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# A multi-stakeholder decision support system for local neighbourhood energy planning

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**This paper shows the design of a nationally covering decision support system that was made to enhance neighbourhood clean energy planning with multiple stakeholders, initiated by local governments. The system consists of a design process, geospatial data, models and tools. The system was tested in a case study, where it was found that the system enhances collaboration in energy planning. Furthermore, the stakeholders proposed solutions that are not suggested when performing a spatial optimization.**

The transition to clean energy to reach climate goals has become more urgent in the past decades and is recognized by many world leaders [1]. Also the European Union sees the relevance of this transition [2]. The Netherlands has accepted a goal of reaching 14% clean energy in its energy mix by 2020 [2]. The role of local governments in reaching these goals has been shown by Kelly and Pollit (2011) and is recognized by the Dutch government, as they made local governments responsible for reaching the climate goals in the Dutch Energy Agreement. As the Netherlands has currently only 4% of their energy mix consisting of clean energy, the Dutch energy transition needs support for further effective planning. To that end, a good decision support system must be designed. The aim of this study is to design a national covering multi-stakeholder decision support system containing data, models, tools and a design process to aid local governments to make an energy plan towards reaching the climate goals.

In designing such a decision support system, local governmental planning was taken as a starting point, as the local government is often regarded as an appropriate public body to facilitate the energy transition [3]. This decision support system should contain three elements of the extended trias energetica [4] to 1) reduce energy consumption, 2) make use of waste streams, and 3) produce energy through clean energy technologies. The fourth solution, making fossil energy resources more efficient will not contribute to the climate goals and is therefore not useful for this decision support system. The system should be used to deal with the barrier of "lack of information" [5]. This system consists of three issues: gathering data, turning data into information and communicating this information. All these issues can be solved using geospatial data [6]. To use the geospatial data of clean energy technologies in the local context a design process was created based on the so-called Geodesign process [7].

Based on the criteria described above this paper sets out to produce a decision support system. First, the design process is shown in Figure 1. In the first stage, the stakeholders looks at spatial data that describes the current reality,  in order to get to know the area and the possibilities for clean energy technologies in this area. Not all data is readily available, so the unavailable data are to be approximated using mathematical models. Furthermore, some data are classified, and to ensure that not everyone has access, these have authorized access only. Then the stakeholders collaborate and come up with proposals for the energy transition needed. These proposals make up the collaborative energy plan.

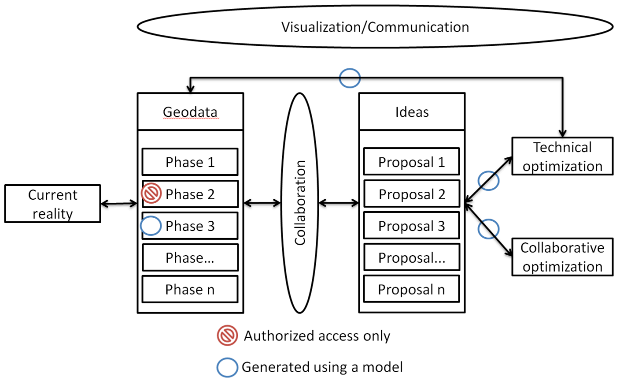


FIGURE 1: DESIGN PROCESS FOR THE ENERGY PLANNING DECISSION SUPPORT SYSTEM.

The geospatial data was mainly collected from the triple helix [8], science, business and government. Data that was not available already was approximated by using mathematical models. Models were made to calculate the energy potential of buildings and larger zones for many different technologies. Furthermore, a model to determine building type was created. All data was integrated into a Spatial Data Infrastructure (SDI). This allows for a combination of data that is stored on different servers to be integrated into one system. The data is then presented to the stakeholders in phases that help the stakeholders gain a solid understanding of context and possibilities of this area. The phases are: socio-economic data, building information, energy consumption, infrastructure, energy potential and location specific data.

These data are then integrated into two tools, which are used to communicate the data. The first tool is a webviewer, where the stakeholders can browse the area by themselves at home or work. As the stakeholders have many different levels of knowledge and understanding, the functionality is kept simple, but extensive explanation of the data is available. The second is a touchtable tool, which is designed to facilitate collaborative planning.

This tool shows the geospatial data, but also allows stakeholders to draw their proposals on the table and perform impact analysis on these proposals. This touchtable tool is used by the stakeholders under supervision of a facilitator, who ensures all stakeholders understand the data, the process and can contribute to the planning process.

The decision support system was tested during a case study in the city of The Hague in the Netherlands. The system was a good way to share ideas and knowledge between the different stakeholders and to come up with original, broadly supported proposals for energy solutions in the case study area. Furthermore, the stakeholders made certain proposals that were not in the technical optimization, and rejected certain proposals from the technical optimization. For instance, the technical optimization showed that the rooftops of apartment buildings were suitable for solar panels. However, in the collaborative session this was rejected, as there is national policy that makes this solution complicated and expensive. However, it became apparent that for certain decisions more data was required. This can be solved by either expanding the nationally covering system, or a second session can be hosted including data gathered for this specific location.

It was shown that the system works well but that there is added value to iterating the process. It enables communication between stakeholders and it enables them to come to an informed and broadly supported energy plan that differs from a technical optimization, as new constraints were discovered during the session. Implementing this system will therefore advance the progress of implementing clean energy solutions towards meeting the climate goals.

## REFERENCES

[Please reference journal articles like this:]

[1] United Nations (2016): *Marrakech partnership for global climate action,* Marrakech: United Nations

[2] European Union (2009): *Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from clean sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (Text with EEA relevance),* Official Journal of the European Union, L 140

[3] Kelly, S. & Pollitt, M. (2011): The local dimension of energy, in: Jamasb, T. & Pollitt, M.G. (eds.): *The Future of Electricity Demand Customers, Citizens and Loads,* Cambridge: Cambridge University Press, 249-279

[4] Vandevyvere, H. & Stremke, S. (2012): Urban Planning for a Clean Energy Future: Methodological Challenges and Opportunities from a Design Perspective, *Sustainability*, Vol. 4, 1309-1328.

[5] Walker, G. (2008): What are the barriers and incentives for community-owned means of energy production and use?, *Energy Policy*, Vol. 36 (12), 4401–4405

[6] Lee, D.; Dias; E. & Scholten, H.J. (2009): *Geodesign by Integrating Design and Geospatial Sciences*, New York: Springer

[7] Goodchild, M.F. (2010): Towards Geodesign: Repurposing Cartography and GIS?, *Cartographic Perspectives*, Vol. 66, 7-22

[8] Leydersdorff, L. (2013). *Triple Helix of University-Industry-Government Relations*, New York: Springer