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# FROM FOSSIL FUELS TO A BIO-BASED ECONOMY: IDENTIFYING THE RATIONALES FOR POLICY INTERVENTION

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*The concept of the bioeconomy is gaining in political importance in Norway and elsewhere in the world; moving from fossil-based to bio-based products and energy is considered to be important in tackling multiple societal problems, from climate change to food security, from health to industrial restructuring. At the same time, there are several important concerns and trade-offs inherent within the area of the bioeconomy, especially linked to the sustainability aspects of the extraction and use of biomass. This policy brief discusses the key perspectives from the contemporary debates on bioeconomy development and summarises the academic views on what may legitimise policy interventions for transformative change.*

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## **1. The politics of sustainable bio-based economies**

Climate change, the increasing global population, natural resource scarcity and environmental pollution are societal challenges that call for new solutions and system change. National governments, therefore, are developing strategies to overcome the negative effects of the current systems of production and consumption.

Over the past decade the vision of a bioeconomy has increasingly attracted political attention, as it represents an opportunity to transform societies from fossil fuels to a bio-based economy. Bioeconomy policies represent opportunities for achieving increased economic growth and employment and simultaneously contributing to achieving sustainability goals. At the same time, the current bioeconomy strategies may be too broad and represent ideas which try to do “something for everyone”, which leads to fragmented policy frameworks (Birch, 2016).

One central question is the balance between economic growth and the sustainability concerns related to the extraction and utilisation of biomass: **are these concerns in conflict or can policies contribute to a decoupling of economic growth from the use of resources?**

## **2. Three visions of bioeconomy**

A main message from available studies is that the transition to a sustainable bioeconomy does not represent one predetermined path, but remains a future possibility. There is still little clarity in terms of what the notion of the bioeconomy implies and means. To make sense of the different meanings and interpretations, Bugge et al. (2016) point to three ideal types for interpreting the bioeconomy:

- The first represents the *bio-technology vision* and emphasises the importance of the development, application and commercialisation of bio-technology in different sectors. The main objectives in this vision relate to economic growth and job creation.
- The second type is referred to as the *bio-resource vision* and focuses on the extraction and processing of bio-based resources as the primary driver and objective for innovation and economic growth. Whereas economic growth in the bio-technology vision is based on capitalising on biotechnologies, growth in the bio-resource vision is expected to come from capitalising on bio-resources.
- The third, *bio-ecology-vision* highlights the importance of ecological processes that



optimise the use of energy and nutrients, promote biodiversity and avoid monocultures and soil degradation. Moreover, this vision highlights participatory policy processes and advocates for local solutions.

### 3. A balancing act

These three visions illustrate that the bioeconomy as a concept has emerged as a highly contested idea, charged with different meanings and perceptions. For instance, critics argue that feedback effects from the use of biotechnology are often ignored, and that environmental risks and ethical concerns need to be balanced against economic growth objectives.

There also seems to be divergent ideas about what makes sense in terms of spatial focus, scale and scope of the bioeconomy: the strategies of those proposing an increased exploitation of global value chains and large-scale centralised production systems (the bio-resource vision) appear to contrast the idea of a bioeconomy based on local, small-scale decentralised production systems (the bio ecology vision). In agriculture, these visions appear with a continued emphasis on mass production and monoculture on the one hand, and prioritising small-scale organic biological practices on the other (Bugge et al. 2016).

Sustainable food systems will require many new approaches involving both technologies and altered social initiatives, such as “the revival of traditional crops, food-sharing platforms and low-meat diets” (El-Chichakli, et al., 2016).

The bioeconomy as a global phenomenon requires attention regarding the balance between rebuilding natural capital and assuring quality of life for a growing world population (ibid). According to Geels (2011) it is important to bear in mind that sustainability is an ambiguous and contested concept and that there will be disagreement and debate about the directionality of sustainability transitions, the (dis)advantages of particular solutions and the most appropriate policy instruments. A concrete example of such

disagreement is the current policy debate in Norway on the use of bio fuels, where short term ambitions for reduced CO<sup>2</sup>-emissions from transport stand against long term climate policies and concerns for biodiversity. This example also reminds us that a good policy mix is not just about getting the right mix of instruments, but also about **consistency in policy strategies and processes**. (Rogge and Reichardt, 2016)

Nevertheless, responding to pressing societal challenges remains an imperative task for contemporary policymakers at different levels of governance, and their policy actions (or inaction) will have a significant impact on future developments.

### 4. What legitimises policy intervention for transformative change?

In recent years, scholars within the field of innovation studies have increasingly been interested in understanding the complex features of policies addressing “grand societal challenges”, such as climate change, loss of biodiversity, resource depletion, health and urbanisation. Addressing such problems require broad systemic changes and novel approaches by innovation policies (Schot and Steinmueller, 2016; Kuhlmann and Rip, 2014). It is widely recognised that the increasing inter-connectedness of global risks and problems requires new governance forms and a state capable of defining and designing policies addressing the challenges defined.

The literature also emphasises how the governance of transitions towards sustainability requires an engaged and *entrepreneurial state* playing a central part in providing the basis for new technologies and shaping the directionality of innovation (Mazzucato 2013). In this view, the role of the state should not be confined to only facilitating and removing barriers in innovation systems by supporting the capability and connectivity of actors and systems to innovate. Traditionally, market failures, such as under-



investment in research, have justified different forms of generic R&D subsidies, tax incentives, or measures facilitating access to venture capital. Strengthening university-industry collaboration has also been considered an important rationale for policy intervention. However, these interventions are primarily designed to address the structural deficits of innovation systems. They are less useful in terms of addressing politically and socially desirable change. In the latter case, the challenge is to understand not only how firms may become greener, but how the emergence of **new configurations of actors (policy, companies and civil society), institutions and novel ways of producing and consuming** may lead to system change (Weber and Rohracher, 2012). Hence, the focal unit of analysis are so-called socio-technical regimes (Geels and Schot, 2010).

#### 5. Rethinking innovation policy and its rationale

Recently, concepts such as *Innovation policy 3.0* and *Deep Transitions* have been introduced into the scholarly debate to indicate that it is time for innovation policy “to focus much more on the achievement of systems wide transformations, since optimisation of existing systems will not be a sufficient answer” (Schot and Steinmueller, 2016, p. 17). **In this context, policies for transformative change need to emerge out of new types of rationales.** Weber and Rohracher (2012), distinguish between four types of failure in legitimising policies for transformative change:

- 1) *Directionality failure*
- 2) *Demand articulation failure*
- 3) *Policy coordination failure*
- 4) *Reflexivity failure*

Each of these failures legitimises specific policy actions and can be used to guide the development of policy approaches to addressing societal challenges.

First, failures linked with the question of *direction* require **technology-specific policies**, targeting the large-scale diffusion of new technologies. The

creation of shared expectations and future visions is central. This calls for policymakers to set **strategic political preferences** which prepare the ground for consistent policy frameworks.

Second, *demand failure* is about learning about **user needs**, and is important for matching products and services to the requirements of users. Therefore, policies should facilitate interaction between users and producers. Innovative public procurement is a policy instrument which addresses the failures related to creating demand for sustainable products and services.

Third, *coordination* problems across policy domains and levels call for action. This failure implies the need for coordination between levels of governance (multi-level policy coordination), horizontal policy coordination (between sector policies and Research, Technology and Innovation policies), and vertical policy coordination (between ministries and implementation agencies).

Fourth, *reflexivity* failure can be addressed by a broad and systematic use of *strategic intelligence* in policymaking. Reflexivity in this sense, however, goes beyond a mere technocratic analysis of the problems and includes wider societal discourses, in addition to discourses in parliaments and formalised consultation groups within ministries. Preparing specific policies for transformative change requires the continuous support of monitoring, anticipation, evaluation and impact assessment.

#### 6. Policy implications

A general conclusion from the reviewed literature is that the bioeconomy cannot be regarded as *one* priority with one set of policy measures. Instead, policies need to consider the tensions, trade-offs and strategic choices *within* the bioeconomy. More specifically policies need to take into consideration the following aspects:

- The balance between centralised mass production systems and local small scale



biological practices requires an alignment of bioeconomy policies with e.g. regional policies and transport policies.

- A traditional science push policy may be adequate for a biotechnology vision, but less appropriate if policies are driven by a bio-ecology vision.
- For the bio-based economy to flourish, there needs to be a balance between feedstock-push, technology push instruments and market pull instruments
- Policies for a resource-effective, circular and sustainable bioeconomy need to follow the principles of the cascading use of biomass, which increases the productivity of raw materials (Carus et al. 2015a, 2015b).
- Innovation policy should give a clear direction towards what is supposed to be achieved. This implies that policies must be targeted and based on an active state, which goes beyond the role of “fixing market failures”.
- A further requirement is for coordination and reflexivity across multiple (and diverse) policy frameworks, embracing, for instance, regional, sector, and foreign policies.

Making choices between divergent solutions (scope vs. scale, centralised vs. decentralised, local vs. global, etc.) is therefore necessary.

**Note:** the content of this policy brief was inspired by ongoing research, including discussions from two recent policy workshops arranged by the SusValueWaste project.

For more information please visit the project website: <http://www.susvaluwaste.no/>

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