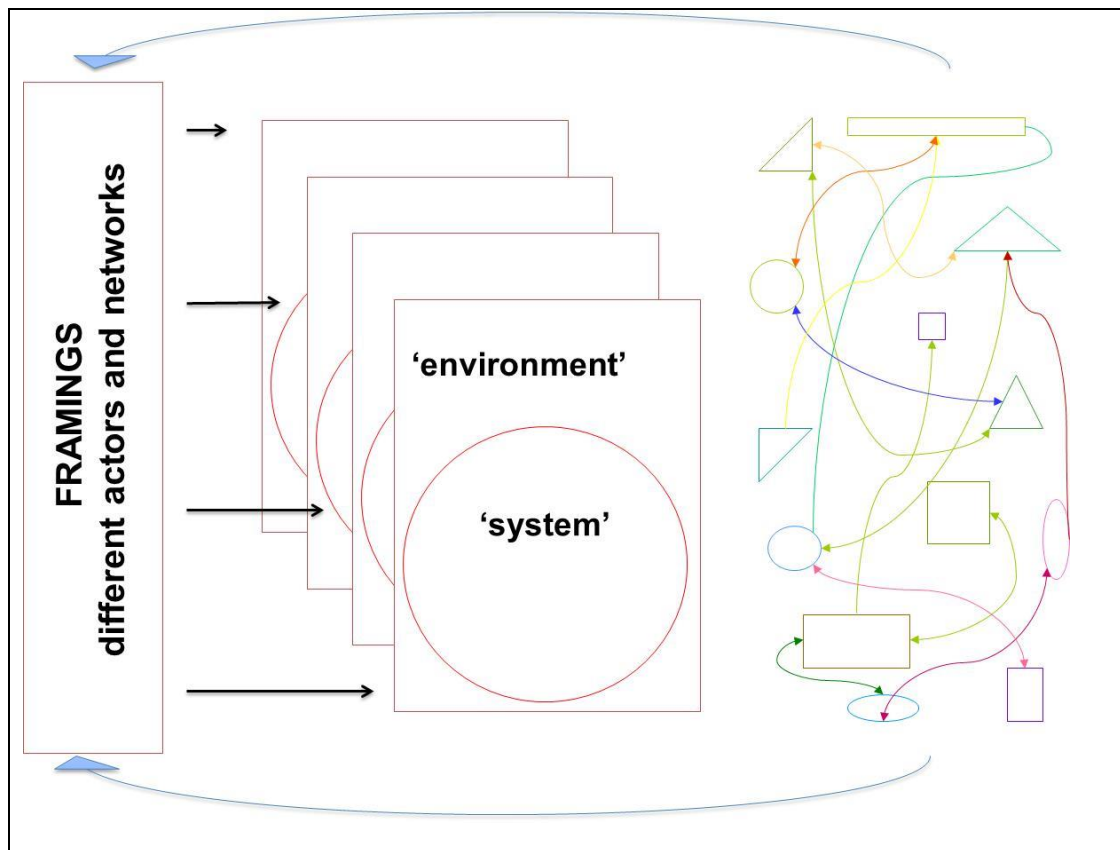
(Ison *et al.* 1997 in Scoones *et al.* 2007: 21)

The pathways approach adds to this a reflexive dimension. It simply puts into words and practice what systems thinking implies but does not address explicitly, namely that when we build systems we must account for the subjective framings of reality that exist within a specific context. Leach *et al.* (2010a: 4) thus define framing as 'the different ways of understanding or representing a social, technological or natural *system* and its relevant *environment*. Among other aspects, this includes the ways system elements are bounded, characterized and prioritized, and meanings and *normative* values attached to each'.

Leach *et al.* (2007a) point to the importance of reflexivity in policy analysis and policy-making, stating, 'reflexivity [...] is the capacity to engage with the ways in which framings of systems are plural, conditioned by divergent social values, economic interests and institutional commitments' (p. 29). Whilst several STEPS research projects (Ely *et al.* 2009; Chenggang *et al.* 2011; Van Zwanenberg *et al.* 2011) have pointed to different framings, and especially the impact of dominant framings in reinforcing dominant pathways, little detailed analysis of these dynamics has been carried out over time, i.e. on the feedbacks between framings, resultant system changes and the mechanisms through which these changes feed back onto framings.

Leach *et al.* (2010a) tried to give an account of the dynamic relations that exist between reality, framings and systems. 'Systems as we consider them in this book, consist of social, institutional, ecological and technological elements interacting in dynamics ways' (Leach *et al.* 2010a: 43). Figure 2.1 illustrates a heuristic for understanding these relationships, and Table 2.1 illustrates some of the dimensions of framings that may differ between different actors and networks.

Figure 2.1: Multiple framings



Source: Leach *et al.* 2010a (Figure 3.1)

Table 2.1: Dimensions of framings

Choice of elements:	Subjective judgements:
<ul style="list-style-type: none"> <li>• Scale</li> <li>• Boundaries</li> <li>• Key elements and relationships</li> <li>• Dynamics in play</li> <li>• Outputs</li> </ul>	<ul style="list-style-type: none"> <li>• Perspectives</li> <li>• Interests</li> <li>• Values</li> <li>• Notions of relevant experience</li> <li>• Goals</li> </ul>

Source: Leach *et al.* 2010a (box 3.1)

The pathways approach has highlighted the ways in which dominant framings reinforce incumbent pathways. We are interested in processes that unbalance incumbent pathways, ultimately feeding back to inform/alter framings and redirect pathways of change. In the 'pathways' literature to date, the specific historical analysis of such feedback relations is rare. Studies of how regulations of agricultural biotechnology have been framed and reframed (Heller 2002; Levidow and Murphy 2003; Levidow 1997) are instructive in this regard as they document the political processes through which dominant framings have come to be shifted. They have not, however, extended this analysis to explore the impacts on redirected pathways of systemic change. The interactions between systems, re-framings and redirected pathways can be seen as subject to feedback relations, i.e. mediated by situated knowledge and perspectives, the material nature of the system influences individual actors' framings that shape action (through policies and material interventions) and in turn shift the system's

pathway of change. This paper proposes to study and explain how dominant and alternative framings can change as a result of such feedbacks, and ultimately if and how these interactions can then redirect the pathways that emerge.

## **2.2. Methodology**

This paper uses qualitative case study methodology, in keeping with most of the STEPS Centre research. As mentioned in the theoretical framework, the pathways approach acknowledges that stakeholders have different understandings of sustainable bioenergy development. For simplicity, this paper categorises them into 'dominant' and 'alternative' framings. Whilst recognising that this is undoubtedly an oversimplification, the purpose of simply distinguishing dominant and alternative framing categories is to make their interaction with each other clearer. Besides this, such a distinction also serves the purpose of explaining the feedback relations between them and the actual system.

To this end, the paper makes use of text/documentary analysis, especially to characterise the dominant framings (for example, among others, Assemblea Legislativa Emilia Romagna 2007; Assessorato alle Attività Produttive 2013; Unione dei Comitati 2011; Direzione Generale Agricoltura Emilia Romagna 2007; Consiglio Regionale 2004; Giunta Regionale 2011a and Giunta Regionale 2011b) and semi-structured interviews to elucidate differences and changes in these and the alternative framings. The interview material was collected during a previous study by Cavicchi on bioenergy policies in Emilia Romagna and Norway in 2012 (Cavicchi 2013; Cavicchi *et al.* 2014) and between April 2014 and February 2015. Interviewees were asked about how they perceived bioenergy development, what obstacles and opportunities they saw, what they saw as positive and/or negative outcomes, what their expectations were and what they would propose as alternative policy strategies. Semi-structured interviews include a broad variety of stakeholders (Annex 1).

### 3. Origins of the Dominant Framing of Sustainable Bioenergy Development in Emilia Romagna

This Section first presents the case study area and some historical developments regarding the evolution of the bioenergy policy in Italy and Emilia Romagna. It then goes on to describe the development of the dominant framing of sustainable biogas development in the region over a period of approximately eight to ten years, from the early 2000s until 2010.

Emilia Romagna hosts a great part of the extremely fertile and flat Padana Plain (Po' Valley) that for decades has been the hub of national agriculture. Much earlier, in the 1940s and 1950s, natural gas fields were discovered in the Padana Plain and Emilia Romagna became one of the first regions to adopt natural gas. This led its manufacturing sector to specialise in the production of engine components, equipment and other parts of methane machinery and a natural gas grid. Beyond this, the Region also had one of the best-developed innovation systems in Europe and Italy, with research centres (such as Emilia Romagna Valorizzazione Economica Territorio (ERVET), Osservatorio Politiche Energetico-ambientali Regionali e Locali, National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), and Centro per l'Innovazione e lo Sviluppo Economico (CISE)) that invested resources into strengthening the links between agriculture and manufacturing. A major example of these collaborations was the sugar industry that was characterised by the close collaboration between sugar beet producers and sugar refineries. Until 2004 Emilia Romagna was the leading region in Europe in the sugar sector (16 sugar factories). However, the 2004 Common Agricultural Policy (CAP) reform, which led to the closure of approximately 13 regional sugar factories, changed this landscape significantly.<sup>1</sup>

The 1970s oil crisis and the economic turmoil that followed turned the interest of regional stakeholders (Centro Ricerca Produzioni Animali (CRPA), regional government, industrial actors) towards developing alternative sources of energy technologies that could secure energy supply stability and security, but which would also benefit regional agriculture, environment and industrial development. Broadly, the stakeholders in the areas of the Padana Plain (i.e. the regions of Emilia Romagna, Lombardia, Piemonte, Veneto and Friuli) focused their attention on biogas technology (Piccinini *et al.* 2008). Biogas seemed to be the best solution for Emilia Romagna but also for other regions, which comprise the Padana Plain (Piccinini *et al.* 2008). Several large national companies showed interest in biogas while research started to focus on technology development and to experiment with biogas feedstocks, for example different types of sewage, and energy crops. This first tentative initiative failed, mainly because the environmental motivation was not very appealing to farmers, who also found biogas plants – developed by industrial actors – too complex and not easily adaptable to their farm's conditions. Additionally, until the early 1990s the national government did not really support the adoption of the technology through incentives or similar instruments (Piccinini *et al.* 2008).

The dominant framing in this first phase was thus Northern Italy-based and particularly limited to the livestock sector (using animal waste as feedstock). The key stakeholders included agriculture, technology innovation and energy sectors (for example CRPA; ENEA; Italian Oil and Natural Gas

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<sup>1</sup> See: <http://www2.stat.unibo.it/Brasili/file/2011-2012/COSDI/La%20storia%20recente%20degli%20zuccherifici%20%20in%20Italia.pdf>

company (ENI); National Entity for Electricity (ENEL) but did not capture the interest of farmers and national politicians.<sup>2</sup> These actors emphasised that the key function of using biogas plants was to process and reduce the environmental impacts of cattle, poultry and pig's sewage, rather than of producing renewable energy or giving a new source of income to farmers (Piccinini *et al.* 2008).

In 1992 the Resolution 6/1992<sup>3</sup> established the first incentive scheme for renewable energy production (including bioenergy), and also supported other sources of energy such as, for instance, coal and hydrocarbons. The main idea was to foster alternative sources of energy to cope with the dependence on import from unreliable countries (for example, Russia and Algeria), while keeping the energy system based on a single operator (ENEL until 1999 and Gestore Servizi Energetici after 1999). This evolution represented the first steps in the development of a dominant framing based on economic and energy security issues. Under these conditions, the initiative did not really foster the use of renewable energy so much as coal and hydrocarbons.

The dominant framing underwent substantial changes at the beginning of the 2000s when the European energy and agriculture policy developments strongly influenced its trajectory. In Particular, the 2004 European Commission (EU) CAP reform on the sugar sector triggered the regional and national interest in biogas. At this stage the dominant framing was exemplified by statements from institutional stakeholders such as regional and national level governments and other public agencies (regional environmental agencies), farmers' unions, and CRPA. The Ministry of Economic Development was the lead signatory of the renewable energy policy, followed by the Ministry of Agriculture, Environment and Cultural Heritage.

The same division of responsibilities applied at the regional level where the Department of Economic Development was in charge of the renewable energy policy. Within this framework, Farmers' Unions are reasonably influential actors. For instance, at a regional level they are formally invited to attend the policy discussions that set up rural development and agriculture strategies (for example Direzione Generale Agricoltura E.R. 2007).<sup>4</sup> An example of this was in the aftermath of the EU CAP reform in 2004 when regional farmers' unions advocated a focus on alternatives such as biogas production to tackle the closure of the sugar industry (interviewees 35 (30/05/14); 37 (16/06/14); Piccinini *et al.* 2008). At around the same time, the EU issued the first Directive on renewable energy (European Parliament and the Council 2002) which was followed by the DL 387/2003 (Presidente della Repubblica 2004), i.e. the first national law to regulate renewable energy production.

In this context, Emilia Romagna was one of the first Italian regions to adopt a law (Consiglio Regionale law 26/2004) that regulated the energy sector and renewable energy development. The Act's priorities were energy efficiency and renewable energy production. Additionally, the Act shaped the public governance of regional energy planning (Clauses 2, 3 and 4). Notably, the regional and provincial level were assigned the key responsibilities on energy planning (for example concessions), whereas municipalities were left with residual duties on energy efficiency and district heating matters (for example to support the development of the infrastructure). In 2007 the region was again a front-runner in adopting the regional energy plan. While it referred to natural gas as the key energy source

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<sup>2</sup> See: [http://www.crpa.it/media/documents/crpa\\_www/Progetti/Seq-Cure/Convego\\_Tadini\\_9\\_12\\_08/Navarotto\\_Tadini\\_9\\_12\\_08.pdf](http://www.crpa.it/media/documents/crpa_www/Progetti/Seq-Cure/Convego_Tadini_9_12_08/Navarotto_Tadini_9_12_08.pdf)

<sup>3</sup> See: [http://www.gazzettaufficiale.it/atto/serie\\_generale/caricaArticoloDefault/originario?atto.dataPubblicazioneGazzetta=1999-03-01&atto.codiceRedazionale=099A1446&atto.tipoProvvedimento=DELIBERAZIONE](http://www.gazzettaufficiale.it/atto/serie_generale/caricaArticoloDefault/originario?atto.dataPubblicazioneGazzetta=1999-03-01&atto.codiceRedazionale=099A1446&atto.tipoProvvedimento=DELIBERAZIONE)

<sup>4</sup> See: <http://agricoltura.regione.emilia-romagna.it/approfondimenti/2014/psr-2014-2020-incontro-a-bologna-lunedì-27-gennaio-1>

of the region (imported from Russia, Algeria and Norway), it identified biogas and solar energy as the main alternatives. The national and regional rural development plans 2007–2013, following the EU Regulation on Rural Development 1698/2005, ultimately strengthened the bioenergy–rural development–climate change link (for example rural employment and energy diversification) (Direzione Generale Agricoltura Emilia-Romagna 2007: 412). However, the vital economic driver followed the Renewable Energy Sources (RES) Directive 2009/28/CE (European Parliament and the Council 2009), when the Italian Government introduced the all-inclusive feed-in tariff scheme (AI-FIT) (Ministero dello Sviluppo Economico 2008). The AI-FIT differentiated the tariff per technology type, i.e. biogas plants up to 999kWh received 0,28 €cent/kWh,<sup>5</sup> and lasted from 2009 to 2012. In addition to the AI-FIT, a tax exemption also applied to farm-based bioenergy production (2006-2014).<sup>6</sup>

Recalling the pathways approach, the key elements of the dominant framing can be summarised in the following paragraphs and Table 3.1.

Table 3.1: Dimensions of the 'dominant' framing that developed in the early 2000s

Choice of Elements	Subjective Judgements
National and regional scale. During the establishment of this dominant phase, the local dimension was not considered.	The dominant framing was interested in providing farmers, especially those who were involved in the sugar industry, with new sources of income. Electricity production is strategic to EU 2020 target fulfillment. Local environmental and economic issues are neglected in this phase.
Sugar industry, livestock, electricity production and energy security boundaries.	The goals of the dominant framing are to integrate the farmers' income and slow down the agriculture crisis; fulfill the EU 2020 targets; and strengthen energy security.
Choice of scale in 999kWh units, energy crops as main feedstock. Complex interrelations between agriculture and energy production, local environmental issues and climate change goals, legitimacy and power relations.	The dominant framing's narrative primarily builds on EU targets' compliance, economic development issues and climate change concerns.
Small farmers and local communities suffer the negative environmental, economic and social effects, e.g. bad smells, local warming, social opposition, farmland rent price increase.	Knowledge about investment measures, economic costs and benefits, carbon emissions are all seen as most relevant knowledge/experience for decision-making.

At the end of the 2010s, the dominant framing adopted both a regional and national scale. At the national scale this included the Ministries of Economic Development, Agriculture, Environment and Cultural Heritage, but excluded many other actors. The regional scale mirrored this structure but with a predominant role for the Department of Economic Development. Other key stakeholders were national regional energy companies, i.e. ENEL, ENI, HERA and IREN; farmers' unions; environmental agency and local health units; provinces; CRPA; farmers (small and large), industrialists and biogas

<sup>5</sup> See: <http://www.gse.it/it/qualifiche%20e%20certificati/tariffa%20omnicomprensiva/Pages/default.aspx>

<sup>6</sup> See: <http://www.gazzettaufficiale.it/eli/id/2014/04/24/14G00079/sg>

producers. The policy boundaries extended from energy security to agricultural growth passing through climate concerns. Their narrative<sup>7</sup> was that biogas was crucial to support farmers' income and rural development and to foster the energy transition towards a low carbon society and climate change mitigation.

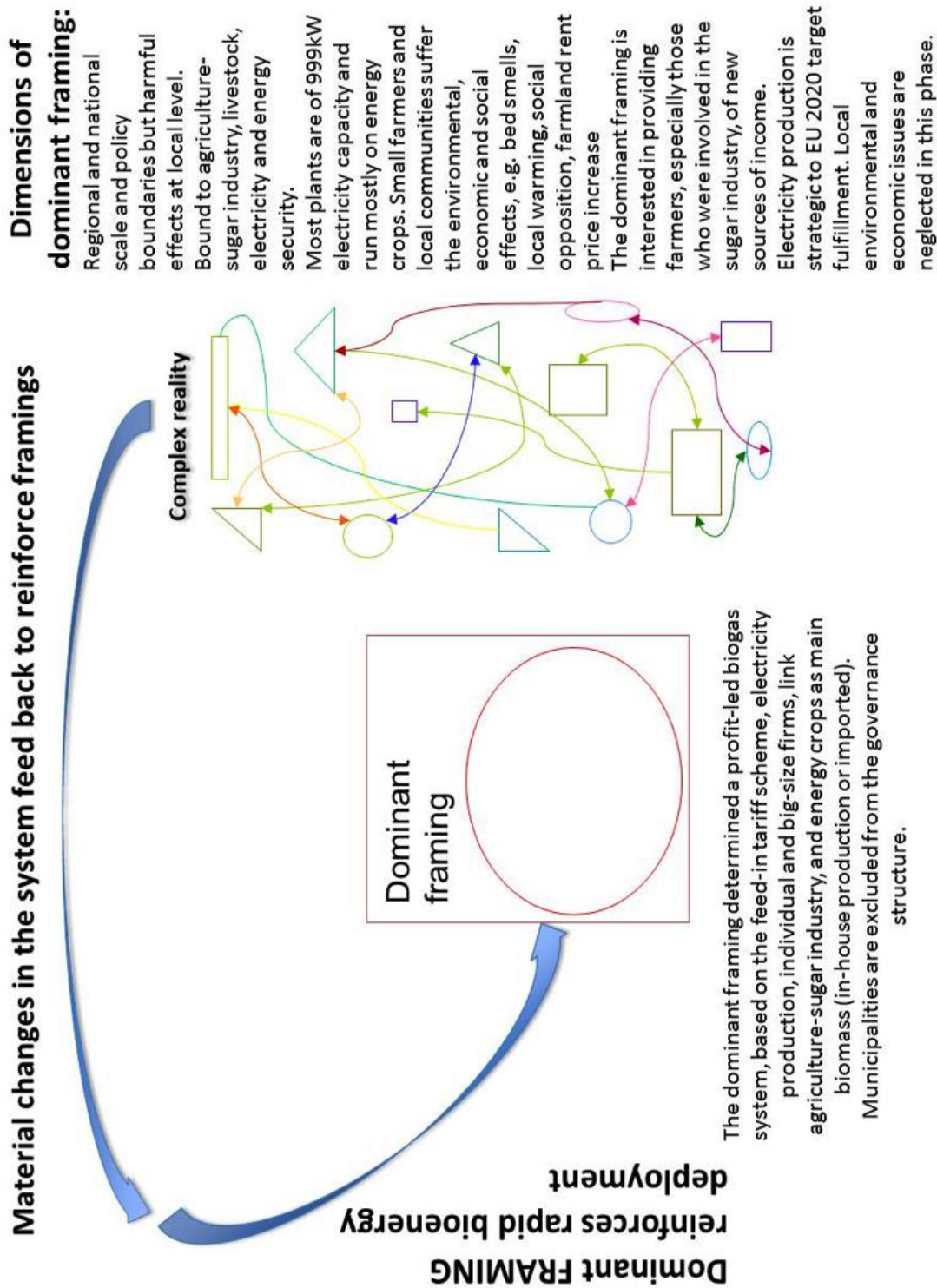
The dominant framing focused primarily on supporting shifts in income generation within farming, particularly for large farms linked to the sugar industry. The core strategy of the national Government was to support renewable and bioenergy-based electricity production to reduce the dependence on natural gas. Heating was not a main concern. Biofuels were included in key policy documents but were affected by the unclear regulatory framework and stakeholders' commitment. The main regulatory instruments at national and regional levels were economic incentives and environmental criteria to limit the negative effects of biogas on the eco-system. These set the scene for a dominant framing and policy environment that initiated and reinforced (through positive feedbacks) a pathway of rapid upscaling of bioenergy development in Emilia Romagna, illustrated in Figure 3.1. In this first phase, whereas the dominant framing included global environmental issues such as GHG emissions reduction and agriculture growth, it neglected some aspects of rural life and the local environment (for example traffic, rural roads capacity, landscape, local warming, social relations between farmers and inhabitants, networks, etc.). Hence, it excluded those local actors, for example municipalities, local inhabitants, environmental organisations and small farmers, that would make significant contributions to the subsequent process of reframing.

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<sup>7</sup> '[...] simple stories with beginnings defining the problem, middles elaborating its consequences and ends outlining the solutions' (Roe 1994, in Leach *et al.* 2010b)



Figure 3.1: Reinforcement of the dominant framing and pathway of bioenergy development



## 4. Early Developments, Alternative Framings and Political Contestation

The diffusion of biogas plants that followed the all-inclusive feed-in tariff was rapid and widespread. In fact, between 2009-2012 biogas plants almost sextupled from 29 plants in 2008 to 172 plants in 2012 (regional database). While biogas farmers' unions, the newly-established Italian Biogas Consortium (CIB), large-scale farmers, the regional government and CRPA eagerly supported biogas diffusion (and maintained their earlier framings around economic development), the development of the sector led to material changes in the system that spurred local inhabitants and environmental organisations to start to raise their voice against it. The dominant framing viewed the biogas system as centred around individual biogas firms (rather than cooperatives), mostly using energy crops (for example sorghum and triticale) and producing electricity up to 999kWh. The associated policy processes excluded local governments and inhabitants but prioritised central actors such as national ministries of economic development and agriculture, energy agencies, regional and provincial governments and environmental agencies, who were able to bring about policies that led to a rapid development in the region's bioenergy sector. This dominant framing had a material feedback on the system through the pathway that it enabled, and therefore affected not only biogas producers but other actors in rural areas as well.

Farmers' unions expressed concerns about the rise in farmland use for biogas production and consequent rent price increase due to the installation of biogas plants, related equipment and the cultivation of energy crops (interviews with farmers' unions, in particular informants 24–30 in Appendix 1). This claim also seems to be supported by recent statistics of the Italian Agricultural Economics Institute,<sup>8</sup> the Emilia Romagna Region<sup>9</sup> and historical databases, as well as specialised newspaper articles.<sup>10</sup> The former source suggests a rent price increase between the years 2008 and 2012, which is in line with the regional database which shows an increased rent for agricultural land.<sup>11</sup> Farmers' unions that represented small and big farms respectively (especially CIA and Confagricoltura) asserted that tensions arose between farmers and biogas producers, where the former accused the latter of distorting the land market (interview with farmers' unions, informants 24–30 in Annex 1). Apart from this, the incumbent actors (particularly represented by interviewees 10, 11, 15, 16, 24–30, and 35 in Annex 1) claim that the incentive scheme created profit expectations that went beyond the farms' financial and productive capacity (Cavicchi *et al.* 2014; Annex 1 interviews with farmers' unions (informants 24–30); biogas firms and cooperatives (informants 1–4, 10 and 11), legambiente (informant 31)). Major related problems were: money was mostly invested in the plant and rather than in supplementary equipment (for example storage room for leachate, digestate and biomass); most of the heat produced (biogas plants are all Combined Heat and Power (CHP) plants) remained unconsumed; the plants' size exceeded the farm's biomass supply capacity, whereas the quantity of

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<sup>8</sup> See: <http://www.inea.it:8080/mercato-fondario/esempi> (especially on land rent prices)

<sup>9</sup> See: <http://territorio.regione.emilia-romagna.it/osservatorio/notizie/valori-agricoli-medi-2015> (especially on land value in euro per hectare)

<sup>10</sup> See: <http://agronotizie.imagelinenetwork.com/agricoltura-economia-politica/2011/07/21/mercato-fondario-e-affitti-l-analisi-di-inea/13735> and <http://www.conipiediperterra.com/inea-la-crisi-pesa-sul-mercato-fondario-meglio-gli-affitti-0725.html>

<sup>11</sup> See: <http://territorio.regione.emilia-romagna.it/osservatorio/notizie/valori-agricoli-medi-2015> and <http://statistica.regione.emilia-romagna.it/servizi-online/censimenti/6b0-censimento-dellagricoltura-2010>

biogas normally exceeded that needed to meet the 999kWh threshold established by the incentive scheme.

The alternative framing, represented by local inhabitants, environmental organisations, small farmers, and municipalities to some extent<sup>12</sup> (Annex 1: interviewees 10, 11, 17, 18, 22, 31, 38 (updated in January 2015), 39, 40 (updated in January 2015) and 41) claimed that these processes produced several local negative effects, particularly traffic increase in rural areas due to the import of biomass from other sites; flows of leachate into irrigation ditches thus depleting the soil (i.e. of nutrients); local warming due to heat dispersion and emissions from combustion of unused biogas; damage to the rural landscape; bad smells and abandonment of production of food crops in favour of energy crops; exclusions from concession process and discussion with other local stakeholders (i.e. investors and local authorities). Local inhabitants and environmental organisations such as Legambiente (an Italian Environmental Organisation) reacted to this situation by creating committees and requiring hearings with local and regional governments.

As a result of the material (social, economic and environmental) changes to the system, the *alternative* framing of sustainable bioenergy production developed and became amplified in the period between 2010–2012 (interview with biogas businesses; regional farmers' unions; Legambiente Emilia Romagna; Sgonfiailbiogas, Galliera and Vigarano Pulito Committees). In December 2011 committees of the Province of Bologna and Ferrara<sup>13</sup> submitted a *request for moratorium* to the regional government, provinces and municipalities within Bologna and Ferrara (December 2011, Unions of Bologna and Ferrara Committees). *Legambiente* Emilia Romagna supported local committees and contributed to draft the moratorium. The final document asked for a suspension of the concessions to build new plants in order to stop the 'brutal' and 'out-of control' diffusion of biogas plants (Unione dei Comitati 2011). In addition, the moratorium proposed an alternative pathway of sustainable bioenergy development. This built on the assumption that biogas production must benefit local agriculture and rural areas. The committees argued, 'real farmers (and not external industrialists) should run the plants that should utilize in-house biomass in order to really benefit farmers' income and agriculture' (Unione dei Comitati 2011: 3). Nevertheless, concessions were not suspended or reviewed.

At this stage, the alternative and dominant framings strongly differed on several factors, such as actors, goals, narratives, values, boundaries and dynamics, in a way summarised in Table 4.1.

The alternative framing included small farmers, environmental organisations, local inhabitants and to some extent municipalities. The boundaries of the alternative framing were thus spatially within the local dimension but with potential effects at larger scales (for example regional, national and global), and within the agriculture–environmental domains. Their political agenda was formalised in the Moratorium (Unione dei Comitati 2011) and focused on small-scale biogas production, local environment and agriculture income diversification and distributed economic benefits and local biomass supply chains. They also stressed the relevance of biomethane production, especially to fuel private transport and to reduce regional greenhouse gas emissions. They neither seemed very concerned with energy security and safety matters, nor with heating alternatives, unlike the dominant framing. On the other hand, they valued bioenergy production at the same time stressing the local, rural and environmental dimension (for example support to real farmers and emissions reduction in private transport) neglected by the dominant framing.

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<sup>12</sup> Municipalities have an ambiguous role. As they do not have responsibilities on bioenergy matters, in some cases they support the alternative framing, in some others they are more reluctant on taking a clear position

<sup>13</sup> According to the regional database 2013, most biogas plants are located in the province of Bologna and Ferrara

*Table 4.1:* Dimensions of the ‘alternative framing’ that was amplified by the early developments of the bioenergy system

<b>Choice of elements</b>	<b>Subjective judgments</b>
Local scale and boundaries span from local agriculture, food crops production, small farmers and small-size biogas plants to short chain and in-house biomass supply.	The alternative framing is interested in fostering local agriculture and rural development by focusing on small farmers and local biomass. This framing is also concerned with the local contribution to climate change especially focusing on alternative fuels for transport (i.e. biomethane).
Biomethane production in addition to electricity. Concerns for local environment and economy.	The goals of the alternative framings are linked more to local sustainable development and control over bioenergy.
Emphasis on stronger local stakeholders inclusion in decision-making.	Lived experience of local people relevant to decision-making.
The dynamics in play involve local inhabitants, some local politicians, small farmers and environmental organisation.	The alternative framing’s narrative primarily builds against the over exploitation of local natural resources, such as land and related products (e.g. crops), and environment. It also values local rural development and environmental concerns.

## 5. Re-framing Dominant Bioenergy Narratives and Pathways

As explained by the regional environmental agency and public actors, 'the diffusion of biogas plants happened very fast and nobody was prepared. Neither the environmental agency nor the municipalities or other stakeholders'.(Annex 1, interviewees 15, 16 and 18).<sup>14</sup> In 2011, the region responded to local concerns by issuing new and stricter regulations on plants' location and management (Giunta Regionale 2011a; Giunta Regionale 2011b). Farmers unions generally favored these interventions, 'the regional resolutions aimed to alleviate local opposition and social conflicts by putting limits on the area where plants could be located (Annex 1, interviewee 28). The new provisions banned biogas plants in the areas of Parmigiano Reggiano, i.e. Parma and Reggio Emilia (due to the presence of clostridia that could affect human health) and established new environmental criteria. The latter provided guidelines to mitigate noise, bad smells, combustion of biogas (i.e. the exceeding part not used to produce electricity) and percolation (Giunta Regionale 2011a; Giunta Regionale 2011b). As mentioned previously, these initiatives did not stop the committees from calling for the moratorium that aimed to suspend the diffusion of biogas and review the concessions.

Members of the Regional Environmental Agency (ARPA) claim that they have learned a lot since the early diffusion of biogas in 2009 and have become more thorough in doing on-site plant inspections (Annex 1, interviewee 15). However, they also assert that the system is still inefficient.

The management of the inspection process is decentralised, namely the provincial ARPAs are in charge of it and of data storage. Therefore, there is neither uniform data collection and storage practice, nor inspection procedures.

Annex 1, interviewee 15 (21/11/14)

The national Government responded to social opposition with a change in the AIL-FIT and tax exemption. In 2012 the Government changed the AIL-FIT scheme, most likely under the pressure of budget shortages, social opposition and pressures from farmers' unions (interviews with farmers' unions representatives, interviewees 24–30). The new scheme only applies to new plants and differentiates between kinds of biomass used, namely agricultural byproducts are supported more than energy crops. Interviews did not collect any relevant data indicating interests of specific feedstock (e.g. biomass) producers. We may assume that is because many plants (particularly the industrially-based ones) were built and started to produce biogas under the previous scheme, which did not differentiate the tariff according to biomass type. According to all the representatives of farmers' unions and biogas businesses interviewed, the new scheme has slowed down, if not stopped, the diffusion of biogas plants. Some claim that it was more efficient to produce biogas with energy crops and with large-scale plants (interview with 25, 26, 35). The tax exemption was removed in 2014. The regional database (2013) shows that only a few new plants were activated between 2013 and 2014, to all of which the old AI-FIT still applies.

In addition to this, at the beginning of 2014 (Ministero dello Sviluppo Economico 2013),<sup>15</sup> the national Government implemented the provisions on biomethane production included in the legislative decree (Dlgs) 28/2011 (Presidente della Repubblica 2011). However, it was only a year later that the Autorità

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<sup>14</sup> Regional Agency for Environmental Protection (author translation)

<sup>15</sup> See: [http://www.sviluppoeconomico.gov.it/images/stories/normativa/DM\\_5\\_12\\_2013\\_Biometano.pdf](http://www.sviluppoeconomico.gov.it/images/stories/normativa/DM_5_12_2013_Biometano.pdf)

per l'Energie Elettrica e il Gas<sup>16</sup> (AEEG) finally issued the guidelines (for example quality criteria) and an incentive scheme for biomethane transmission in the natural gas grid (AEEG 2015).<sup>17</sup> Biogas producers and sectorial organisations (CIB, farmers' unions) are not sure whether existent biogas plants could be easily converted in biomethane plants. Generally, most stakeholders are in favor of biomethane production although some fear the competition between food crops and energy crops (for example some representatives of Coldiretti), or are aware that biogas companies should be up-scaled in order to make biomethane production competitive. In the meantime, farmers' unions have softened their support for both large-scale plants and large-scale biogas production. Interviews from 2014 suggest that all three of the farmers' unions have been concerned with rising conflicts between farmers and biogas producers, especially due to the agricultural land rent increase (Annex 1, interviewees 30 and 25).

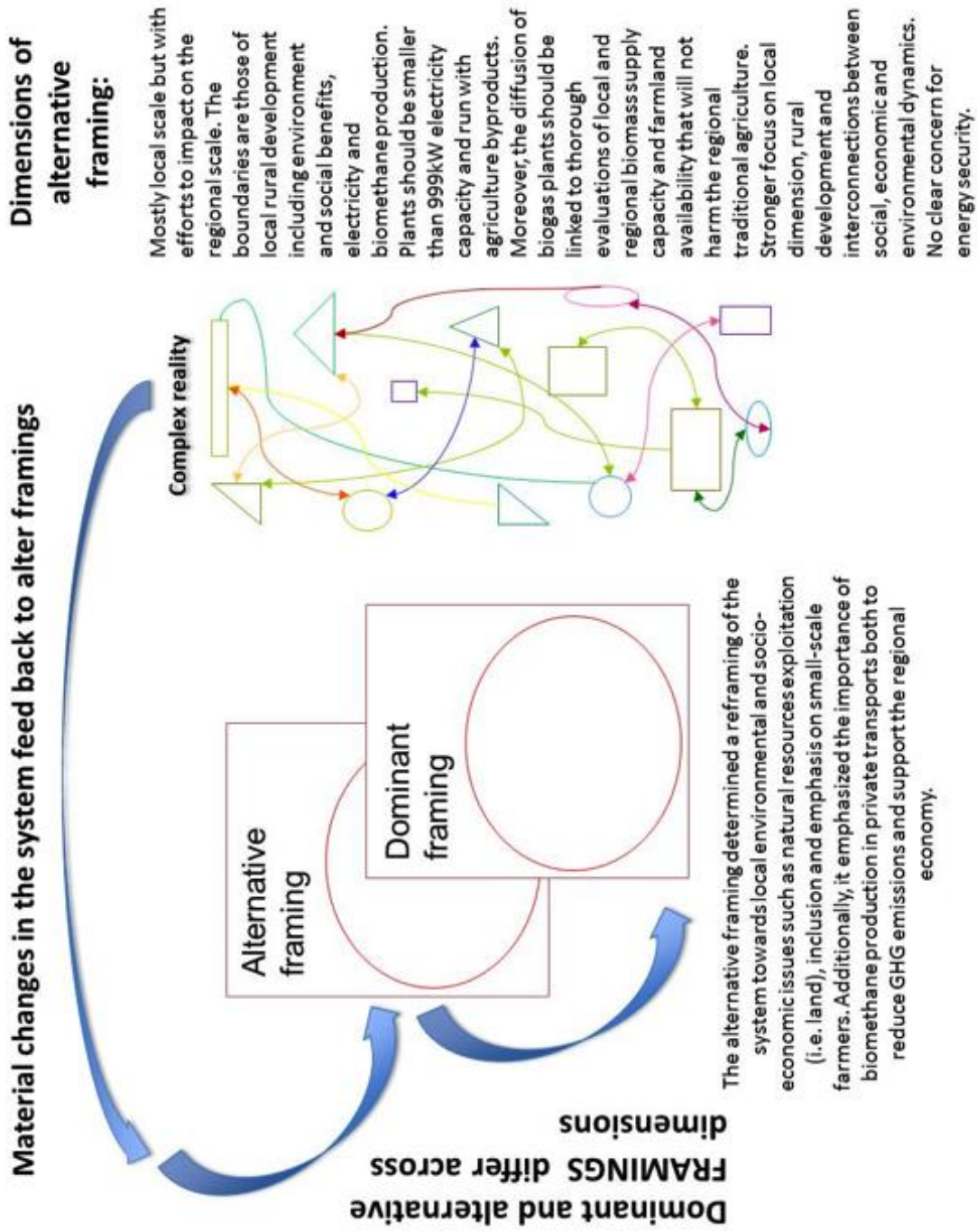
Figure 5.1 below aims to illustrate how some dimensions of the dominant framing have been modified under the influence of the alternative framing (which was amplified by feedbacks from the material changes in the system).

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<sup>16</sup> Italian Regulatory Authority for Electricity Gas and Water (author translation)

<sup>17</sup> See: <http://www.gse.it/it/Gas%20e%20servizi%20energetici/Biometano/Pagine/default.aspx>

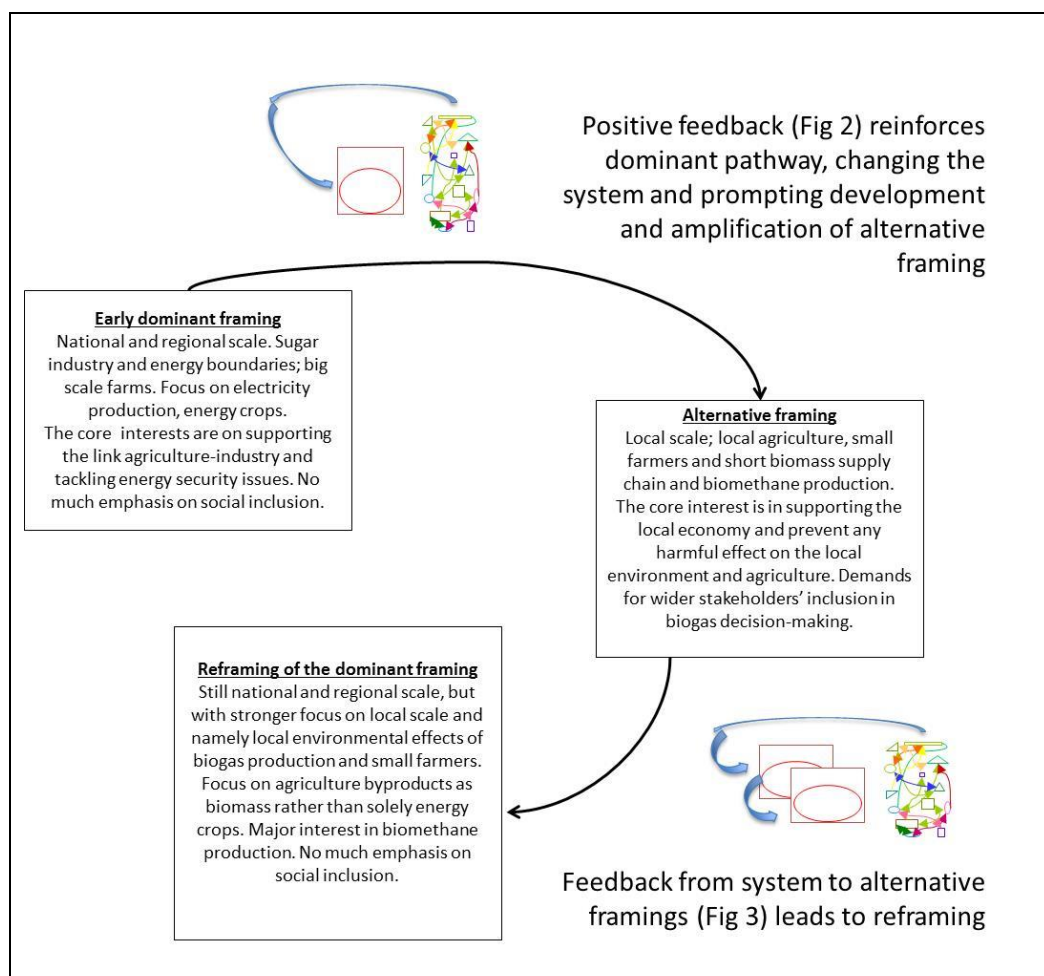
Figure 5.1: Feedbacks between the system, alternative and dominant framings, leading to reframing



## 6. Discussion: Feedbacks and Tentative Evidence of New Bioenergy Pathways

We have presented evidence of a dominant reframing on the basis of feedbacks between the system and system framings (summarised in the Figure 6.1 below). Extending our application of the pathways approach in this way, we argue that the interactions between different framings and the system may lead to the redirection of the pathway. This section will draw some initial considerations on this from the case study.

Figure 6.1: Feedbacks leading to reinforcing and reframing



It is still too early to state definitively how the feedbacks between the system and framings have changed the biogas system and redirected pathways. However, there is tentative evidence that seems to indicate a new future pathway. Two very preliminary observations are based on most recent interviews with farmers' unions (Annex 1, interviewees 24–30) and the ARPA database. Farmers' unions say that very few biogas plants were built after the change in the feed-in tariff scheme. Most of the new ones were authorised under the previous scheme but delayed for bureaucratic reasons.



This statement seems supported by ARPA's regional database of bioenergy plants,<sup>18</sup> which also shows that several plants built after the change of the incentive scheme have a much lower power capacity than the former ones (for example 0.02 kW vs. 0.99 kW). Information on the biomass value chain (production to consumption) and firms' ownership structures is still not available. Beyond this, ARPA claim that its inspections have become more thorough as they have gained greater knowledge and skills on biogas production, plant management and environmental issues (Annex 1, interviewees 15 and 16). Lastly, biomethane production is still at a very early stage in Emilia Romagna. There is not an active plant in the region yet. However, the Emilia Romagna High-Technology Network (ASTER)<sup>19</sup> is carrying out a demonstration project on biomethane together with CRPA, HERA, IREN and Safe spa (BioMethEr Life+).<sup>20</sup> The goal is to prove the feasibility of biomethane production and its added value to bioenergy production. In addition, the project aims to gather as much information as possible on environmental and technical issues. In this regard, they will work on two demonstration biomethane projects in cooperation with HERA and IREN (Piccini and Valentini 2014).

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<sup>18</sup> See: [https://www.google.com/fusiontables/DataSource?docid=11WLPsgNkbLATOha\\_CMDhNOWEzRGfml-RitPgWbP0#rows:id=1](https://www.google.com/fusiontables/DataSource?docid=11WLPsgNkbLATOha_CMDhNOWEzRGfml-RitPgWbP0#rows:id=1)

<sup>19</sup> ASTER is a consortium promoting competitiveness and innovation. It involves the Emilia-Romagna Regional Authority (the Authority's main shareholder), the National Research Centre (CNR), the Universities of Bologna, Modena and Reggio-Emilia, Parma, Ferrara and the Catholic University of Piacenza, ENEA, and regional chambers of commerce and business associations. ASTER coordinates and supports the Emilia-Romagna Regional High Tech network, which includes the regional Energy and Environment Platform. The specific mission of the Platform is to promote sustainable energy and transport

<sup>20</sup> See: [http://www.showwproject.eu/images/b/bd/140723\\_scheda\\_BioMethER.pdf](http://www.showwproject.eu/images/b/bd/140723_scheda_BioMethER.pdf) and [http://www.crpa.it/media/documents/crpa\\_wwww/Convegno/014/20141102\\_Ecomondo\\_RM/Piccinini\\_5-11-2014\\_Biomether.pdf](http://www.crpa.it/media/documents/crpa_wwww/Convegno/014/20141102_Ecomondo_RM/Piccinini_5-11-2014_Biomether.pdf)

## 7. Conclusion

This paper investigated the framings of sustainable biogas development in Emilia Romagna (Italy) and was particularly interested in exploring how the feedback processes influenced the former framings and pathway of change, and how the mutual influence of dominant and alternative framings of bioenergy development (socially, economically and environmentally) contributed to processes and outcomes that were more accommodating of rural communities' goals, values and needs. The empirical findings have demonstrated the powerful role of feedbacks in terms of complex interrelations between different framings and material changes in the system. The study has therefore made three distinct contributions: first, it brings forward and operationalises the concept of feedback within the pathways approach; second, its application in a European context of sustainable bioenergy development demonstrates how the pathways approach (and its attention to social inclusion, equal redistribution and sustainable exploitation of natural resources) might be considered in the 'developed' world; third and last, it has some important policy implications.

The study demonstrates that the analysis of feedback relations can give both a greater insight on the forces that drive a system's change in new directions and enable a much more comprehensive account of the policy implications of such dynamics. This brings us to the issues of social inclusion, redistribution and local environmental effects of bioenergy development in the European context and policy implications. In this case of Italy, feedback effects were brought about within the context of a neoliberal democracy, where citizens can raise their voice without risking dangerous consequences and where they may hope to have a real effect on policy-makers. As in earlier STEPS work, this European case study shows that dominant framings, frequently driven by powerful stakeholders' interests, often tend to neglect the alternative framings and follow top-down and profit-led policies and exclusive governance. They may also forget the impact of feedback mechanisms, namely that local communities would most likely react when powerful interests and top-down policies endanger their life and local environment. Further consideration of complexity and feedback within the social-technological-ecological systems is advised to avoid such challenges in the future and to identify more robust pathways to sustainability (in the bioenergy domain or elsewhere).

The policy implications of this finding point to inclusive, 'broadened out' (Stirling *et al.* 2007) processes such as local or regional platforms where citizens can engage in decision-making, as well as processes through which organisations, businesses and other groups can meet together and share ideas, concerns and future plans. It also points to the possibility that national policies should decentralise part of the bioenergy planning responsibilities to municipalities, which would be more likely and capable of listening to, and addressing, local perspectives. Policies could also grant flexibility in terms of local adaptation to biophysical and natural characteristics, environmental and social needs. For instance, the soil quality may be poor in one locality and thus require a different approach to the use of digestate, biomass storage etc. Lastly, regional or local research or business programmes could foster, for instance, the formation of local synergies among local actors on biomass supply and infrastructure-development for the delivery not only of electricity but also of bioheat.

The insights from this paper also offer lessons (although as yet relatively underdeveloped) for those actors who may wish to redirect pathways towards more socially just or environmentally sustainable ends. Use of the moratorium as a political strategy and other advocacy tools that amplified the alternative framing are the key examples. Whilst these findings are limited to the case study in question, they raise the question of whether similar processes are, or might be, at play in other controversial areas (for example, fracking, transgenic food and crops) where global/national/local

framings are markedly different and the possible amplification of alternative framings could lead to the redirection of current pathways.

Further research could build upon the methodological and theoretical approach of studying frame-system-frame interactions and feedbacks. Further research could be more specific with respect to a formal definition of the notion of feedback and develop a better structured methodological framework to support the causal claims made in the study. The methodology employed in this paper allowed us to explore the influence of actors' perceptions and expectations on the bioenergy pathways in Emilia Romagna. However, the study could benefit from a more formal methodology, and in-depth longitudinal analysis that would allow a more robust mapping of the causal links between changing framings and the system. Additionally, future research could discuss in more depth the role of human perceptions of the system, and how these could be integrated in the discussion around feedback and causality.

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## Annex 1 - Key Interviewees

Informants	Area	Date	Reference
<b>Biogas businesses</b>			
	<b>Province</b>		
biogas cooperative	Bologna	24/11/14	1
biogas cooperative	Bologna	15/09/14	2
biogas cooperative	Bologna	22/09/14	3
biogas cooperative	Reggio Emilia	07/11/14	4
HERA multi-utility <sup>21</sup>	Bologna	11/02/15	5
biogas firm	Bologna	02/12/14	6
biogas firm	Bologna	11/09/14	7
biogas firm	Ferrara	24/11/14	8
IREN – multi-utility <sup>22</sup>	Parma	06/03/15	9
biogas firm	Ferrara	21/10/14	10
biogas cooperative	Reggio Emilia	11/10/2014 e 11/11/2014	11
biofuel cooperative	Ravenna	05/08/14	12
bioenergy cooperative	Ravenna	10/11/14	13
biogas firm	Ferrara	29/07/14	14
<b>Public institutions</b>			
Environmental Agency (ARPA)	Bologna (regional council)	21/11/14	15
Environmental Agency (ARPA)	Bologna	28/11/14	16
Municipal Council	Ferrara	03/11/14	17
Municipal Council	Medicina (Bologna)	21/11/14	18
Department of Environment	Bologna (regional council)	18/02/15	19
Department of Environment	Bologna (municipal council)	09/02/15	20
Department of Economic Development - Energy Section	Bologna (regional council)	20/10/14	21

<sup>21</sup> Since 2002, **Hera** combines public service companies (11 of them operating in **Emilia-Romagna**) into a single **multi-utility**. Nowadays, Hera is one of Italy's largest local utilities and operates mainly in Environmental services (waste collection and treatment), Energy services (distribution and sale of electricity and gas) and Water services (waterworks, sewerage and purification). [http://eng.gruppohera.it/group/who\\_we\\_are/](http://eng.gruppohera.it/group/who_we_are/)

<sup>22</sup> IREN, a multiutility company listed on the Italian Stock Exchange, operates in the sectors of electricity (production, distribution and sale), thermal energy for district heating (production and sale), gas (distribution and sale), the management of integrated water services, environmental services (collection and disposal of waste) and services for the local authorities. Iren is structured as an industrial holding with its main corporate offices in Reggio Emilia, operating units in Genoa, Parma, Piacenza, and Turin, and separate companies in charge of the individual business lines. Holding company, Iren S.p.A. handles strategic, development, coordination and monitoring activities, while the operating companies ensure the coordination and development of the business lines. [http://www.gruppoiren.it/chi\\_siamo.asp](http://www.gruppoiren.it/chi_siamo.asp)

Municipal Council	Ravenna (in the province of)	02/10/14	22
Department of Environmental	Province of Ferrara		23
<b>Farmers Unions and Interest Organisations</b>			
CIA (regional office)	Bologna	24/02/12	24
CIA	Ferrara	10/12/14	25
Italian Biogas Consortium (CIB)	Milano	23/06/14	26
CNA Emilia Romagna	Bologna	29/10/14	27
COLDIRETTI (regional office)	Bologna	02/02/15	28
COLDIRETTI	Ferrara	29/07/14	29
Confagricoltura (regional office)	Bologna	21/11/14	30
Legambiente	Bologna	28/02/12	31
<b>Research Centers and Innovation Platforms</b>			
CISA	Bologna	03/11/2014 & 28/08/2014	32
ASTER (Emilia Romagna)	Bologna	22/09/14	33
University of Ferrara (Economic History)	Ferrara	06/08/14	34
CRPA	Reggio Emilia	30/05/14	35
University o Bologna (History of Regional Economic Development)	Bologna	17/04/14	36
University of Bologna (History of the Energy System)	Bologna	16/06/14	37
<b>Local Committees</b>			
Comitato Argenta	Ferrara	12/03/2012 updated in January 2015	38
Comitato Galliera	Bologna	05/12/14	39
Comitato Vigarano	Ferrara	12/03/2015 updated in January 2015	40
Comitato Sgonfia il Biogas		23/09/14	41