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Testing transformative energy scenarios through causal layered analysis gaming

Sirkka Heinonen [a,*], Matti Minkkinen [b], Joni Karjalainen [a], Sohail Inayatullah [c,d]

[a] Finland Futures Research Centre, University of Turku, Korkeavuorenkatu 25 A 2, 00130 Helsinki, Finland
[b] Finland Futures Research Centre, University of Turku, Rehtorinpellonkatu 3, 20500 Turku, Finland
[c] Tamkang University, Taiwan
[d] University of the Sunshine Coast, Australia

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ABSTRACT

This paper presents the results of an innovative pilot experiment on elaborating transformative energy scenarios by using a causal layered analysis (CLA) game. CLA is an integrative and communicative method, which divides issues into four layers: litany, systemic causes, worldviews, and metaphors. In the piloted CLA game, four existing scenario drafts from the Neo-Carbon Energy project: "Radical Startups", "Value-Driven Techemoths", "Green DIY Engineers" and "New Consciousness" were used. The CLA game session, as depicted in this paper, worked through the CLA layers sequentially per each scenario, contributed new elements to the scenario narratives, and utilised roleplay for the worldview and metaphor layers. This CLA game highlighted the complexity, polyphony and actor dynamics of the future worlds. We identify four key benefits: developing the CLA game scenario methodology, gaming-based social learning, deepening of sociocultural energy scenario drafts and exploration of energy transformation toward renewable energy based futures. As a new type of CLA workshop, the game expanded the method's boundaries. Recommendations are presented for developing serious gaming further in scenario processes.

1. Introduction

Transforming the energy system is one of the greatest global challenges. Climate change is caused by the increase of global atmospheric concentrations of greenhouse gases. In particular, the level of carbon dioxide (CO_2) is increasing at a worrying rate, if we want to restrict global warming below + 2 °C degrees (IPCC, 2014; NOAA/ESRL, 2016). Despite an increasing appreciation of renewable energy, around 80% of the world's primary energy is still produced with fossil fuels (IEA, 2015). In the recent decades it has become clear that for reaching a sustainable future, business as usual approaches are inadequate, and therefore more radical and discontinuous scenarios are urgently needed. However, the field of energy is a complex environment-society system whose evolution is difficult to model because it includes societal responses (Valkering et al., 2013). Hence, radical approaches and experimentation are needed, not only in the content of scenarios, but in scenario methodology itself.

This paper presents the process and results of an innovative experiment on elaborating transformative energy scenarios by using a causal layered analysis (CLA) game. The experiment of combining scenarios, CLA and gamification took place during the International Conference "Futures Studies Tackling Wicked Problems" in Finland in June 2015. Scenarios from the Neo-Carbon Energy project were used as materials for the game. The aim was to test and elaborate existing scenario sketches in a participatory setting. The interactive three-hour game was moderated by a game team which included the authors of the Neo-Carbon Energy scenarios.

In the first two sections, we will discuss the role of serious gaming in futures studies and the interlinkages between the CLA method, serious gaming and scenario-building. Then, we will illustrate how this causal layered analysis game was conducted. The choices made during planning and execution of the CLA game are explained and critically discussed. In the discussion section, we will explain what the benefits of our CLA game approach are. We argue that through the CLA game, we were able to promote methodological development of scenarios and CLA and generate a setting for social learning for the workshop participants. Gaming can be used to deepen sociocultural energy scenarios and ultimately strive to promote transformation of the energy sector. We explain practical considerations that need to be taken into account in a gaming session, and make suggestions how a gaming approach that uses scenarios could be improved in the future. The causal layered analysis game is presented as a pilot case study which may be further elaborated in subsequent workshops. In future research, closer investigation of the hypothesised learning outcomes of such gaming exercises is warranted. Translating the societal implications of the scenarios into energy policy remains a challenge.

* Corresponding author.
E-mail address: sirkka.heinonen@utu.fi (S. Heinonen).

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2. Literature overview: scenarios, gamification and causal layered analysis

2.1. Sociocultural energy scenarios

The CLA game exercise brought together three futures research approaches: sociocultural energy scenarios, gaming, and causal layered analysis. In the past, various scenario building methods have been used to make climate and energy scenarios. Forecasting approaches have traditionally been influential in policy-making, while backcasting approaches have become increasingly relevant. In forecasting, formal quantitative models, often based on rigid assumptions about system dynamics, are used to forecast total energy consumption and the level of CO_2 emissions (Hong, 2014; Hong et al., 2016; Silberglitt et al., 2003). Transition and backcasting approaches, in turn, have been developed to find sustainable energy solutions and to move beyond the limits of extrapolating from past or present trends (Grubler, 2012; Kemp, 2010). Recently there have also been increasing calls for participatory approaches to scenario building to take into account stakeholder views and qualitative sociocultural factors such as values and lifestyles (Cairns et al., 2013, 2016; Wangel, 2011).

Clear methodological guidelines have been proposed for transformational sustainability research (Wiek and Lang, 2016). We define *transformative* energy scenarios as explicitly normative scenarios which take the necessity of radical change as the starting point (Börjeson et al., 2006). As a distinctive qualitative approach to scenario-making, sociocultural energy scenarios are narratives that seek to account for the broad economic and political context of possible energy futures (Miller et al., 2015; Upham et al., 2016). Within qualitative sociocultural scenarios, the 'intuitive logics' method remains the most established scenario technique (Wright et al., 2013).

In the literature, scenarios are seen as learning devices which are meant to produce "epistemic value-added" and tackle uncertainty (Aligica, 2005; Rhisiart et al., 2015). In particular, scenarios help to challenge and reframe perceptions about the dynamics of complex systems (Wilkinson et al., 2013; Wright et al., 2013). Trutnevyte et al. (2016) suggest that scenarios should not only be produced but they should be iteratively evaluated and improved, focusing on scenario users' needs. Thus scenarios can be expected to provide a vehicle for continuous learning about complex systems and the boundaries of uncertainty.

2.2. Serious gaming

In the CLA game, existing sociocultural energy scenarios were evaluated and iteratively improved through gaming. The use of gaming has a long history in the field of futures studies, from the war games developed by Herman Kahn and others after World War II to more recent applications in simulating students' future careers, in prediction markets and in business strategy (Kahn, 2007; Ollila et al., 2014; Prokesch et al., 2015; Schwarz, 2013).

In futures studies, gamification is closely related to the concepts of experimental and immersive futuring. We consider experimental futuring as a broad frame which encompasses immersive futuring and game-based futuring (see Fig. 1). Scenarios as such can be seen as thought experiments which anticipate the implications of action (Aligica, 2005; Andreescu et al., 2013). Experimental futuring takes this characteristic further by experimenting with novel combinations of methods. The methods may involve multisensory immersion in the depicted futures which allows participants to experience multiple futures (Dator, 2009; Heinonen and Hiltunen, 2012; Heinonen and Kurki, 2011; Selin, 2015). This is analogous to virtual reality where immersive techniques are used to create impressions of real life. Various immersive tools can be used to create the impression of being in the future: for instance collages, videos and narratives in physical or digital space. In particular, Vervoort et al. (2010, 609) highlight the role of visualisation in communicating scenarios and making them immersive and experiential.

Immersion in futures can also be achieved through serious gaming, which means playing a game that has a societally important goal. Homo Ludens (Man the Player) is a concept originally coined by Dutch historian Johan Huizinga (1939), who suggested that play is a meaningful activity, free from practical life and its requirements. Gamification as a tool is gaining increasing interest (e.g. Bontoux et al., 2016; Burke, 2014; McGonigal, 2011), and it has significant potential for addressing complex global challenges such as developing sustainable energy systems. Like scenarios, games have communicative power and they can be conceived as instruments for learning (Vervoort et al., 2010, 608). Power Grid (Funkenschlag), designed by Friedemann Friese, is an example of a popular board game about energy. Future-oriented interactive games have been used to educate consumers on sustainable energy (Barrios-O'Neill and Hook, in press). Haug et al. (2011, 969) point out that policy games have been frequently used to stimulate learning on issues of global environmental change. In the corporate sector, games are increasingly adopted to improve leadership skills, test key strategies and enhance the ability to adapt to change (Kinley and Ben-Hur, 2015). Gaming promotes experiential and relational learning, which improves the ability to co-operate and understand other participants' mindsets (Haug et al. 2011, 970).

The Institute for the Future (IFTF) is a pioneer in serious gaming in the field of futures studies. In 2013, they launched a game "Catalysts for Change" where the goal was no less than finding ways out of poverty. Director of Game R&D at IFTF, McGonigal (2011) claims that gaming channels positive attitude, sense of meaning, motivation and collaboration in a real world context. McGonigal has designed alternate reality games aimed at solving difficult real life problems such as hunger or climate change. Some games, such as Superbetter (McGonigal, 2015), focus on improving the health and self-resilience of players.

The causal layered analysis game presented in this article is an example of game-based futuring that is immersive and experimental, although all game-based futuring need not have these characteristics. The objective of this serious game is to test and elaborate transformative energy scenarios. Gaming has previously been connected to scenario planning for instance by role-playing stakeholder reactions to scenario storylines (Wright et al., 2013) and simulating society-environment dynamics through possible interactions among advocacy coalitions (Valkering et al., 2013). Notably, the European Commission's Joint Research Centre together with the University of Hawaii developed a serious game titled the JRC Scenario Exploration System (Bontoux et al., 2016). In this game, participants role-played developments related to a sustainable EU economy, in order to discover alternative futures and to foster stakeholder engagement.

2.3. Causal layered analysis

The CLA game on Neo-Carbon Energy scenarios presented in this paper contributes to the discussion on scenarios and gaming by using causal layered analysis (CLA) as the methodological framework for the game. CLA is a method developed by Sohail Inayatullah, and later applied by several futures researchers and practitioners to a wide range of topics (Inayatullah and Milojevic, 2015; Inayatullah, 2015a,b, 2008, 2004a). Causal layered analysis is a communicative method which uses storytelling and narratives to explore and construct possible futures. A key assumption is that the framing of problems determines how policy solutions are seen (Inayatullah, 1998, 820).

In causal layered analysis, representations of the future are divided into four layers: litany, system, worldview, and metaphor (Inayatullah, 1998, 2004a, 11 – 15; see Fig. 2). Each of the four layers exposes distinct aspects of a scenario: 1) *litany* refers to quantitative problems, trends that are often exaggerated and used for political purposes; 2) *the system* focuses (NB: DEL: layer) on the social scientific explanations of quantitative data and systemic connections, as illustrated by morphological

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