THE TOUCH TABLE AS A WAY TO DISCUSS A VILLAGE ENERGY PLAN

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Summary

The Dutch national government decided to place a large wind farm called Oostermoer in the Veenkoloniën, the region in the municipality of Aa and Hunze, as this region was designed as search area for the realization of wind energy. This regional task caused social tension in the municipality. In order to solve the disagreement between the government and inhabitants of the villages of the municipality Aa and Hunze, good communication has to be established. The goal of the project "The Touch Table as a tool for sharing ideas on a Village Energy Plan" is to improve the communication between the municipality Aa and Hunze and inhabitants of the villages by using the Touch Table as a tool for discussion and a search for new solutions. A Village Energy Plan is a plan for a village to implement energy options on specific locations, which can be used for planning sustainable energy production in a village. The Touch Table is a digital platform, which allows several users to see and to manage a large amount of data in such a way that it promotes discussion. The team created the method for using the facilities of the Touch Table in order to support a Village Energy Plan design. The method was tested in the village Gasselternijveenschemond. Two interactive sessions with the Touch Table were organized. Participants drew simultaneously on their individual maps, afterwards the maps of all participants were combined in two different ways and the connection to the calculation model, which includes the amount of energy produced by sources, investment per energy source per year and annual revenue per unit per year, was made. The first combined map consisted of the overlapping energy sources, the second map of the non-overlapping energy sources. The maps were created by means of a model in ArcGIS. These two maps were offered to the participants for discussion. Both the Village Energy Plans and the added value of the Touch Table in the discussion were evaluated. From the offered eight options participants of the both sessions prefer isolation, and different kind of solar energy. The total energy produced per year in MWh in the Village Energy Plan in the first interactive session is 1914625 MWh. Despite to the fact that the participants placed only a few large windmills and co-digesters, the biggest part of this energy is produced by this energy sources. The total energy produced per year in MWh in the Village Energy Plan in the second interactive session is 293581 MWh. Energy produced per year is much lower in this Village Energy Plan in comparison with the Village Energy Plan of the first interactive session, mostly because the participants of the second session placed no big windmills. The participants could deal with using the Touch Table and did not think it was too difficult to use. Furthermore, they gave the value of the Touch Table a high score: most of the participants fully agreed with the usefulness of the Touch Table within this project. Therefore it is wise to use this source also in the other villages of the Veenkoloniën. The recommendations regarding the preparation of the Touch Table and the set-up of the interactive sessions are given in this report.

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1. Introduction

1.1 Background

As a result of energy and climate crisis, the European Union has set compulsory targets of 20% of its energy supply to come from wind and other renewable resources by 2020. To meet this target, more than one-third of the European electrical demand has to come from renewable sources of energy by 2020 (European Commission, 2013b).

The Directive 2009/28/EC on renewable energy, implemented by Member States by December 2010, includes national overall targets for the share of energy from renewable sources in gross final consumption of energy by 2020 (European Commission, 2013c). The Netherlands, as a Member State, has to achieve this Renewable Energy Directive target of 14% renewable energy in 2020 (European Commission, 2013a).

In order to implement this plan, the Dutch government intends to install a number of wind farms. The government has denoted the Veenkoloniën as search area for the realization of wind energy. The Veenkoloniën is located in the Province of Drenthe in the North of the Netherlands. The National government decided to place a large wind farm called Oostermoer in the area of the Veenkoloniën. This wind farm is supposed to cover around 2800 hectares (Pondera Consult & BWN partners, 2012).

The regional task of the Veenkoloniën to implement this wind farm in the area caused social tension in the municipality of Aa and Hunze. The inhabitants of the villages of the municipality are not against the energy task, however they are against the placement of huge windmills in their direct surroundings, as this will spoil the landscape, make shadows and noise. Thus they would like to have alternative energy plans which include other renewable energy sources like solar, biomass energy or insulation programs for their villages. The municipality of Aa and Hunze also claims that the negative effect of placing large wind farm could be significant (Startnotie Windpark Oostermoer, 2012)

As both the municipality Aa and Hunze and the inhabitants of the villages of the Veenkoloniën are against placing the large wind farm, the municipality gives the inhabitants an opportunity to participate in designing alternative local energy landscapes. The municipality would like to support the creation of those alternative Village Energy Plans. The main objective of this project is to seize the opportunities of the Touch Table for the communication and discussion between the different stakeholders. The Touch Table is a device, which promotes discussion and decision making. It allows different users to draw simultaneously the location of alternative energy options, to make a comparison of several maps, to combine them in one map and makes the connection with the calculation model created by the student group of VHL (VHL student group, 2013). The Touch Table showed itself as a helpful tool to come up with a possible alternative and sustainable Village Energy Plan for the different stakeholders. See Appendix 9 for an in depth explanation of the Touch Table.

1.2 Problem analysis

As is mentioned in section 1.1, for some of the residents of the area the windmill planning is a problem. The farmers owning the area where the windmill park called Oostermoer would be placed would earn a lot of money. While, at the same time, the value of the land of the neighboring farmers/residents would decrease and those farmers would not receive any profit of the windmill farm in the existing plan. Furthermore, during the meeting of the GIS student group with inhabitants of the village on the 16th of May, they mentioned that it would pollute the horizon, because the reason to live in this area was the wide, free horizon. Above this, the municipality states that the windmill parks will have a negative impact on several factors of living: natural environment, landscape and living environment of the inhabitants of the eight villages located in the Veenkoloniën (Gemeente Aa En Hunze, 2012).

Due to the social tension between the opponents and the ones in favor of the plan, the municipality of Aa and Hunze wants first to investigate the different options in order to understand motivations of the inhabitants of the area and to prevent that people would leave the already low populated area. So, this problem is a problem for the local residents and the municipality in the first place. However, next to the stakeholders mentioned above, more stakeholders are involved in this specific project and the overall problem. A detailed description of those stakeholders and a SWOT analysis of them can be found in Appendix 3.

In order to reach agreement about the different energy sources to be placed in which every stakeholder is satisfied, good communication is needed between them. This communication has been done by means of the Touch Table in which alternative local energy landscapes were developed. To test the method two interactive sessions were organized. The Touch Table allows several participants to create alternative local energy landscapes simultaneously, in this way every participant produces his/her own map, all maps are combined and afterwards the participants discuss the resulting map and adjust or re-draw it. By means of the different designs of the energy plan implementation the different stakeholders had a discussion about a certain local energy landscape. (Appendix 3).

Within this project the method is developed for the use of the Touch Table to support the design of a Village Energy Plan, the Touch Table was programmed and its application was tested for one village in the Veenkoloniën: Gasselternijveenschemond. After the Touch Table application was tested, the use of it was evaluated. Taking into account the results of the evaluation and recommendations, the method can be improved and a better tool can be provided for the other villages and eventually used for discussion and hopefully getting agreement between the different stakeholders about the final sustainable Village Energy Plan.

1.3 Objectives

The main objective of this project is use and evaluate the possibilities of the Touch Table to generate a discussion which is valuable to come to a Village Energy Plan for the village Gasselternijveenschemond including stakeholders from the local community. A Village Energy Plan is a plan for a village to implement energy options on specific locations, which can be used for planning (sustainable) energy production in a village. Energy options and the calculation model prepared by Van Hall Larenstein students were used to program the Touch Table and provide the correct visualizations.

In order to achieve the main objective the following activities were done:

1. A General method for the use of the Touch Table to support the design of a Village Energy Plan was created.
2. Two interactive sessions for the design of a Village Energy Plan for Gasselternijveenschemond village were prepared and executed.
3. Alternative energy landscapes from the interactive session were evaluated.
4. Two maps (from two interactive sessions) of the Village Energy Plans were prepared.
5. The added value of the Touch Table in the Village Energy Plan design process was evaluated, both the user and the technical aspect.

2. Methodology

To reach the main objective of this project as is mentioned in section 1.3, three phases are executed. These are the exploring phase, the planning phase and the executing phase. The phases and the whole complete process are presented in Figure 1.

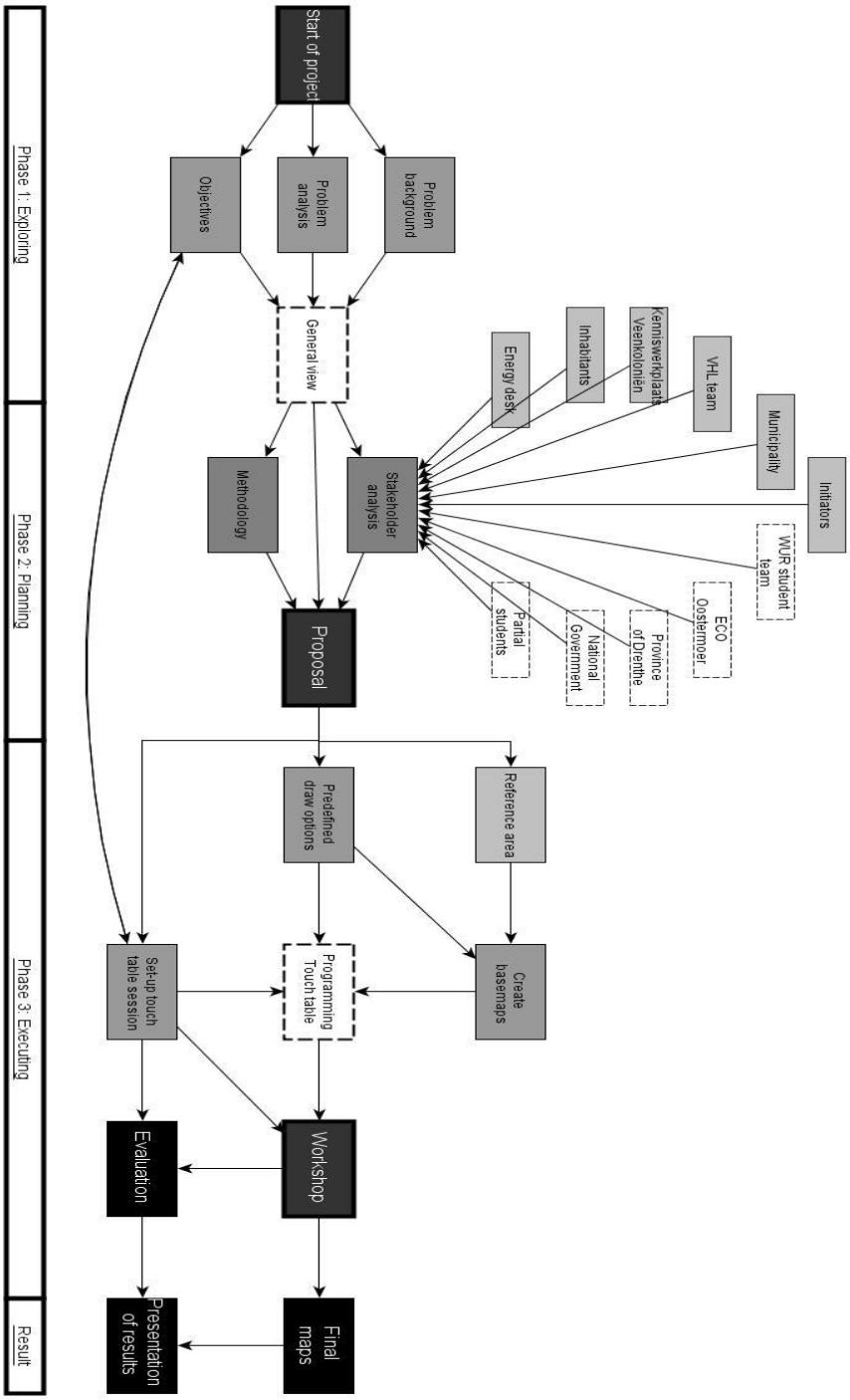

Figure 1: Flowchart methodology

Phase 1: Exploring

In the exploring phase the situation sketch for the project is made. This situation sketch contains in first instance an overall objective. This overall objective shows the problem and the knowledge gap underlying the project. Besides this description of the background a problem analysis is done. This aims on the definition and setting of the problem that is going to be tackled, and why this research is necessary to be executed. Also a view regarding the stakeholders is implemented here. When the background is understood and the problem is set the objectives towards the end goal are described. In the objectives, an expectation can be made regarding the results.

Phase 2: Planning phase

The second phase is defined as the planning phase. In the project "The Touch Table as a tool for sharing ideas on a Village Energy Plan" the stakeholders are an important factor. Because of this, there is an extensive stakeholder analysis executed in this phase, using the SWOT analysis (Appendix 3). Besides the analysis, the methodology and planning are set regarding the entire project. This planning is shown in the GANNT chart (Appendix 4). The methodology is visualized in the flowchart (Figure 1).

Phase 3: Execution phase

For the methods regarding the execution phase, there are three parts which deserve attention: the execution of a session for discussing a Village Energy Plan, the preparation of this session and the evaluation of the Touch Table when using it as a tool to help coming to a Village Energy Plan. These three parts combined generate the method necessary to shape and create the general session which can be used to come to a discussion about a Village Energy Plan. The exact content and execution of the method is described in paragraph 3.1: The session .

A session for discussing a Village Energy Plan

In the organized interactive sessions on Thursday the 13th of June, the Touch Table is used as a tool for generating a discussion about possible implementations of a Village Energy Plan in Gasselternijveenschemond. The tool provides the possibility to communicate and emphasize discussable points on the Village Energy Plan. For the exact Touch Table that is used in this project (Appendix 8) five participants is the max amount of participants. Before the participants start drawing, their initial view and knowledge about the Touch Table and new technologies is gathered using a questionnaire (Appendix 9). Then a brief presentation is given to indicate the goal of this project and the goal of the day. After this presentation, the functionality and usability of the Touch Table is explained by a facilitator. The exact execution of the session is prepared and analyzed beforehand (Appendix 8). To create this preparation test sessions have been held.

In first instance the participants can separately give their ideas in an own map and screen. In this way the individual ideas regarding the Village Energy Plan from a single participant are monitored. The map that is used for this is a map showing the village borders, the basemap. The ideas of the participants can be implemented by the use of eight different stamps indicating eight different energy options. These stamps can indicate the location for the energy option the stamp is representing. Because certain energy types are more efficient or better suitable in certain types of landscape, suitability maps are provided, which can be viewed in the drawing screen to indicate the valuable locations for certain energy options. A participant can easily view these individual suitability maps by making use of arrows which can switch maps. The locations that are already drawn are visible in all their individual maps,

because the drawing is done in a particular overlay. While the participants are drawing their ideas on the map, they are observed in order to be able to analyze their reactions on the use of the Touch Table. Pictures, a video and notes are made during those observations.

After the first individual drawings are finished, those drawings are combined with the combine function of the Touch Table in order to give the participants a global idea of what they all have drawn. During the break the participants have already the chance to discuss this new map. The executing project group then imports the different point datasets, which are generated by a python script converting the placement of the energy options. These point datasets are exported to another computer where they are used as input in prepared GIS models. These GIS models provide output maps and graphs which are exported from ArcGIS and imported into the Touch Table again. There are two discussion maps and indicating graphs coming out of the models. The first map is the different overlapping energy options map, see result Figures 6 and 7. In this map it is shown where the two or more different energy options overlap based on the individual drawn maps. Energy options can have a wider spacing individually according to their influence on the landscape e.g. a windmill is located in a bigger location than isolation. The other map, see result figure 6 and 7 shows the non-overlapping energy options and the overlap of the same energy options. The two maps created by the models in ArcGIS are used to create a discussion between the participants. Participants will visually see overlapping locations of different energy options and can discuss about the individual ideas on which the locations and the options chosen are based on. Besides the maps, graphs are produced, see result. These graphs visualize the amount of MWh produced per energy option per year, the initial investments needed and the revenue of the generated energy per year. During this discussion, the secretary keeps track of the interesting locations and discussion points and writes interesting comments down.

The use of the Touch Table by the participants has time constraints per session. The facilitator tries to keep track of the predefined time schedule and tries to get the most interesting locations and most important discussion points out of them during the indicated time (Appendix 8). There are time constraints because of the chance that the generated discussions will continue endlessly without much progress. The goal of the session is to get the ideas and discussion points ‘on the table’ and not to decide about the final Village Energy Plan. To finalize the session people are asked to fill in questionnaires to find out the experience and their opinion about the session and the use of the Touch Table in order to come to a discussion about the Village Energy Plan.

The session has been tested twice on the 13th of June to discuss possible realizations for a Village Energy Plan in Gasselternijveenschemond. These sessions are held with a different group of participants. A detailed description of the division of those sessions is given in Appendix 8.

Preparing the session

The two "test" interactive sessions which are done with inhabitants of Gasselternijveenschemond on Thursday the 13th of June needed preparations. The session is described in the former paragraph where seven points came out that where prepared. These points are described below. A more detailed time schedule of the test day including the two test interactive sessions is given in (Appendix 8)

Questionnaire expectation of participants

The questionnaire about the expectation of the participants with regard to the use of the Touch Table in the discussion about the Village Energy Plan (Appendix 8) has been created based on theories from Jaap van der Meijden, Ron van Lammeren, Arend Ligtenberg and C.M. Goossen. The questions aim on the characteristics of the participants, e.g. age and gender, the expectation they have regarding the use of the Touch Table and on the opinion of the participants about the Village Energy Plan.

The base map

A clear basemap should be provided to the participants in order to let them be able to stamp their ideas on this map. This base map needs to be recognized by the participant easily. The project location was Gasselternijveenschemond and a map of this village has been created which can be used as base map. An aerial map of the village borders has been cut out which originated from the base map Imagery from ArcGIS. This shows a common aerial view where people are most likely to be familiar with: it looks like a Google maps image.

Stamps

In this project, special stamps where created to use on the Touch Table. In the interactive session these stamps are used to put the different energy options at certain locations on the maps. The following materials are used for stamp making: paper clip, paper, foam rubber or plastic, code images and label images. Each image has to be placed in a specific location: the small code image should be placed on the bottom of the stamp and the label image which are used to know the meaning of the stamp should be on top (Figure 2).

Figure 2: View of stamps and code which is on the bottom of the stamp

Suitability maps

The different energy options that are possible to stamp in the map have different characteristics and can be more profitable to place in specific locations. Therefore, three suitability maps have been created. The participants can use these suitability maps to better reason their choices for the locations of the energy options. One of the suitability maps is the map with houses. Another suitability map is the map indicating the fields in the area. The third suitability map indicates the waterways. In Appendix 6 more information and visualization of the suitability maps is given. Which energy options belong to which suitability map is indicated in a table which is displayed during the session via a PowerPoint presentation. On the suitability map with houses the energy options: Soltech, PV-panel, Isolation, V3 and small windmills are expected to be drawn. On the suitability map indicating the fields the energy options: PV-panel, co-digester, small windmills and large windmills are expected to be drawn. And for the last suitability map, waterways, the floating panels are expected to be drawn.

GIS Models

In Appendix 2 the technical methodology is explained in detail regarding the GIS models and the scripting. Underneath the general process which the models have followed is described.

The GIS models convert the created point datasets, containing the locations for the different energy options created by the participants on the Touch Table, to buffer areas in a new map. These buffered areas are used to create two result maps which are used for discussions between the participants. One of the result maps is the different overlapping energy options map. This map shows which different energy options buffers are overlapping.

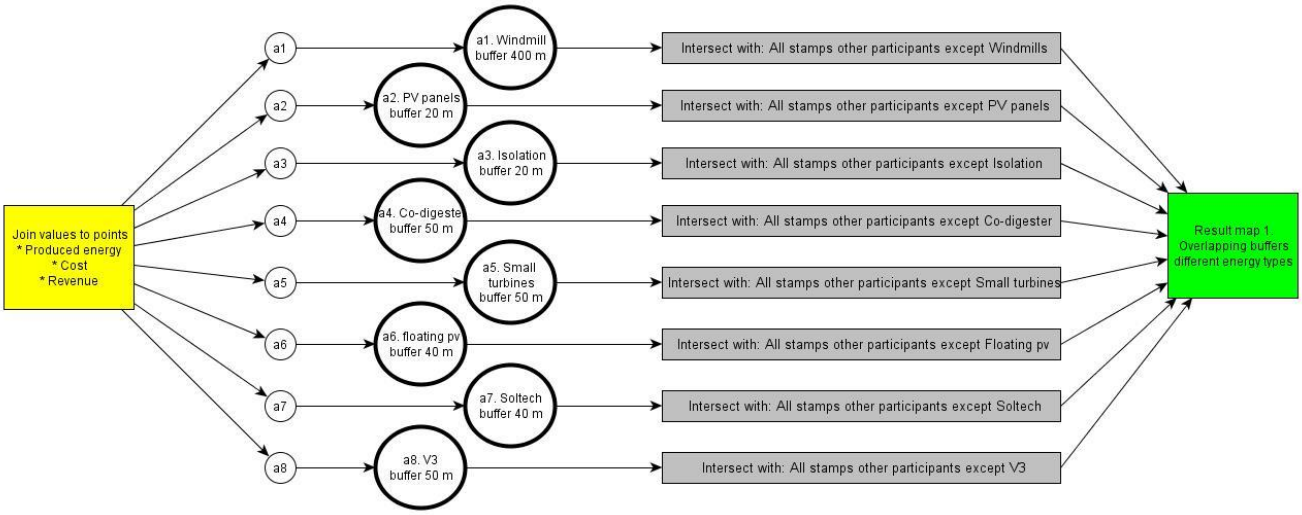

Figure 3: Flowchart to derive the first map containing the overlapping buffers of the different energy options

To create this map, first the point datasets which are created by python scripts underlying the Touch Table, are joined to values of amount MWh produced energy per year, initial investment needed per energy option and the revenue per energy option per year. These values originate from the model given by the VHL student group. These points are buffered to a certain size representing their influence on the landscape. Afterwards, the buffers are intersected with all other stamps of the other participants except the intersections between the same energy options. These intersections are all merged together into a final result map. The

map contains all intersections of the buffers of the different energy options. The flowchart of this method is given in **Error! Reference source not found.**3.

The second result map contains a map indicating all non-overlapping energy options and all overlaps of the same energy options at the same location. In first instance the same steps are followed as in creating the first result map. All points are joined with the values of amount MWh produced energy per year, initial investment needed per energy option and the revenue per energy option per year where after they are buffered according to their size and spatial influence. Then, all buffers are merged together. This creates a dataset with all buffers created by the participants. The buffers created in the first map are then erased from this dataset creating map 2: Non-overlapping stamps and the overlap of the same energy options.

Questionnaire about the experience of using the Touch Table

The experience questionnaire (Appendix 9) has been created based on theories from Jaap van der Meijden, Ron van Lammeren, Arend Ligtenberg and C.M. Goossen. The questionnaire is given after the discussion part of the session and aims on the experience of the participants. It aims on questions indicating the opinion of the participants regarding usefulness, usability, recommendations, positive experiences, negative experiences and judgment of the execution of the Touch Table in the discussion about the Village Energy Plan.

Evaluation of the session and the use of the Touch Table

To evaluate the sessions held in Gasselternijveenschemond on Thursday the 13th of June, there have been four different methods used. These methods are: questionnaires, notes, images\video and observations. The questionnaires are gathered at the beginning and end of the sessions. With the questionnaires, individual views of the participants have been gathered. Especially in the expectation part of the questionnaire it is possible to individually take their opinion without interference of other views. Therefore, from the questionnaire, it is derived the expectations and feedbacks of the participants about the methods and the value added of the touch table in the village energy plan. Besides the questionnaires, there are notes made during the session. This helps to evaluate the activities and individual interactions between the participants during the discussions and possible recommendations. Observations are made on how participants react to the touch table, how they are using it, what they are discussing and what they want to draw in the provided maps. This information can be emphasized and confirmed by taking images\videos and observations. In the end all the gathered data will be used to evaluate the set-up of the session and the use of the Touch Table in a discussion about a Village Energy Plan.

3. Results

3.1 The sessions

The two interactive sessions that are held in order to test the method of the Touch Table in the discussion about the Village Energy Plan of Gasselternijveenschemond have had a certain set up. The way of thinking behind the method is explained in chapter 2: Methodology, The Session. This set up is the method used for evaluating the Touch Table to be a discussion tool for creating a Village Energy Plan. The duration of each interactive session was 2 hours and 45 minutes and the exact program/time schedule is added in appendix 8.The facilitator of the session is responsible for giving an explanation about the use of the Touch Table, to help the participants when it was necessary and to keep an eye on the time schedule of the session. Other group members were observing the behaviour of the participants, making notes, photos and videos.

Per session there are 4 or 5 participants. Considering the size of the specific Touch Table used, this is the maximum amount of participants. Before starting the session there is taken note of the individual views of the participants regarding the Touch Table. This is executed by using a questionnaire, appendix 8, as is explained in the methodology part.

At the start of the session the facilitator informs the participants about the day and the project before letting them work on the Touch Table. Then the Touch Table functionality (Appendix 11) is explained where after the participants can draw for 30 minutes. In these 30 minutes the first 15 could be used for testing where after they can clear their drawings and start drawing their real ideas. The facilitator explains this and makes sure all participants finish their 'real' drawing in time.

After this individual drawing there is a break of 15 minutes. In this break the stamps which are drawn are exported to point datasets. These datasets are copied to a USB stick and on a separate laptop GIS models are run using these point datasets. By running these GIS models two maps and three graphs are produced (paragraph 3.2: The Village Energy Plan) which are used in the second part of the session after the break. The GIS models and the scripts used for programming the Touch Table are provided in Appendix 2.

The result maps and graphs are used for discussion with the participants. They can see the map and values and start discussing about what they see and think. In this process of 45 minutes the facilitator tries to discuss multiple sensitive points. Also the facilitator tries to include all the participants their opinion. The other organizers make notes of the discussion and observe the behaviour of the participants.

To finalize the session the facilitator stops the discussion part and questionnaires are handed out for the participants to fill in. Hereby there is a short reflection talk where in general conversation can found out what the participants thought.

3.2 The Village Energy Plan

During the interactive sessions as explained above people were placing different energy options in their maps. They had 30 minutes to do this. The maps of all the participants were saved via the save button given on their screen. Afterwards, all individual maps were combined to one map. The visualisation of the individual maps of the participants of the sessions and the combined map created on the Touch Table by means of the combine button provided in each individual screen are shown in Figures (4 and 5).The combined map is the Village Energy Plan.

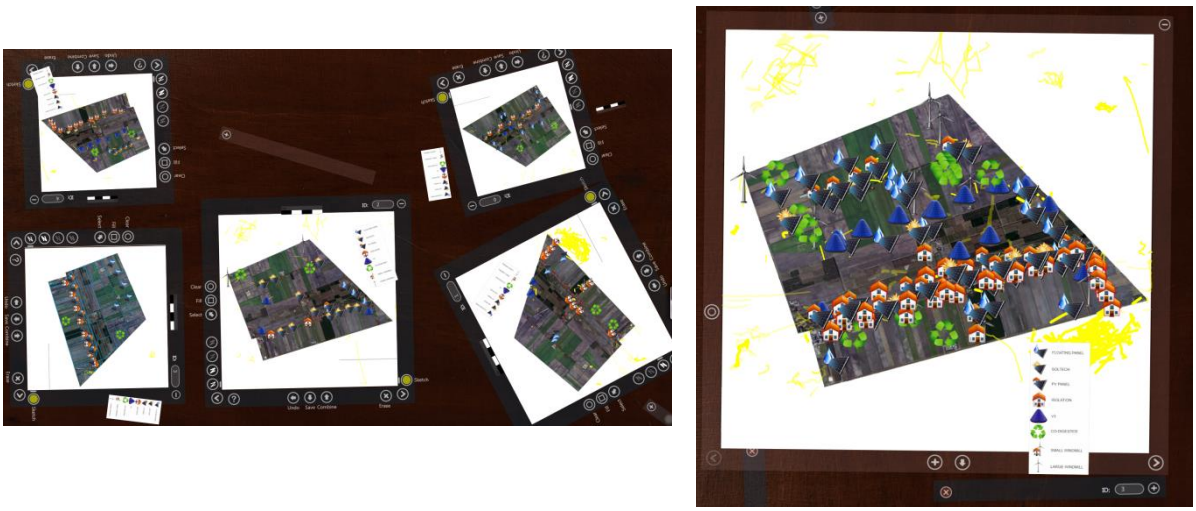

Figure 4: The visualisation of the individual maps of the participants of the first session (left) and the combined map as displayed on the Touch Table (right) (the first interactive session).

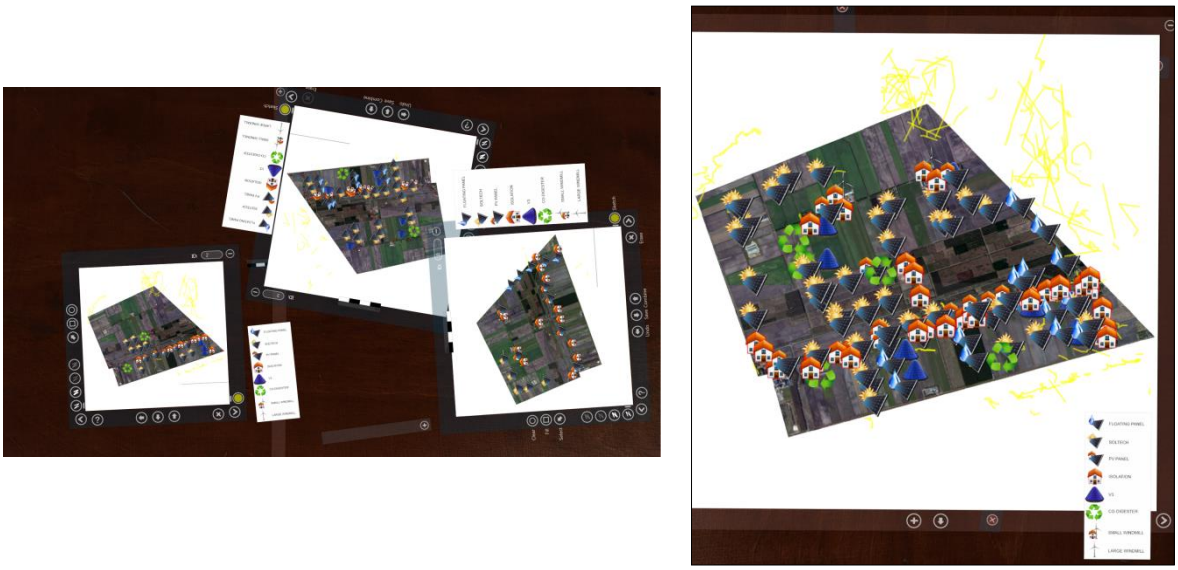

Figure 5: The visualisation of the individual maps of the participants of the first session (left) and the combined map as displayed on the Touch Table (right) (the second interactive session).

After the energy options were placed and the combined map was created, the participants had a coffee-break for 15 minutes. During this time the data, saved by the participants were processed by the team members. The processing of the data was made in ArcGIS 10.0 in laptop. The vector map of all energy options with buffer, which corresponds to the area needed to place this energy option and the vector map of intersected energy options were produced for the discussion part of the interactive session. These maps from the interactive sessions are shown in the Figures (6 and 7).

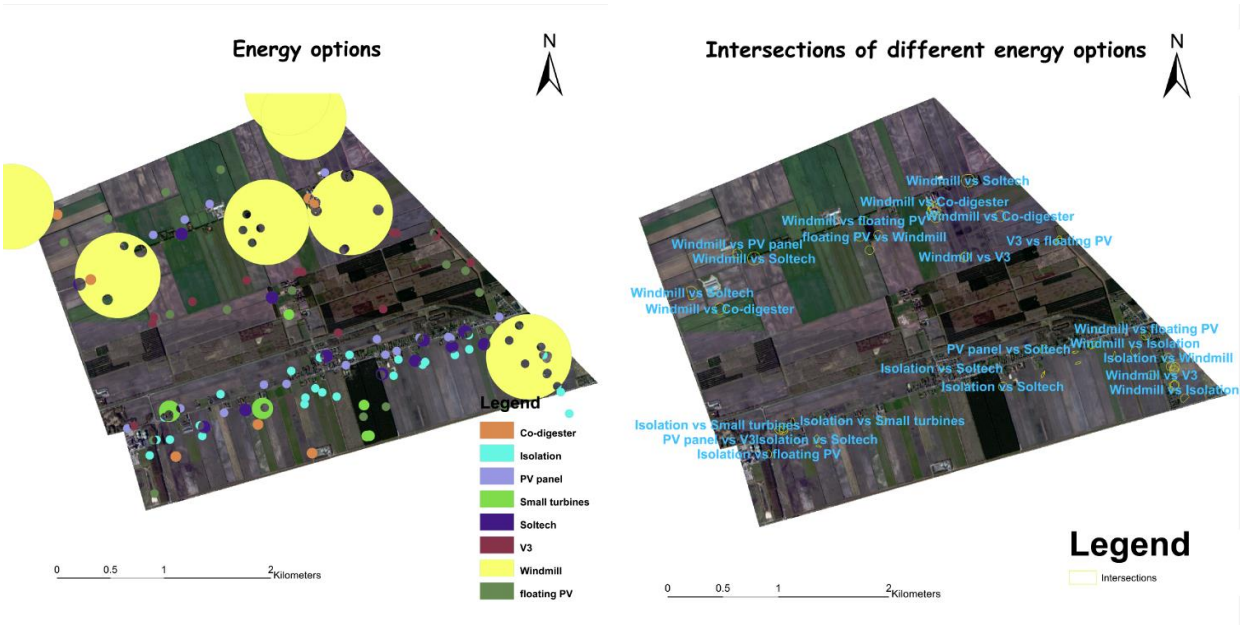

Figure 6: Energy options map and map of intersected energy options (the first interactive session)

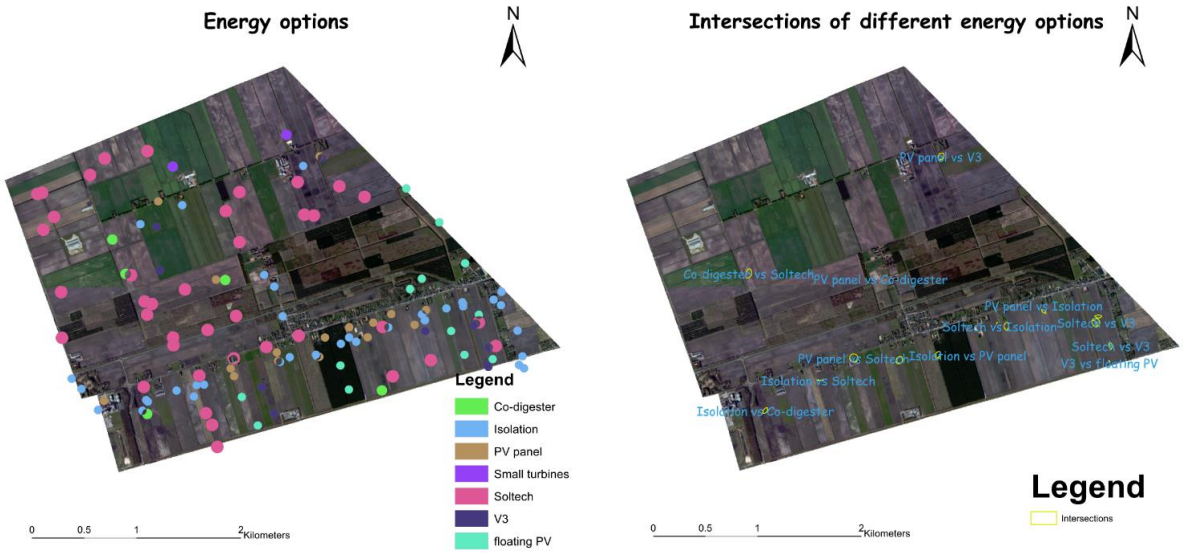

Figure 7: Energy options map and map of intersected energy options (the second interactive session)

Next 45 minutes were given for the discussion. The participants of the interactive session were discussing both the placement of the energy options they created together and the intersected energy options. The graphs presenting the total energy production per year in MWh, the total investment needed per energy option and the total revenue per year were produced in ArcGIS 10.0 (Appendix 2) using the data from the individual maps, which were saved by participants. The participants could see the graphs on the big screen of the projector. The graphs are presented in the Figures 8 and 9 and are from the first session.

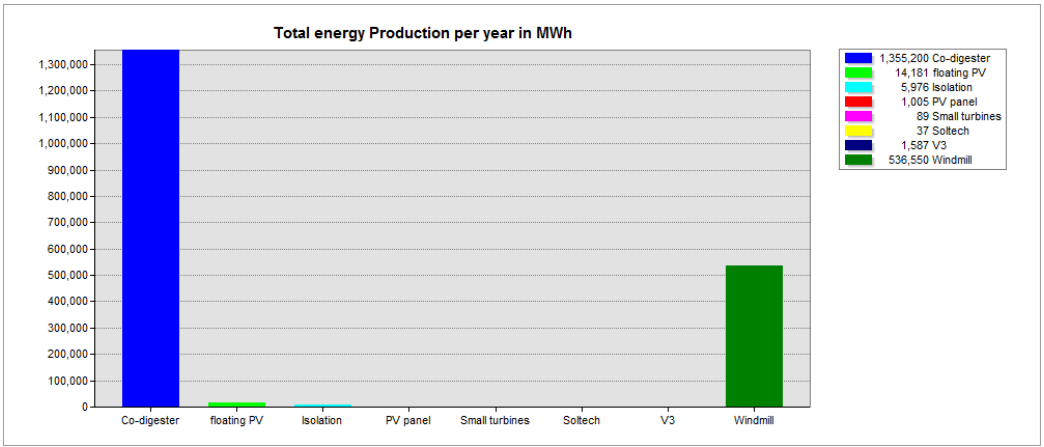

Figure 8a: Total energy production per year in MWh, Session 1

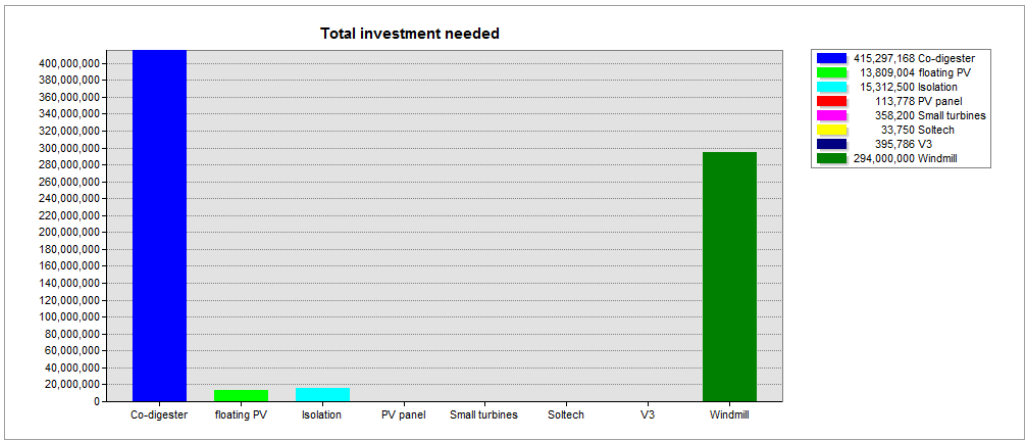

Figure 8b:Total investment needed per energy option, Session 1

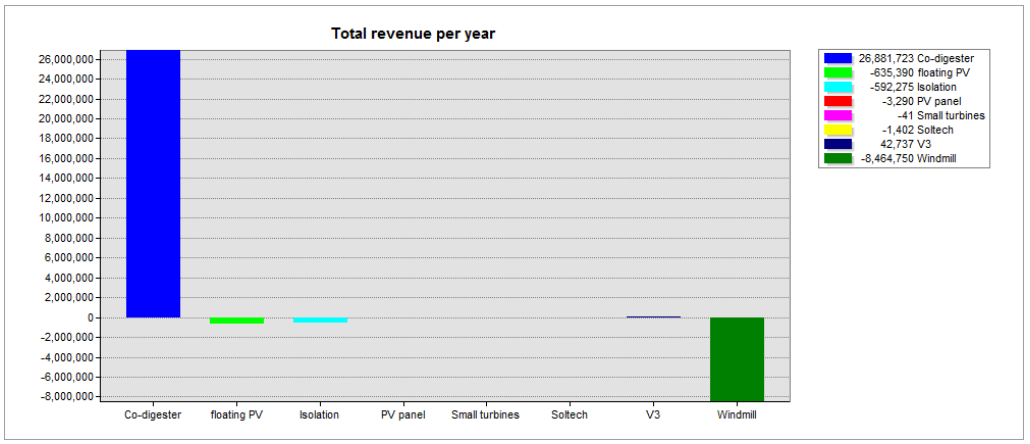

Figure 8c: Total revenue in euro's per year, Session 1

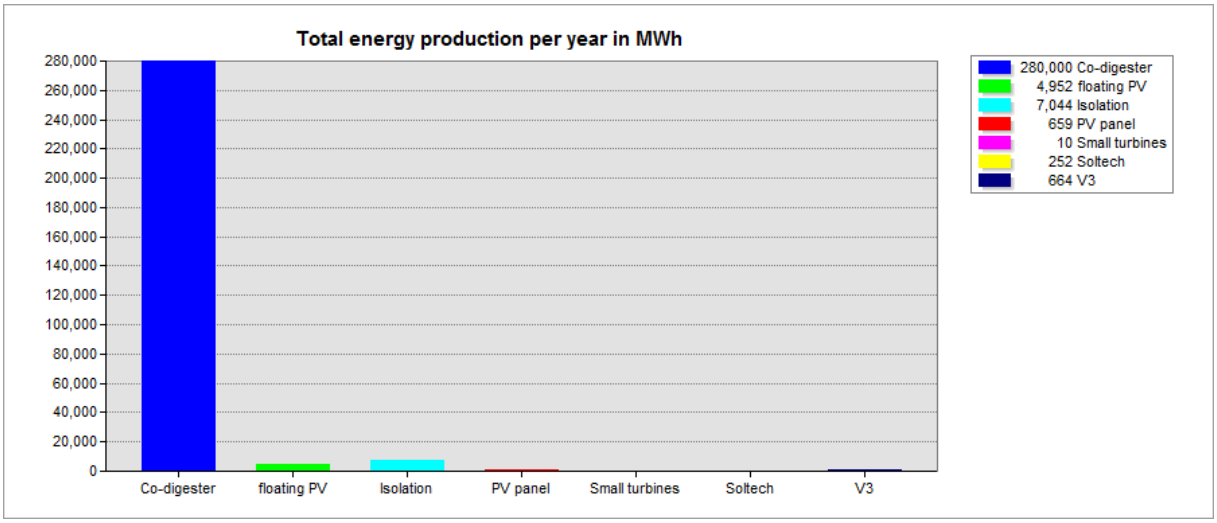

Figure 9a: Total energy production per year in MWh, Session 2

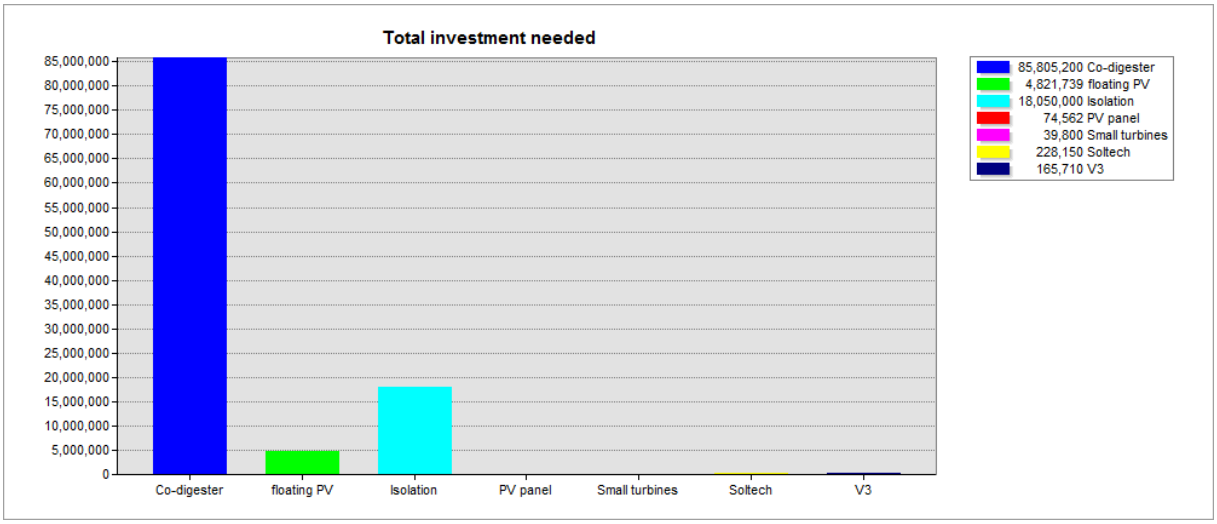

Figure 9b:Total investment needed per energy option, Session 2

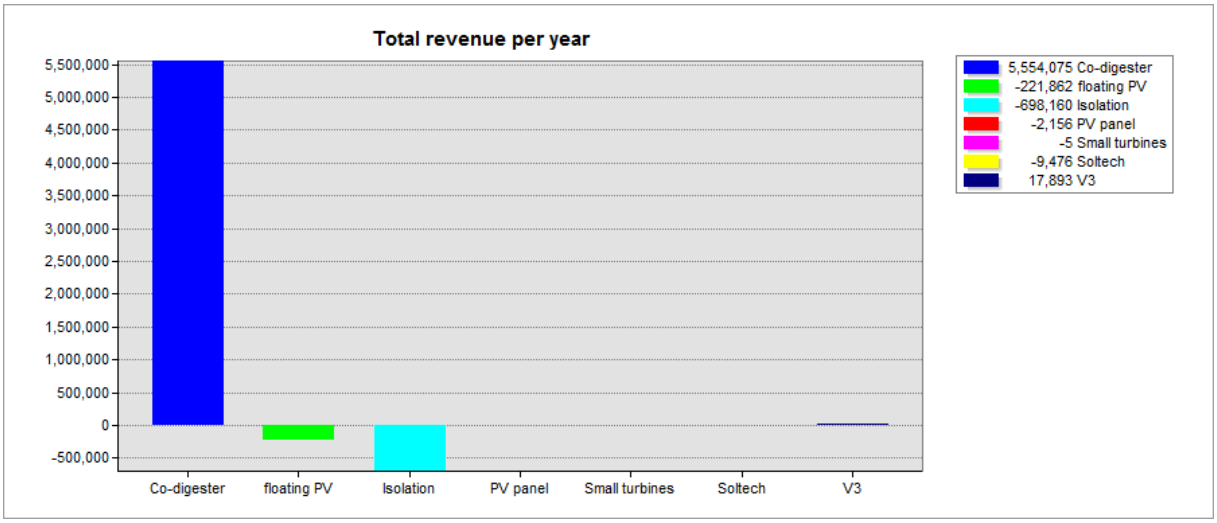

Figure 9c: Total revenue in euro's per year, Session 2

3.3 Added value of the Touch Table

As is already described in the methodology part, the questionnaires done on the test day of the Touch Table on the 13th of June are split up in two parts: expectations of the interactive session of the participants and evaluation of the functionality and use of the Touch Table. For a more detailed view about what was asked in the questionnaire, see Appendix 8.

According to the questionnaire answers of the expectations, almost all of the participants have experience with using touch devices. The majority of the respondents were expecting that using the Touch Table would neither be very difficult nor very easy for them: 67% of them thought that using the Touch Table would be on average doable (Figure 10). Only 11% expected it to be very difficult.

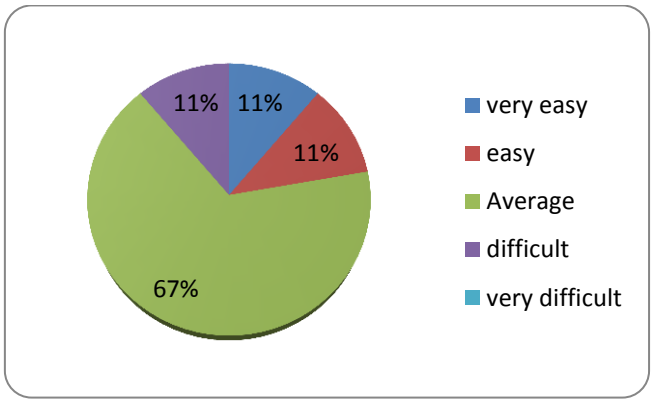

Figure 10: Participants expectation on the difficulties of the Touch Table

No-one of the participants did have prior knowledge about the use and functioning of the Touch Table. Most of them had different views regarding the Touch Table functioning and its use. According to the questionnaires, some of them thought it is a tool for creating a visualization of the landscape, while others expected an electronic device or super I-pad without any clue about the used program. A few participants really did not have a clue about what the Touch Table would be looking like. So, most of the participants are going to experience a totally new device.

With respect to the contribution of the Touch Table to the discussion of the Village Energy Plan, the meanings where divided. Half of the participants recognized the Touch Table as a device that would be really helpful for the organization and the planning of the Village Energy Plan of Gasselternijveenschemond. Others answered that they do not have a clue what a Touch Table is and therefore cannot answer this question.

Now that the expectations have been reviewed, the evaluation part of the questionnaire is given a turn (Appendix 8). The first thing that was asked was what the participants were thinking of the functionality of the Touch Table. Most participants thought the Touch Table was useful, convenient, practical and special as well as sufficient (Figure 11). Besides this, the majority of the respondents described that the Touch Table is easy to use: user friendly and not tiring to use. They indicated also that the Touch Table could be able to do more but they stated that the functionality is sufficient for this test session. Almost all the participants enjoyed their personal experience with the Touch Table, they said it was interesting, exciting, unique, adventurous and trustworthy during personal talks with them and as was indicated in the questionnaires by them.

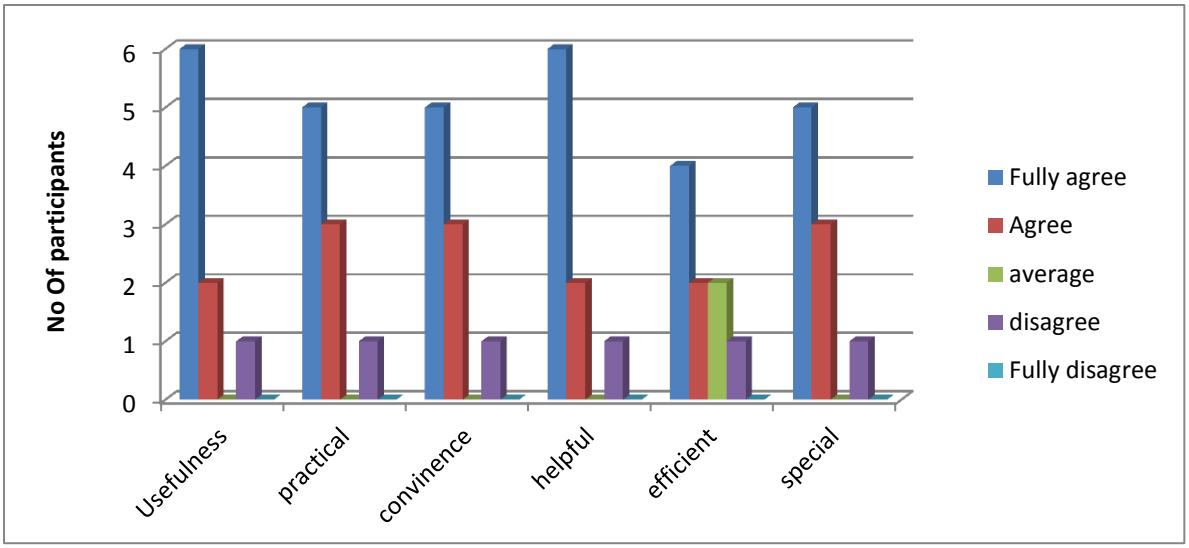

Figure 11: Value of the Touch Table

However, there is one person that disagrees with everything. He thinks as was stated in the questionnaire, that the Touch Table is just luxury. To solve this plan people should just talk and use pen, paper and good arguments to persuade the others. Furthermore, he states that the involvement of inhabitants is not a good idea; he thinks the Municipality of Aa and Hunze should solve this on their own.

Other questions were asked to the participants about the efficiency of working with the Touch Table and whether they have some possible improvements for the Touch Table. Most of the participants responded positive: they liked the visualization, the effects of the Touch Table and the working with the created stamps. However, they mentioned that it would be better if there would be a possibility to add 3D maps in order to get an even better spatial visualization. Another point of attention mentioned by a few participants was the size of the maps, it would be easier to stamp in the correct location if those maps would have been bigger. Most of the participants indicated that the Touch Table met their expectations regarding the project and they recommended the use of this device in other related projects. All participants graded the overall use and functionality of the Touch Table very high: 67% of them gave a 9 out of 10 and 33% of them gave an 8 out of 10.

What has become clear out of this questionnaire is that most of the participants did not know the Touch Table before the session started and that this device really has an added value in the discussion about the Village Energy Plan: the participants indicate that the use of the Touch Table in the last part of the session: the discussion: really caused a shift in view with regard to the Village Energy Plan. They state that this was mostly due to the fact that they saw the different plans of others in a spatial perspective now and heard certain arguments which led to the change of views and which can maybe lead in the end to agreement between the different stakeholders in the area of Gasselternijveenschemond.

4. Discussion

According to the answers to the questionnaire, in the interactive sessions both the representatives of the village and the employee of the municipality were participating. However, the participants have more or less the same view regarding a Village Energy Plan. All of the inhabitants were against the large windmill park, but in the meeting with the stakeholders on the 16th of June we identified, that there are also villagers, who are in favour of windmill park plan. Thus not all parties, interested in creation of a Village Energy Plan were participating in the interactive session. In our opinion, the representatives of all the groups of inhabitants with different views on a Village Energy Plan should be present in an interactive session.

In the interactive sessions the combined maps, which includes the energy options placed by all participant was offered to them for discussion. The important thing which was missing in the created general method is the way how the participants should come to the complete Village Energy Plan. To get to the complete Village Energy Plan the participants should not only discuss the resulting maps, but also to make decision regarding the locations of placed energy options and regarding the overlapping energy options.

4.1 Evaluation the Village Energy Plan

The Village Energy Plans were evaluated by observing the behaviour of the participants and by analysing the final maps, which were created by them. The energy sources placed by the participants of the sessions are presented in Figures 12 and 13.

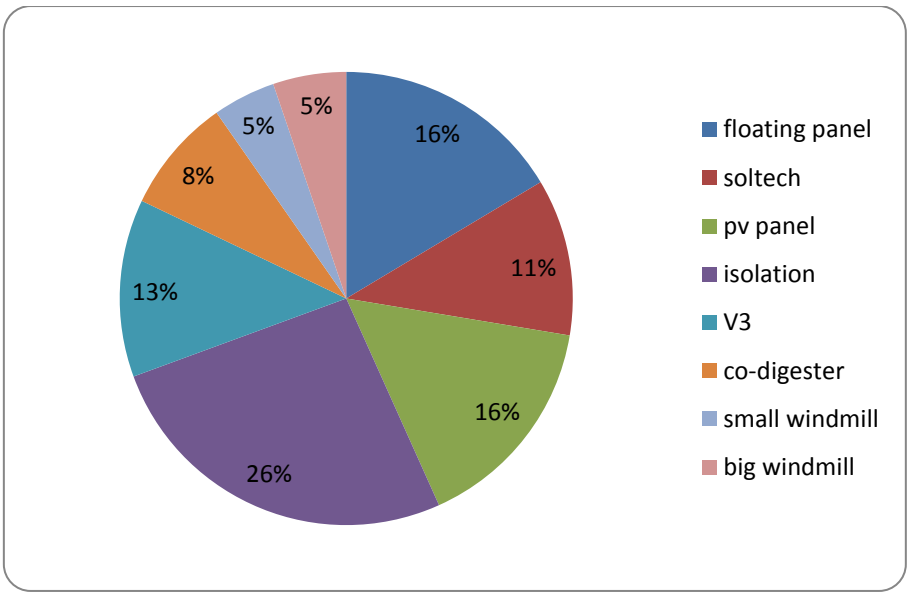

Figure 12: Energy options in session I

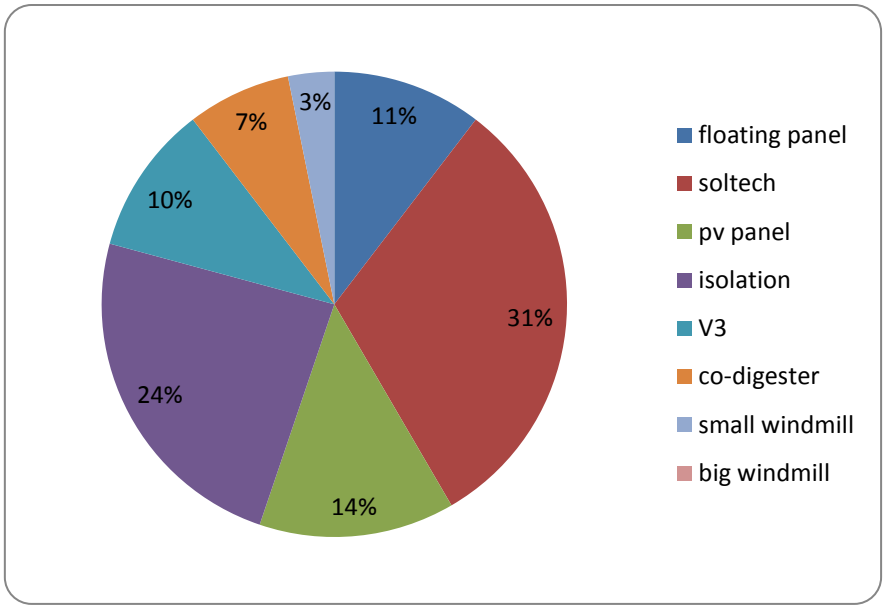

Figure 13: Energy options in session II

The energy options were used in the two interactive sessions differently. The most often used source of energy in the first interactive session was isolation, the participants used in a quarter of the cases. During the interactive session, the participants mentioned that a lot of houses are not isolated and a lot of energy was lost due to this. Thus the isolation measure is very popular among the participants. Energy options such as PV panels, V3, floating panels and soltech were used by them quite often in comparison to the other options. In general, all these energy options can be classified as solar energy options. The most unpopular energy options among the participants were small and big windmills. According to the questionnaire answers of the first session, 1 person among 5 agreed with the wind park plan of windpark Oostermoer, thus a few large windmills were expected to be placed by the participants of the first interactive session. This was also the case in the end result of the map in figure 6. The Village Energy Plan made by the participants of the first interactive session includes all energy sources, but in different amount. The majority of the energy sources used in it are solar energy sources.

The total energy produced per year in MWh in this Village Energy Plan in the first interactive session is 1914625 MWh. Despite to the fact that the participants placed only a few large windmills and co-digesters, the biggest part of this energy is produced by this energy sources. In comparison with the other six sources, this sources produces a lot of energy, but the investments, which are necessary to build them are also very high.

As in the first interactive session the participants of the second interactive session used the isolation in a quarter of the cases. However, the most often used source of energy is not isolation, but soltech. The participants used it in a third of the cases. Floating panels, PV panels and V3 were used often too. In contrast to the first interactive session the participants didn't use the big windmills at all. According to the answers of the questionnaire no one of the participants agreed with the wind park plan of windpark Oostermoer, so they were not expected to be placed by the participants of the second interactive session. The Village Energy Plan made by the participants of the second interactive session mostly consists of solar energy options and isolation.

The total energy produced per year in MWh in the Village Energy Plan in the second interactive session is 293581 MWh. The biggest part of this energy is produced by co-digesters. Energy produced per year is much lower in this Village Energy Plan in comparison with the Village Energy Plan of the first interactive session, mostly because the participants of the second session placed no big windmills.

4.2 Evaluation of the added value of the Touch Table

By means of the test sessions done on the 13th of June, it is possible now to evaluate the added value of the Touch Table in the discussion about the Village Energy Plan of Gasselternijveenschemond. Based on the questionnaires (section 3.3), overall, people could deal with using the Touch Table and did not think it was too difficult to use. Furthermore, they gave the value of the Touch Table a high score: most of the participants fully agreed with the usefulness of the Touch Table within this project.

During the test sessions, the team also made some notes, which made clear that the participants especially liked that they first could draw their own ideas on the map, after which those ideas could be combined. They told us that they found it user-friendly and very helpful for getting an overall view of the spatial planning of the area. The interface is indeed fast enough for drawing and by means of combining all the ideas, the participants got the idea what the others were planning in the landscape. By means of reasoning about why they would have that kind of source in that particular location, they sometimes could persuade the other participants that that particular source should be installed at that location instead of something else.

So, by means of the session the GIS group prepared, all participants were able to visualize their ideas about the spatial distribution of particular energy sources and were able to discuss about the final result. In the end, most participants changed their view on the Village Energy Plan due to this discussion at the end.

However, those sessions were only test sessions and thus were only held in the village Gasselternijveenschemond, while the problem of the search area for alternative energy is for the whole area of the Veenkoloniën. What appears from the test session and the evaluation of those test sessions by means of the questionnaire is that most participants are sure that the Touch Table has an added value in the discussion of the Village Energy plan. Therefore it is wise to use this source also in the other villages of the Veenkoloniën.

When the source is being used in other parts, in order to achieve this added value it is important that the same set up is used for the interactive sessions as is used in the test sessions. So first start with the individual drawings, combine those and run the models in ArcGIS to create maps showing overlays of different energy sources and maps containing the energy sources without overlay, show the background information about the amount of energy in MWh produced, the investments needed and the revenues in euros per year per energy source for all created maps in total. Afterwards, the discussion should be done.

The added value of this set up and this source mostly lays in the fact that the participants get a good spatial insight of their village by means of the used maps and in this way can create their own view on possible locations for alternative energy sources. Furthermore, the possibility of discussing the combined and overlay maps give the participants the opportunity to exchange their ideas about certain locations where a certain energy source has been placed and give arguments why it should or should not be placed here. However, there should be some-one present at all of those sessions who is going to develop those Village Energy plan(s) in real, in order to be sure that the proposed ideas can be implemented for real in the Village Energy plans. Maybe it is even possible that some agreement can be reached about a certain location and/or a certain energy source by means of the generated discussion and participation of the creator of the Village Energy Plan.

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5. Recommendations

The method was tested during the interactive sessions in Gasselternijveenschemond on the 13th of June and some recommendations could be given concerning both the set-up of the interactive sessions and the preparing of the Touch Table itself in a technical way.

The recommendations regarding the setup of the interactive session are as follows:

1) Encourage people to discuss the overlapping energy sources and the spatial distribution of energy options, not the energy options themselves.
2) Only four-five people can participate in interactive sessions with the use of the Samsung SUR40 Full HD Touch Table. If there are more participants a table with bigger screen is needed.
3) During the sessions it was identified that some substances (e.g. carbon) works like isolation and if fingers are covered by this substance, the sensor screen of the Touch Table does not respond to the touch (Figure 14). The fingers of the participants should be clean before they can participate.

Figure 14: Photo of dirty hand

4) The Touch Table reacts to the flash of the digital camera. It is better not to use the flash while taking photos.
5) It is tiring for the participants to stand for a long time during an interactive session. It is better to organize an interactive session in such a way, that participants will sit during it. By including for instance a break.
6) To get to the complete Village Energy Plan, the participants have to not only discuss the resulting maps, but also to make decisions regarding the locations of the energy options. They have to come to agreement regarding the locations of non-overlapping energy options and decide which of overlapping energy options they would like to keep.
7) Regarding the people, who will take the initiative to continue with the use of the Touch Table to support the discussion regarding a Village Energy Plan we suggest some student group or organizers of the Knowledge Workshop. We do not recommend municipality stuff or inhabitants of the villages to this role, because their view to a Village Energy Plan is biased.

The recommendations regarding the preparation and programming of the Touch Table are as follows:

1) Add the opportunity to zoom-in and zoom-out the map.
2) Include more and more clear energy options. Only eight energy options from the calculation model made by VHL student team were programmed in the Touch Table. It is good idea to consult with the inhabitants representative about the energy options which are preferable for the citizens of a certain village. There are a lot of new developments, which were presented during the interactive sessions and which inhabitants wanted to use to create a Village Energy Plan.
3) The processing of the maps and connection with the calculation model were done in the laptop using Model Builder in ArcGIS 10.0 and a USB disk. It could be faster if the processing will be done in the Touch Table itself using a python script. However, knowledge of Python scripting is required for this. A Touch Table should have installed ArcGIS software for this. An important point is to check the license of the software; it should work in the place, where an interactive session is planned.
4) The Touch Table should be programmed in such a way that it is more interactive. For example, participants will be able to see immediately the amount of energy produced in MWh by the energy option and the investment that is needed to be made to install the device, which they just placed to a map.
5) As one of the inhabitant's reasons against placement of the windmills was the spoilage of the landscape, is it good idea to use the 3D visualisation in the Touch Table or just such functionality of the ArcGIS software as Viewshed function, because the participants will have an immediate insight in how the landscape will look like with a particular energy device and can discuss it immediately during the session.
6) As the participants should place limited amount of energy options a good idea is to have a counter of the energy options, which have already been placed to an individual map.
7) Adjust the size of the stamps regarding maps.
8) In the graphs, showing the amount of energy produced by each source per year show the sum of energy produced by all energy sources.

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Appendices

Appendix 1: Figure reference list

Appendix 2: Technical implementation –Python scripts, GIS Models

Appendix 3: Stakeholder Analysis – SWOT analysis

Appendix 4: Gannt Chart

Appendix 5: Flowchart suitability maps

Appendix 6: Data sources and relation to different suitability maps

Appendix 7: Organizing The Touch Table test day with the citizens

Appendix 8: Questions for the interview with participants of interactive session for evaluation of the added value of the Touch Table in the Village Energy Plan design process.

Appendix 9: The Touch Table as used in this project

Appendix 10. Alternative energy options with possible placement ,Amount of energy and Costs

Appendix 11. GLEE software for Touch Table

Appendix 1: Figure reference list

This report contains a large number of images that are of importance for explaining and emphasizing the written part of the report. Because of this there has been an 'Figure reference list' added which gives the reader the chance of looking back at images, or finding images, that are required to see.

Appendix 2: Technical implementation – GIS Models, Python scripts

In this appendix the technical execution for having the session with the Touch Table in Gasselternijveenschemond is explained. In first instance the scripts underlying the Touch Table are explained. These scripts have been developed by Wilco Haaren, Arjan de Jong and Aldo Bergsma. They have been copied and used and have not been adjusted by the project team. After the script part the GIS model part follows. This is developed by the project group and shows how the point datasets, which are created by the scripts, are used to come to the result maps and graphs.

Scripts

In the interactive session scripts were used. First the "Start GLEE" script is activated and then the script to create a point dataset. The function of the "Start GLEE" scripts is to make a structure, where files will be moved into a new folder with an indicating name in a usable date format. The script: "GasseltenijveenschemondCreatePointSHAPE" is used to create a point dataset which will be used in the analysis part. These datasets are used as input for running the models in ArcGIS. The used scripts are shown below:

Start GLEE

```
$date = Get-Date -Format hhmmss
```

*Configure format of date

```
if (Test-Path C:\Data\Data_Client\GLEE_Gasseltenijveenschemond\data\save\_* -include *.txt,
*.isf)
  {New-Item C:\Data\Data_Client\GLEE_Gasseltenijveenschemond\data\save\Session_$date -
ItemType directory}
  elseif (Test-Path C:\Data\Data_Client\GLEE_Gasseltenijveenschemond\data\Save* -include *.txt,
*.isf)
  {New-Item C:\Data\Data_Client\GLEE_Gasseltenijveenschemond\data\save\Session_$date -
ItemType directory}
  else {'Data does not exist'}
if (Test-Path C:\Data\Data_Client\GLEE_Gasseltenijveenschemond\data\save\_* -include *.txt,
*.isf)
  {Move-Item C:\Data\Data_Client\GLEE_Gasseltenijveenschemond\data\save\_* -include *.txt,
*.isf C:\Data\Data_Client\GLEE_Gasseltenijveenschemond\data\save\Session_$date}
  else {'Sketch data does not exist'}
if (Test-Path C:\Data\Data_Client\GLEE_Gasseltenijveenschemond\data\Save* -include *.txt, *.isf)
  {Move-Item C:\Data\Data_Client\GLEE_Gasseltenijveenschemond\data\Save* -include *.txt,*.isf
C:\Data\Data_Client\GLEE_Gasseltenijveenschemond\data\save\Session_$date}
  else {'Combined data does not exist'}
```

*Create folder, name folder as a date, move all *.txt files into the folder

```
'Run GLEE_Map'
cd C:\Data\Data_Client\GLEE_Gasseltenijveenschemond\
start GLEE_Map
```

*Run GLEE software

Gasseltenijveenschemond_CreatePointSHAPE

```
#D:\Projects\GLEE\trunk\GLEE_Map2\data\save\OpenStreetMap.txt
# open sketch file,

GLEEFolder = "C:\\Data\\Data_Server\\Databases"
```
*Define input folder

```
print "open sketch *.txt"
for i in range (0, 5):

   Input = GLEEFolder + "\\IA_TouchTable_1_Project.gdb\\InputPoint_" + str(i)

   Track = open("C:\\Data\\Data_Client\\GLEE_Gasseltenijveenschemond\\data\\save\\_" +
str(i) +".txt", "r")
   #Track = open("E:\\Data\\GLEE\\Databases\\save\\_1.txt", "r")
```
*open txt file

```
   ##TagObject: 161 - 931.774017613082,1111.30093090617
   ##TagObject: 161 - 1210.84191688699,2360.52479354918
   coordList = []

   for line in Track.readlines():
      cleanline = line.rstrip()
      if "TagObject" in cleanline:
         firstSegment = cleanline.split("-")
         tagID = (firstSegment[0].split(":")[1]).lstrip()[:3]
         remainder = firstSegment[1]
         #print remainder
```
*exclude tagID

```
         # parse points into array
         segmentedLine = remainder.split(",")
         #print segmentedLine

         xPoint = float(segmentedLine[0])
         yPoint = float(segmentedLine[1])
         coordList.append([xPoint, yPoint, tagID])

   #print coordList
```
*exclude X and Y point coordinates, and puts cell info in coordList.append

```
   #D:\Projects\GLEE\trunk\GLEE_Map_images\OpenStreetMap.pgw
   # recalculate according to pgw into new array
   print "open worldfile OpenStreetMap.pgw"
   Worldfile = open("C:\\Data\\Data_Server\\GLEE\\Worldfile.pgw")
   #Worldfile = open("E:\\Data\\GLEE\\Databases\\save\\Worldfile.pgw")
   # read 5th and 6th line
   linesCounter = 0

   for line in Worldfile:
```

```
        if linesCounter == 0:
            resX = float(line.rstrip())
        if linesCounter == 3:
            resY = float(line.rstrip())
        if linesCounter == 4:
            WorldPointX = float(line.rstrip())
            #print "wX: " + str(WorldPointX)
        if linesCounter == 5:
            WorldPointY = float(line.rstrip())
            #print "wY: " + str(WorldPointY)
        linesCounter += 1

    print "Calculate RD coordinates"
    realworldCoordList = []
    for point in coordList:
        rwPointX = (point[0] * resX) + WorldPointX
        rwPointY = (point[1] * resY) + WorldPointY
        rwTagID = point[2]
        #realworldCoordList.append(["(" + str(rwPointX) + "," + str(rwPointY) + ")", rwTagID])
        realworldCoordList.append([rwPointX, rwPointY, rwTagID])

    #print realworldCoordList
```

*worldfile used to calculate geoposition, recalculate and put in new list

```
    # open arcpy, save points into feature
    print "Open arcpy"
    import arcpy
    from arcpy import env
    import os

    env.overwriteOutput = True
```

*open arcpy, it will add possibility of using ArcGIS tools

```
    try:
        # delete all features
        print "delete existing features first"
        arcpy.DeleteFeatures_management(Input)

        spatialRef = arcpy.Describe(Input).spatialReference
```

*delete all old features to add new

```
        # add new features
        print "add new features: sketch points"
        for p in realworldCoordList:
            # Create the insert cursor
            cur = arcpy.InsertCursor(Input)

            pnt = arcpy.Point()
            pnt.X = p[0]
            pnt.Y = p[1]
```

```
        feat = cur.newRow()
        feat.shape = pnt
        feat.tag = p[2]
        cur.insertRow(feat)
```
*add new features (attribute table) which includes |Xcoordinates|Ycoordinates|Tag|

```
    del cur
    print "Done"
```
*finishing process

```
  except Exception, e:
    # If an error occurred, print line number and error message
    import traceback, sys
    tb = sys.exc_info()[2]
    print "Line %i" % tb.tb_lineno
    print e.message
    print arcpy.GetMessages()
    del cur
    print "Done"

  finally:
    import gc
    gc.collect()
```
*standart script for errors

GIS models

CREATING THE TWO OUTPUT MAPS

First step: Prepare the point dataset

After running the python script which creates point datasets of the stamps implemented by the participants, these are copied into the model. In this way the original point datasets are not touched and can be regenerated whenever something goes wrong. An excel table indicating the values of the different energy options is joined to the copy of the point datasets: Figure 1.

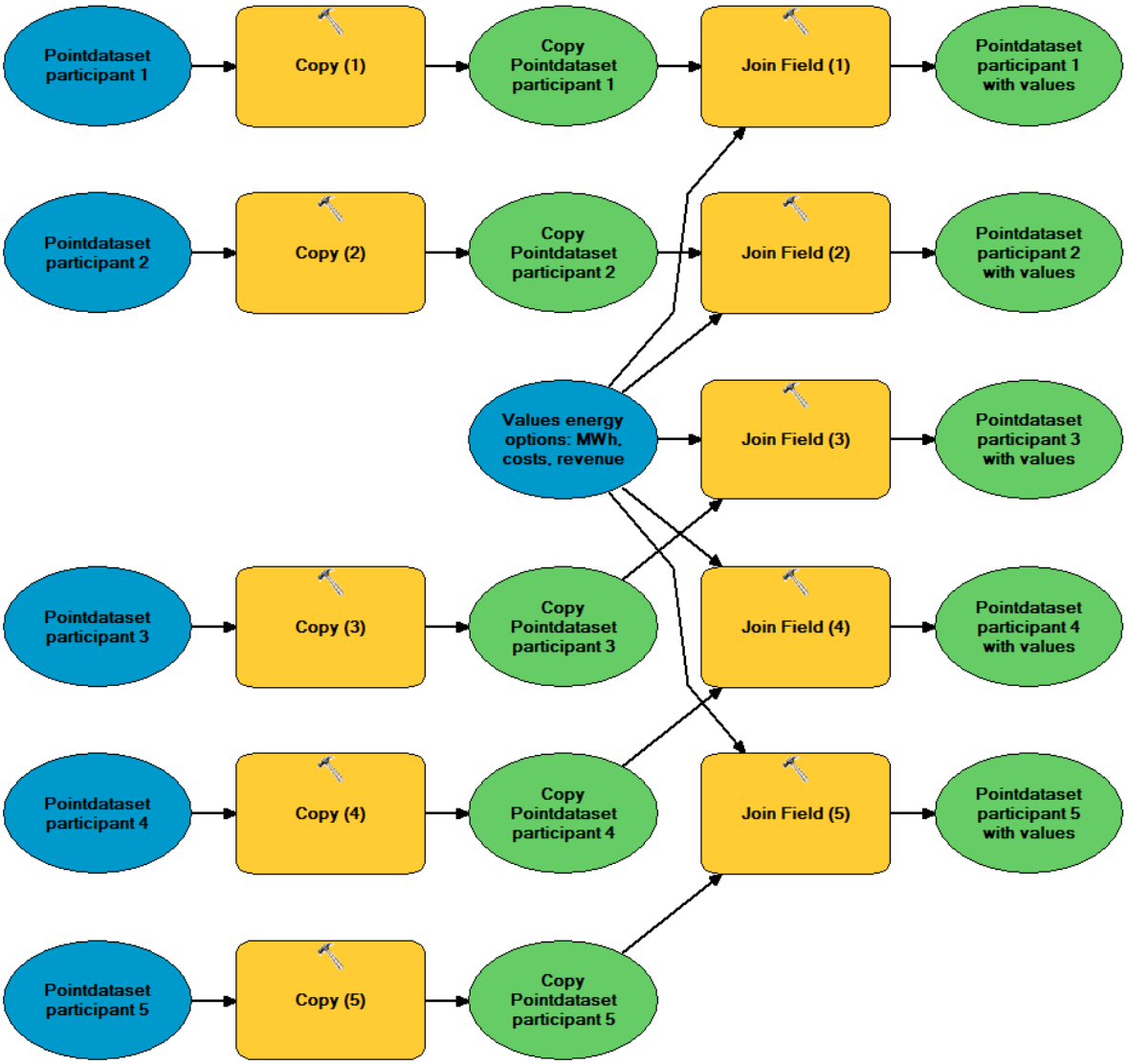


Figure 1: First GIS model, copy import points and join energy option values to it

Second step: Create the buffers

For all five point datasets made in figure 1 buffers are created. These buffers can be separate per energy option. In figure 2 the process of reaching this is visible. First the energy option is selected where after a buffer size is given to create a buffer. Then they are merged together in one dataset containing all buffers for all energy option of this single participant. This model is separately executed for all participants.

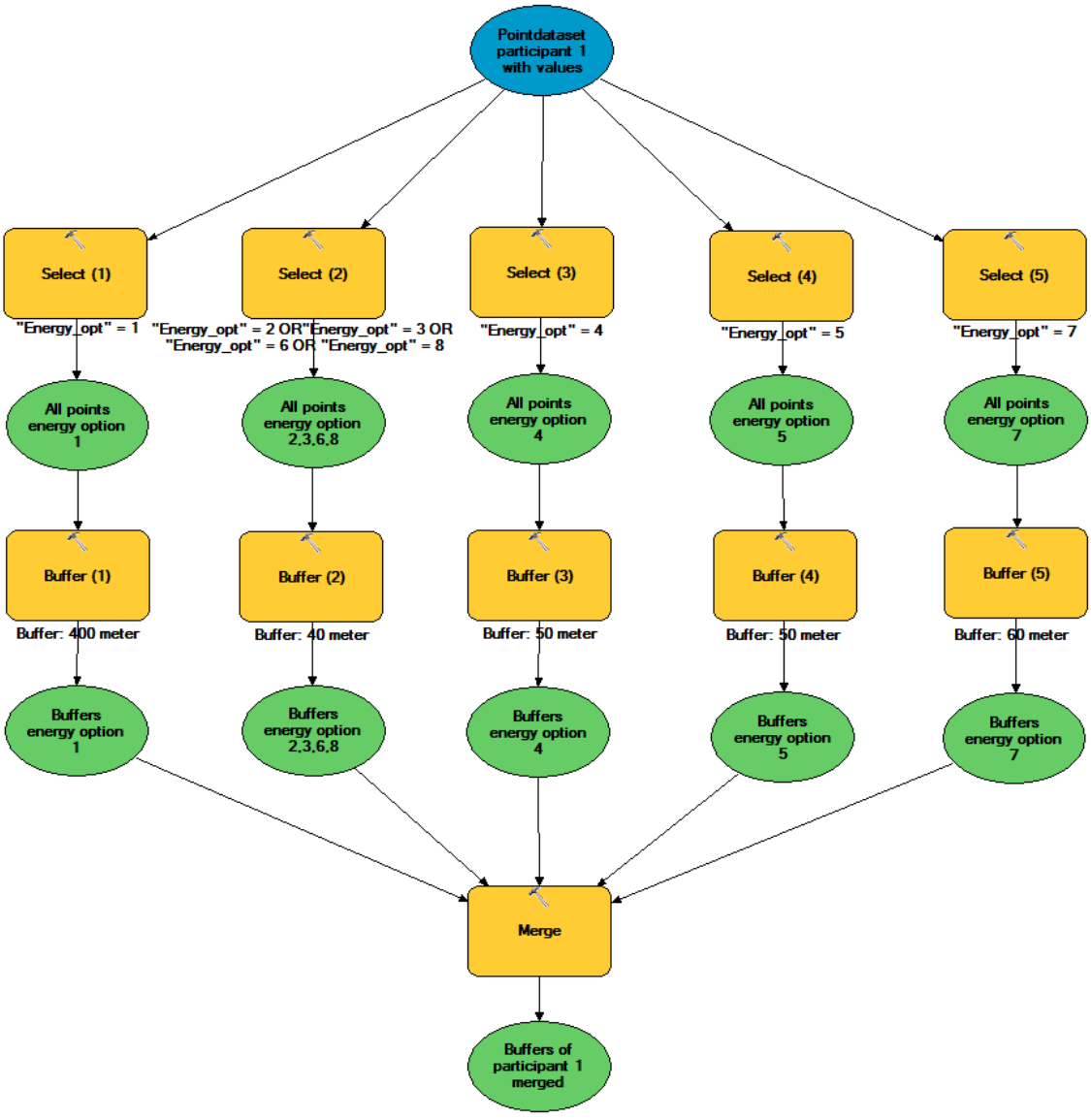


Figure 2: Creating buffers dependant on energy option

Third step: Intersect buffers of all participants

In the next step the buffers created in figure 2 are intersected with the buffers of all the other participants. This leaves a polygon dataset with all the intersections that also includes an attribute table indicating what type of energy options are intersecting with which other type (Figure 3).

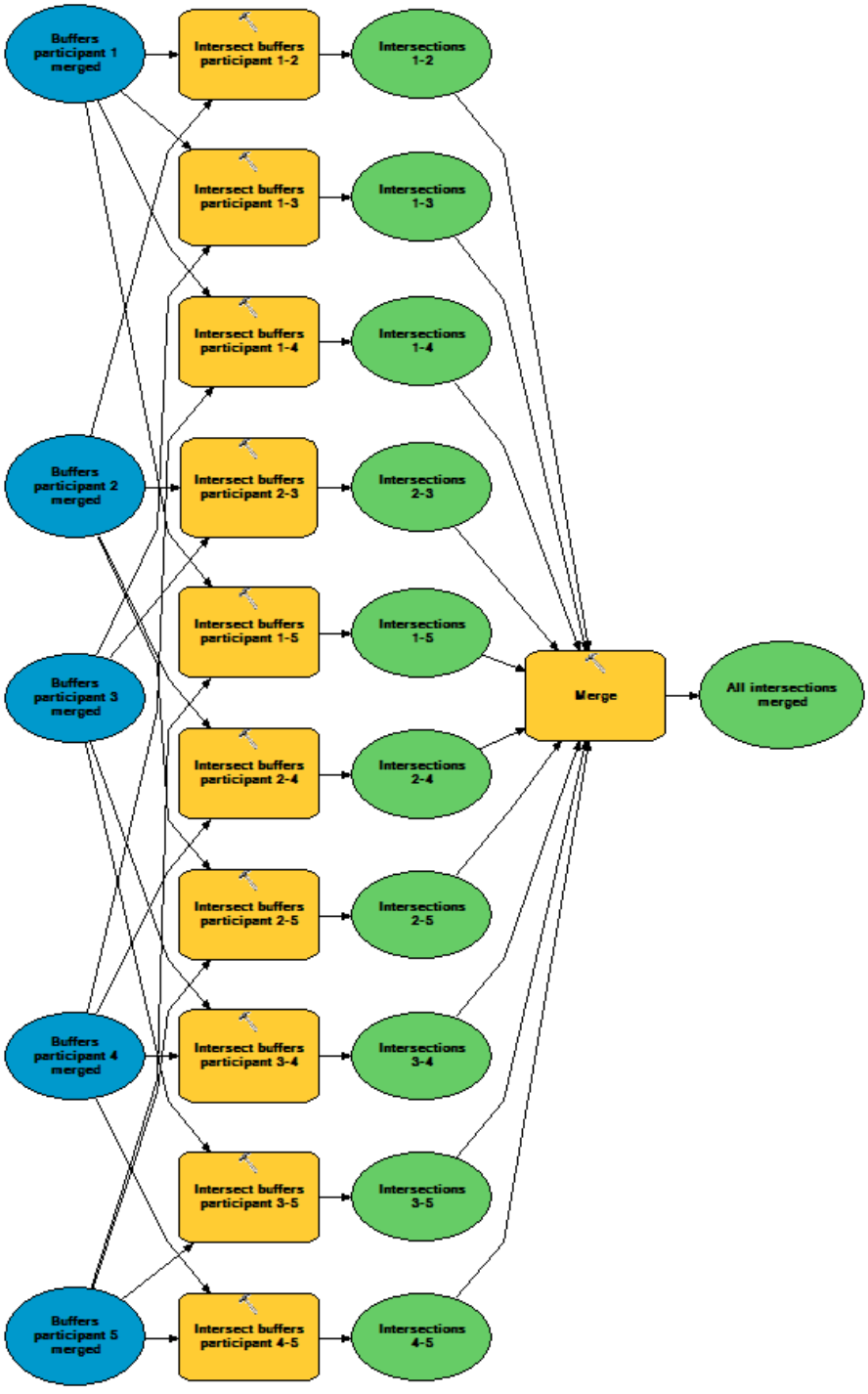


Figure 3: Intersections buffers all participants

Fourth step: Creating the results

In the last part the intermediate results are used to come to the two result maps (Figure 4). For map 1 the polygon dataset 'All intersections merged' (Figure 3) is used. Out of this polygon dataset all intersections between two different energy options are selected. This selection creates a new polygon dataset creating result map 1. The second result map requires more processing steps. First all buffers of all participants (Figure 2) are merged together where after the intersections (Figure 3) are erased from this polygon dataset. Then out of the ' All intersections merged' polygon dataset the similar intersections are selected. This selection is merged to all the buffers where all intersections have been erased from. This results into map 2: All buffers – All intersections + intersections same energy option.

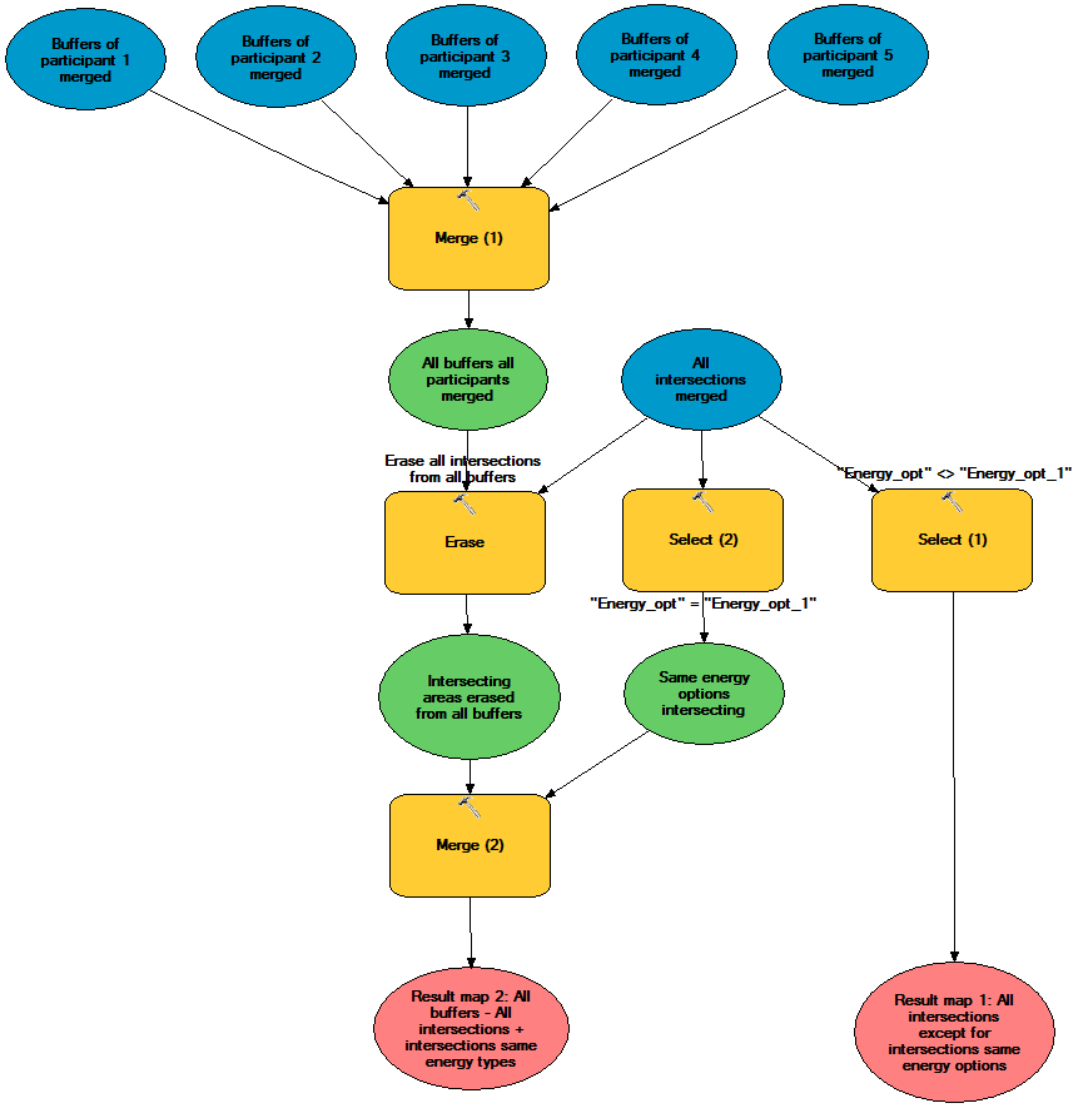


Figure 4: Generating the two result maps

CREATING THE THREE GRAPHS

Step 1: Creating the dataset which is used for creating the graphs

For creating the result graphs the copied points with the joined values of the excel table are used (Figure 1). These are copied again for safety reasons where after a frequency function is executed. This frequency function lists the amount of drawings for each energy type. Then a table with a max amount of eight rows exist indicating the eight possible options with the values per option. There are three fields separately added and calculated where the frequency of the stamped option is multiplied with the amount in the table. This is done with total energy production, total investment needed and total revenue (Figure 5).

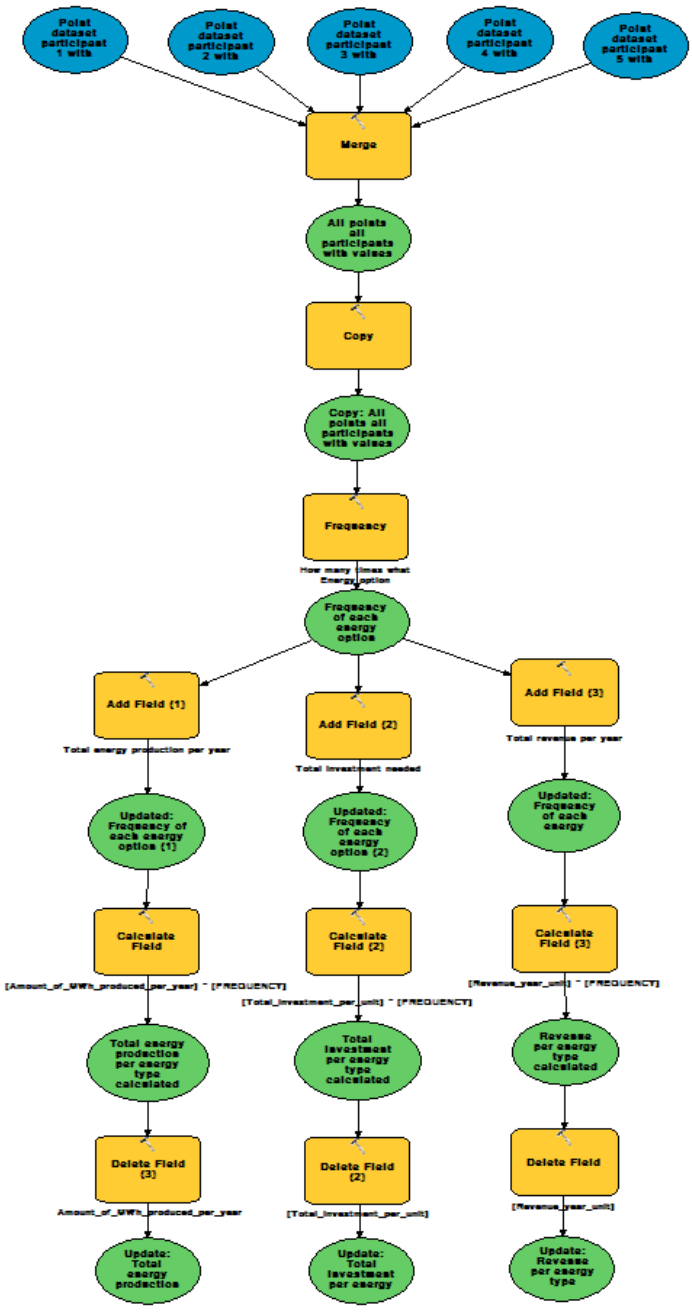


Figure 5: Graph preparation model

Step 2: Creating the graphs

Function of this model is to create graphs from results of session. First was created input graph template, and then model makes graph with including all necessary data. For example: for Total energy production graph use results from calculation model which shown before. All necessary input data to make graphs, prepared by model shown before. This model creates following graphs:

- Total energy production per year
- Total investment needed
- Total revenue per year

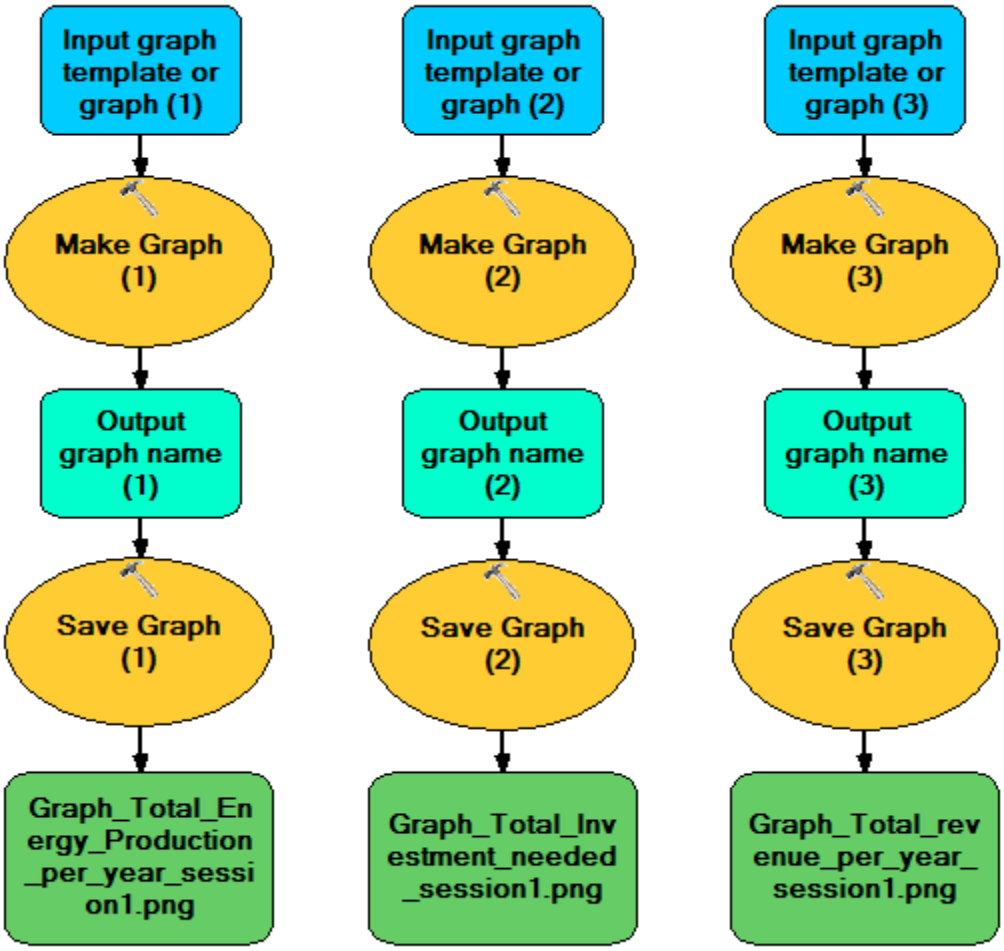


Figure 6. Model for graphs

Appendix 3: Stakeholder Analysis – SWOT analysis

In order to do the stakeholder analysis, it has been decided to do a SWOT analysis, developed by Albert Humphrey, for each direct stakeholder involved in the process (Humphrey, 2011). The indirect stakeholders are described shortly, there is decided to not include those stakeholders in the SWOT analysis. In

Table 1, the different stakeholders are given and there is mentioned whether they are involved in the Touch Table project in a direct or in an indirect way. The conclusions about stakeholders were made according to analysis of meeting with the stakeholders on 16th of May and of literature sources such as "Bouwstenen voor het advies van de Commissie Landbouw Veenkoloniën", "Concept Notitie Reikwijdte en Detail. Windpark De Drentse Monden" and "Concept Notitie Reikwijdte en Detailniveau Windpark Oostermoer en samenhang met Windpark De Drentse Monden".

The SWOT analysis has been chosen, since it analyses strengths, weaknesses, opportunities and threats and it is a structured planning method that can be carried out for each stakeholder individually. Furthermore, it takes into account the favourable and less favourable conditions of each stakeholder and gives in this way a good overview of each stakeholder (Humphrey, 2011).

Table 1: Overview of direct and indirect stakeholders involved in the Touch Table project.

Stakeholder	Involvement in project
National government	Indirect
Province of Drenthe	Indirect
Inhabitants	Direct
Municipality	Direct
ECO Oostermoer	Indirect
Kenniswerkplaats Veenkoloniën	Direct
Energydesk – RUG team	Direct
VHL student team (Model)	Direct
WUR student team	Indirect
VHL student team – part-time students	Indirect

Stakeholders involved directly

Inhabitants : both in favour and against the Village Energy Plan

During the meeting with all the different stakeholders on the 16th of May 2013, it became clear that the inhabitants of the Municipality of Aa and Hunze can be divided in two groups. The first group contains the inhabitants. This group consists of farmers which are united in the association of Groenpark Boerveen (Greenpark Farmerpeat). The statement of this group is that they would like to help with the sustainable energy provisioning and they think windmills are a good solution for this plan and for this area. Citizens are also covered in this group: they do not receive the benefits which the farmers will get if the windmills are built on their terrain. Furthermore, several negative factors of windmills are also playing a role: noise (low frequency), shadowing and possibly diseases. The SWOT analysis can be found in Figure 1 for all the inhabitants together.

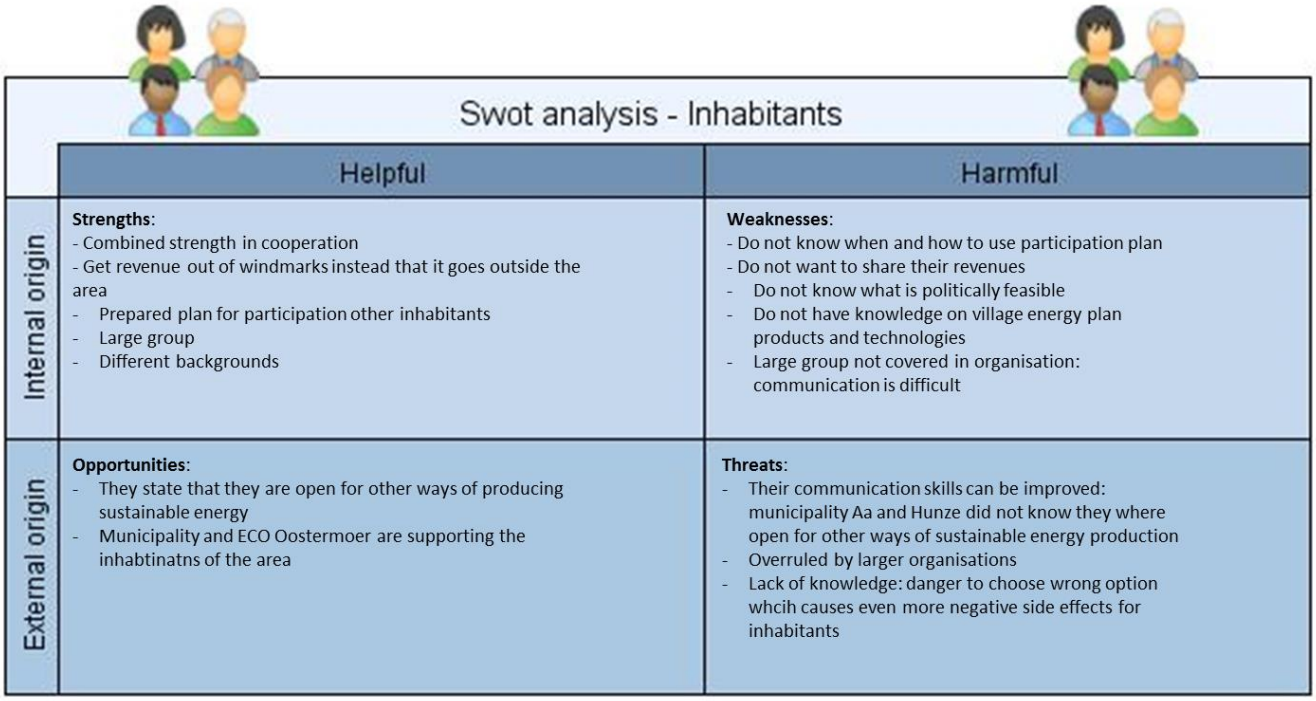


Figure 1: SWOT analysis of inhabitants, including the association Groenpark Boerveen.

Municipality Aa and Hunze

The Municipality of Aa and Hunze is one of the stakeholders for which this project is set up. The commissioner is part of this municipality: Peter van der Veen. The goal of the Municipality, according to our meeting on the 16th of May, is trying to keep the area attractive for citizens and implement the Village Energy Plan in a different way as the national government was aiming at. They want to make the villages more self-reliant and give them more facilities. The SWOT analysis can be found in Figure 2.

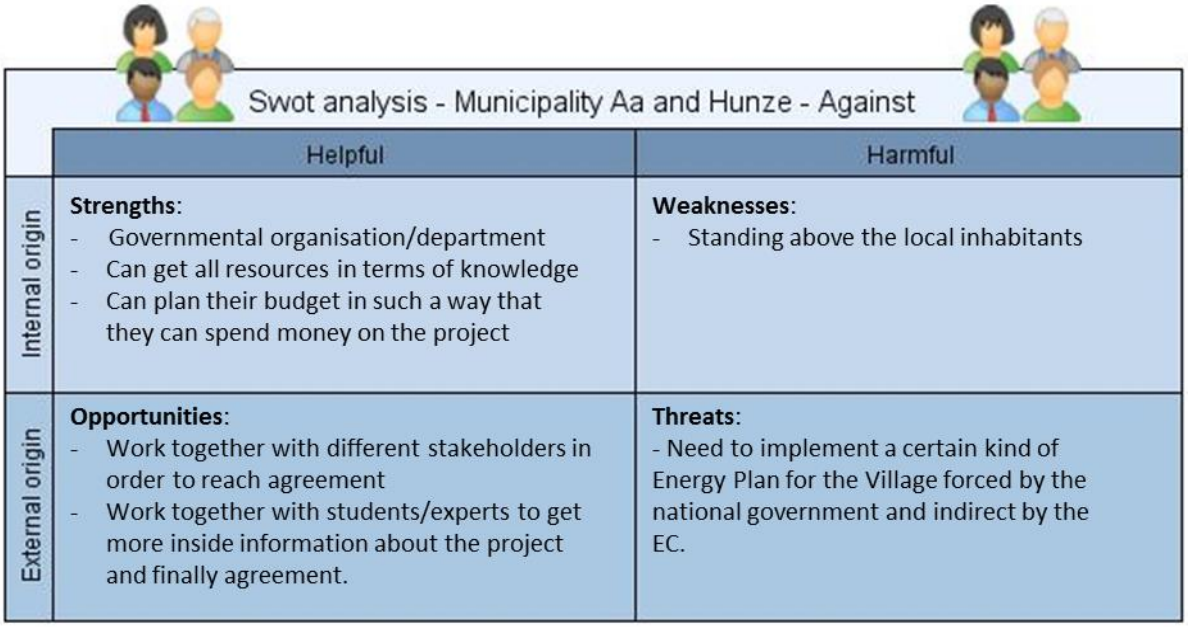


Figure 2: SWOT analysis of the Municipality Aa and Hunze, who are against the Village Energy Plan.

Kenniswerkplaats (Knowledge working place) Veenkolonieën

Kenniswerkplaats is an organisation that combines different organisations, institutions and knowledge centres that can contribute to the development of the regional knowledge concerning the agro-industry. Just like the Municipality Aa and Hunze, they aim for an improvement of the social-economic development of the Veenkolonieën. According to one of the meetings on the 16th of May, in this project, they connect the local area with knowledge of different students by organising student knowledge workshops. This is organised for the transfer of knowledge from student research teams towards entrepreneurs and residents in the area in order to support them to come up with an alternative for the Village Energy Plan containing the windmill farm Oostermoer. The SWOT analysis can be found in Figure 3.

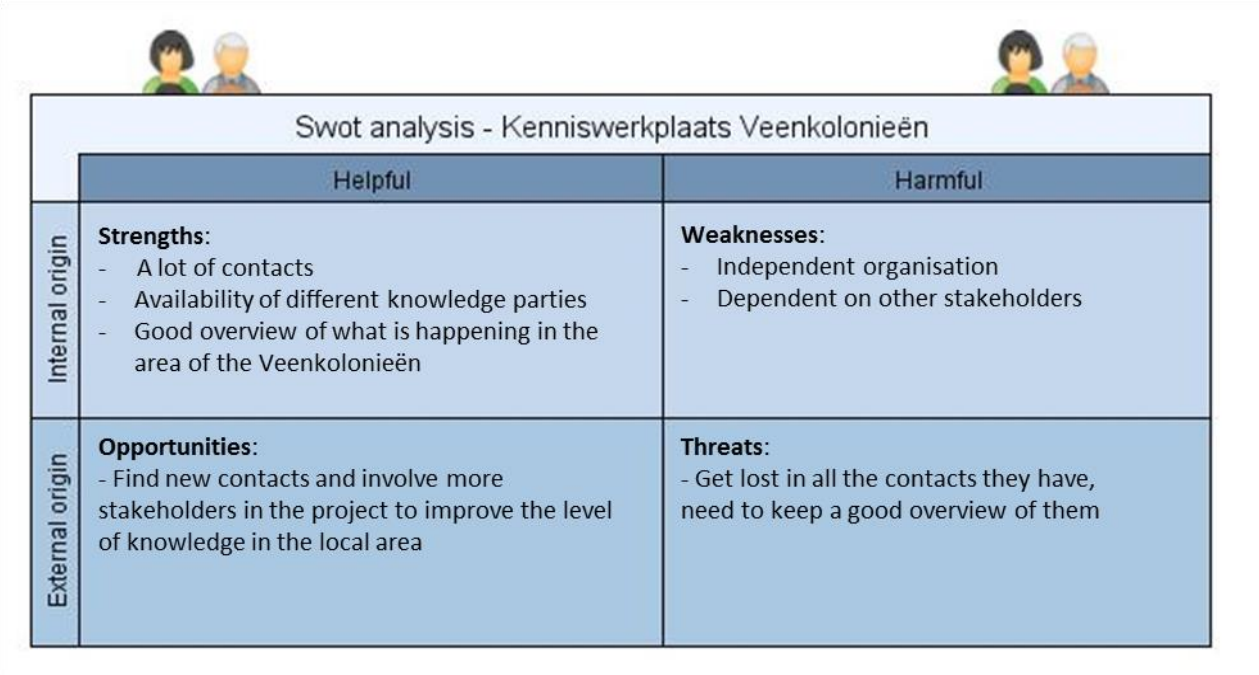


Figure 3: SWOT analysis of the Kenniswerkplaats Veenkolonieën: contribute to find a solution for the problem in the area.

Energie bureau (Energy desk)

The Energy desk can be seen as a knowledge broker: they support regional sustainable development for the municipality of Aa and Hunze. They are the coordinators in the process and they make sure everybody can get into contact with each other. Thus, participation of residents is very important. They focus especially on the contact between students and residents of the area. The SWOT analysis can be found in Figure 4.

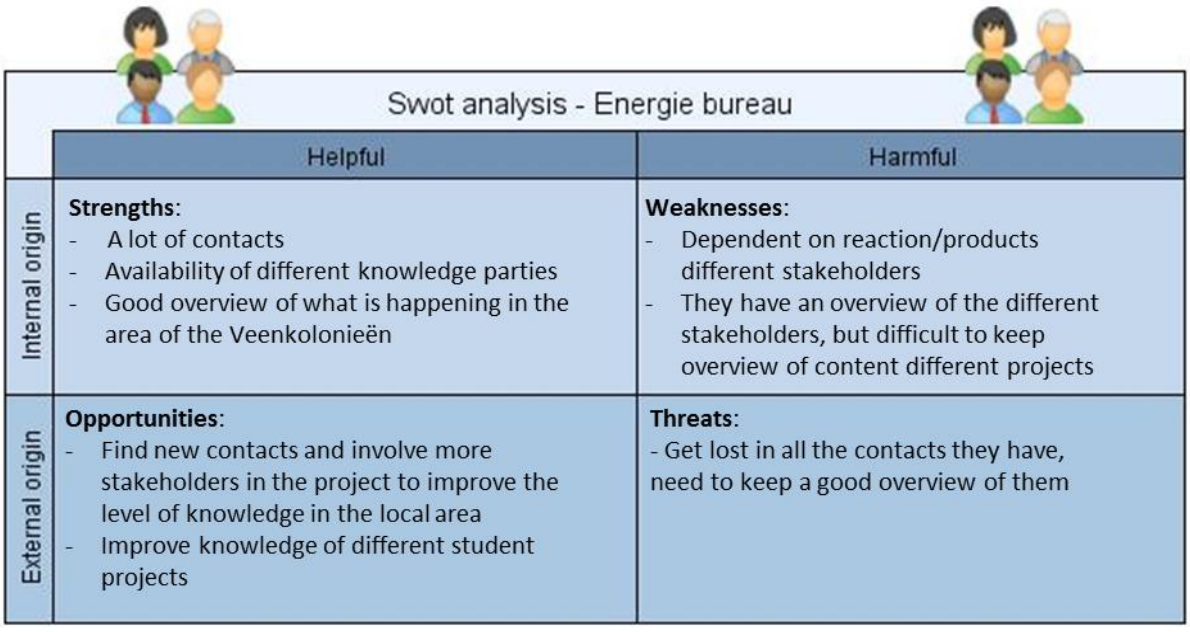


Figure 4: SWOT analysis of the Energy desk: contribute to find a solution for the problem in the area.

VHL student team

This is a student team from Van Hall Larenstein, University of Applied Sciences. Their goal is to come up with a model which calculates the economic costs and benefits of different sustainable energy options, containing for example investment and efficiency. This model can be used for the use of the Touch Table project. The SWOT analysis can be found in Figure 5.

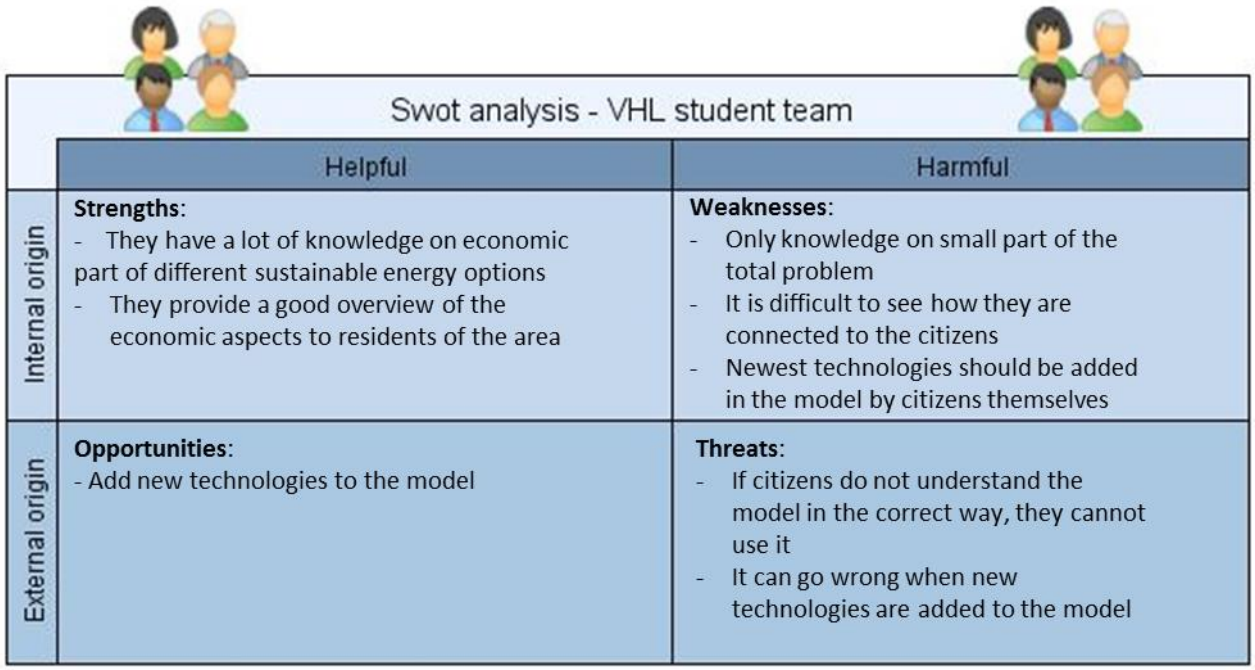


Figure 5: SWOT analysis of the VHL student team, contribute to find a solution for the problem in the area.

B. Stakeholders which are involved indirectly

National government

The Dutch national government has agreed to implement the European union goal of reaching the goal of 20 % of the total energy production should be sustainable in 2020 at European level and specifically to 14 % and reducing CO2 emissions with 20% by then in Netherlands. To reach this goal, the national government appointed the Veenkoloniën as search area for implementing measures: windmill parks, in order to reach this goal. This windmill park should generate 280 MW of sustainable electrical energy per year. (Consult, 2011)

Province of Drenthe

The province of Drenthe is against plan of the national government to place the wind park in the area of the Veenkoloniën with a capacity more than 100 MW. The reason for this is that they cannot control this windpark anymore, because it produces more than 100 MW. In this way it will become the task of the national government to do so. The province prefers smaller wind parks, since they can control them and ensure a good integration with the landscape and the socio-economic situation of the region. (Provincie Drenthe, 2013)

ECO Oostermoer

According to the knowledge gained during the meeting on the 16th of May, ECO-Oostermoer is a young organisation which has started with the goal to create a sustainable, social correct agricultural area for residents of the area. The organisation includes the municipalities Aa en Hunze, Borger-Odoorn, and Tynaarlo and the area with peat. The whole organisation originates from the village Eexterzandvoort where they wanted to start with sustainable energy provisioning. They developed a plan to buy gas/electricity themselves from which the profit is going back into the region**.** What they also did, was providing the three energy options for the energy plan of the WUR student team.

WUR student team

This group is a student team from Wageningen University Department of Environmental Technology. They are primarily analysing the eight alternative energy plan options investigated by VHL. Furthermore, they are working on the technical possibilities and feasibilities of the three selected alternative energy sources by ECO Oostermoer as an alternative of the windmill park and its environmental impacts to finally choose the most sustainable and applicable one (considering technology, economy and social tolerance). They also set the technical requirements, calculate the amount of energy, calculate the percentage of the energy use per household and finally at village scale. In the end they want to contribute in solving the problem about those windmill parks in this area.

VHL student team (part-time)

According to the meeting at the 16th of May, this student team of van Hall Larenstein is trying to work out three ways of new sustainable power generation and they are testing whether those options are possible in the area. Those three ways are the following:

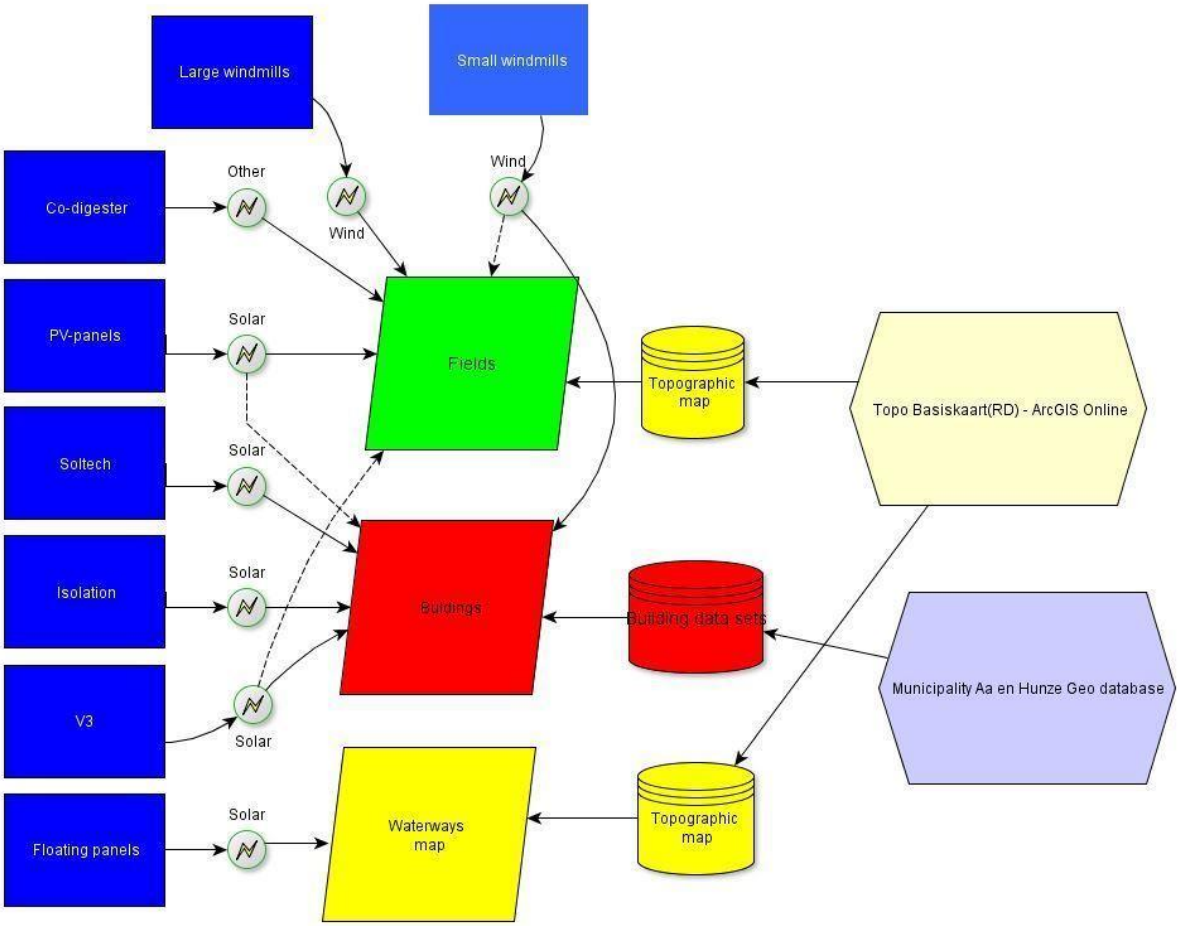
1. Duckweed
2. Floating solar cells
3. They are not sure yet: biochar/wuk: heat out of earth

Appendix 4. Gannt Chart

	Month	May				June			
	Week	week 1	week 2	week 3	WEEK 4	week 1	week 2	week 3	week 4
	Tasks								
Getting to Start	phase-1 Exploring								
	Getting to know eachother b/n the team members								
	Over view and instructions with the Project coach								
	Define the problem								
	Define the objective								
Schedules	Phase-2 Planning								
	Analysis the problem								
	Identify and describe the stakehoders								
	Group meetings and discussions								
	Meetings with the expert (Ron van Lammeren)								
	Preparing question for the meeting with Commisionaire								
	Meeting with the student group of Env'tal Technology								
	Preparing a plan of touch table test day								
Operation	phase -3 Excution								
	Proposal writting								
	Prepare a general method for the use of the Touch Table								
	Prepare base map and reference maps								
	Adjust the touch table with programing								
	Excuting the touch table test (Interactive session)								
	Evaluations and feedbacks of the interactive session								
	Evaluate the alternative energy landscapes								
	Visualization of the interface								
	Evaluating the functionality of the touch table								
product delivery	Phase 4-Result								
	Produce map								
	Reporting and documenting the end Products								
	Presentations of the results								
	Remark*								

Legend	
	Exploring
	Planing
	operation
	Product
	Remark
	Fieldwork

Appendix 5. Flowchart suitability maps



Legend
Energy label (type of energy)
Database
Suitability Map
Energy source
Source of data

For Fields and Waterways maps,it is derived from Arc GIS online Topo nl . and for buildings it uses the Geo data bases and data sets of Aa en Hunze Municipality. After that possible areas for Energy source was defined. As indicated in the flowchart:

Windmills (large, small) there is a potential placements of the windmaills. For large wind mills it should be placed in the fields and for small wind mills it is possible to place on the houses as well as in the fields.. .
V3 better locate near to water, and floating panels could be used only on the water, to indicate possible locations waterways map was used;
Soltech and ***PV-panels*** could take position in two maps (the can be placed on buildings and fields);
PV-panels are useful on roofs and lands but the position of the sun should be taken in account;
Isolation can be located in buildings map. Highest profit with energy reduction can be reached at farms
Co-digister depends on what sort of things putted in the digester. The best location for them are fields or locations nearby to farm(chicken farm).

Appendix 6. Data sources and relation to different suitability maps

Suitability Maps

In the project, three suitability maps are used. The main purpose of this suitability maps are to help the participants in placing their desire energy options on the exact location. This suitability maps are used in all the sessions and by all the participants.

The first suitability map is the buildings suitability maps. This suitability map shows all the building in the village. The source of the data is collected from the municipality of Aa en Hunze geo-data bases. This suitability maps helps the participants to place the eight energy options in their right places. according to this soltech, pv panels, isolation,V3 and small wind energies are possible to plant in side and on the roof of the buildings.

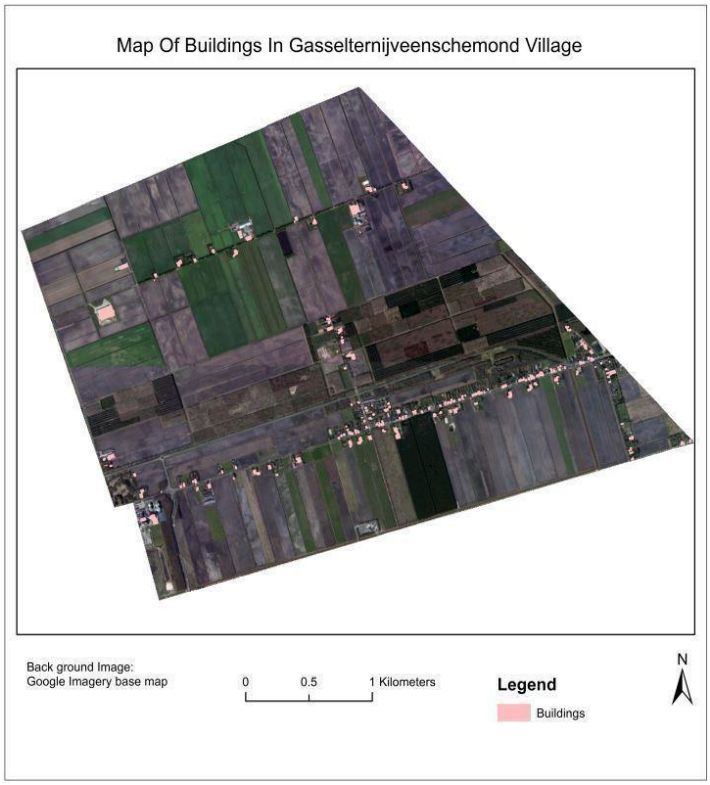


Figure 1: Suitability map of Buildings

The second suitability map is the Fields. This data is collected from ArcGIS online of TOPO NL data sets. Basically, the suitability map includes the agricultural areas , grass land areas and the open areas of the village. Therefore, this is a helpful map for the participants to place their desire energy options in the Fields such as big windmills, Co-digester, small wind mills, V3 and Pv panels.

Figure2: Suitability map of Fields

The third suitability map is the waterways map. This data is collected from the ArcGIS online datasets. The same as stated above this suitability map contributes to the participants to select the energy options on the exact locations. For instance, the floating PV energy options.

Figure 6: Suitability map of Waterways

Appendix 7. Organizing The Touch Table test day with the citizens

The test sessions of the Touch Table as a tool for discussion about the Village Energy Plan are planned on the 13th of June 2013, in Gasselternijveenschemond in the municipality of Aa en Hunze, Drenthe, the Netherlands. Two test sessions will be done during that day starting with the first session from 13:00 onwards and the second session from 18:45 onwards. Per test session 4 inhabitants of the municipality Aa and Hunze will participate. There will also be a representative of the Municipality Aa and Hunze, so in total 5 people will participate per session.

The facilitator of the day will be Annemieke Mulder from the GIS student team of the WUR. She will guide the participants through the session and takes care of the explanation of the usage, the drawing with the table and the discussion session at the end. The rest of the GIS team will also be present. They will observe the reaction of the participants and help Annemieke especially during the drawing part of the session. Furthermore, Ron van Lammeren, the Touch Table expert in this project will be present the whole day.

For this day, the location: "het dorpshuis van Gasselternijveenschemond" will be available for the sessions which will be arranged for the team by the Energy Bureau. List of things that should be done before the test session from a practical point of view:

1. Test user interface and provided software starting already Friday the 7th of June if that is possible and organise a session also with Ron van Lammeren since he is the touch table expert in this project.
2. The possibility of having dinner for the team should be checked with the Energy Burea.
3. It is already known that the canteen can be used for providing drinks for the participants. We will get the bill afterwards. Check whether e.g. there are also some snacks for the participants present or that the team should take care of this.
4. A car needs to be rented beforehand in which the touch table can also be transported. Lammert Kooistra will be contacted for this as soon as it is sure that the date will be the 13th of June.
5. Get confirmation about amount of participants per session from Energy Bureau.
6. Check whether participants can speak and understand the English language.
7. Take storing device (laptop/usb with us)

In order to make sure the two sessions will go smoothly, a more specific planning of this day is given in Table 1.

Table 1. Planning of the two test sessions of the Touch Table with inhabitants of Gasselternijveenschemond at the 13th of June, 2013

Session Day	**Category**	**Time**	**Tasks**
	Pre-session Preparations	09:30	Check if all necessary materials are prepared for trip to the Aa en Hunze and load them in the rented car
		10:00	Leaving from Wageningen University by car, Ron van Lammeren will drive us there
		12:00	Arriving municipality of Aa en Hunze,

June 13		12:00 – 13:00	Get touch table out of the car and prepare technology/software for the test session and make sure coffee/tea/snacks are available.
	Session 1	13:00 – 13:15	Participants are arriving and coffee and tea will be served by one or two of the GIS team. A questionnaire for the participants will be distributed in order to find out what expectations the participants have of this day.*
		13:15 – 13:45	An explanation will be given about how the touch table can be used by the participants, the legend of the maps and what the goal is of this day.
		13:45 – 14:15	The participants can start drawing in the map, and as indicated by Annemieke they will have 30 minutes in total to draw each energy option (there will be 8 in total) in the map and get feedback of the system in terms of cost and energy production of their plan. They will have here also a limited amount of drawings indicated at the start of the session (This amount should first be tested, before it can be indicated). During this session, help of the GIS team is given whenever needed.
		14:15 – 14:30	This will be the break for the participants and some drinks and snacks will be provided here again. The GIS team will make sure the different maps created in the session will be combined and a final map will be provided on the touch table which will be used for the discussion part of the session.
		14:30 – 15:15	Here the final map displayed at the touch table is discussed with the participants. The first 15 minutes will be used to delete indicated options. Another 15 minutes will be used to discuss which indicated options should definitely stay in the plan. The last 15 minutes will be used to discuss the map that is created by this method.
		15:15 – 15:45	In this 30 minutes an evaluation of the method will be done with the participants by means of a questionnaire and some informal chats with the participants. **
Break		15:45 – 18:45	Save all results, have a short break first, have a short feedback session about the first test session, have dinner and prepare from 17:15 onwards the next test session.

June 13	Session 2	18:45 – 19:00	Participants are arriving and coffee and tea will be served by one or two of the GIS team. A questionnaire for the participants will be distributed in order to find out what expectations the participants have of this day.* (Appendix 7)
		19:00 – 19:30	An explanation will be given about how the touch table can be used by the participants, the legend of the maps and what the goal is of this day.
		19:30 – 20:00	The participants can start drawing in the map, and as indicated by Annemieke they will have 30 minutes in total to draw each energy option (there will be 8 in total) in the map and get feedback of the system in terms of cost and energy production of their plan. They will have here also a limited amount of drawings indicated at the start of the session (This amount should first be tested, before it can be indicated). During this session, help of the GIS team is given whenever needed.
		20:00 – 20:15	This will be the break for the participants and some drinks and snacks will be provided here again. The GIS team will make sure the different maps created in the session will be combined and a final map will be provided on the touch table which will be used for the discussion part of the session.
		20:15 – 21:00	Here the final map displayed at the touch table is discussed with the participants. The first 15 minutes will be used to delete indicated options. Another 15 minutes will be used to discuss which indicated options should definitely stay in the plan. The last 15 minutes will be used to discuss the map that is created by this method.
		21:00 – 21:30	In this 30 minutes an evaluation of the method will be done with the participants by means of a questionnaire and some informal chats with the participants. ** (Appendix7)
	Finally	21:30 – 22:00	Thank citizens and save all data, put everything in the car and drive back to Wageningen at 22:00.

Appendix 8. Questions for the interview with participants of interactive session for evaluation of the added value of the Touch Table in the Village Energy Plan design process.

In order to evaluate the Touch Table device within the development of the Village Energy plan it is necessary to assess the expectations of the participants beforehand and also afterwards. In this way, the GIS team is able to first see what expectations the participants have and afterwards whether those expectations are being met, how they thought about the functionality of the Touch Table as a tool for discussion and as an overall tool. The following questions will be asked before the meeting takes place:

1. What is your age?
2. What is your profession?
3. How far do you live from expected wind farm location?
4. Do you have a lot of experience with using computer software?
5. Do you have a smartphone or I-Pad?
6. How do you see the touch table?
7. What is your expectation with regard to the touch table?
8. How do you see the functionality of the touch table in the discussion about Village Energy plan?
9. How difficult do you expect it is to use this Touch Table?

**After the use of the device it is necessary to let them evaluate the device by means of the following questions the team will ask:

1. What is your overall opinion of the Touch Table?
2. Are you satisfied with the functionality of the Touch Table used?
3. Did the Touch Table meet your expectation?
4. Which part of the Touch Table do you think works very well?
5. Which part of the Touch Table do you think is frustrating?
6. Was the Touch Table difficult to use?
7. What was the most common mistake you made during the use of the Touch Table (if there is any)?
8. Which usability issues do you think will remain after the product is launched?
9. Do you think the tool is trustworthy?
10. Is the tool visually appealing?
11. Is it easy to find where you were looking for during the use of the product?
12. Did you know where you were in the overall structure of the Touch Table during the working with it?
13. Was it clear after the explanation which options you have?

The answers to those questionnaires will be analysed after the test session day in order to find out the users perspective on the usability of the Touch Table as tool for discussion. The questions of the questionnaire are based on information given by Tullis and Albert (2008).

The exact questionnaire is implemented on the next page.

Questionnaires about the expectations and evaluation regarding the Touch Table.

1. What is your age category?
    a. Below 25
    b. 25 – 35
    c. 35 – 50
    d. 50 +

2. What is your "gender"?
    a. Man
    b. Woman

3. What is your educational level?
    a. Lower or no school (basisonderwijs)
    b. Lower over all training (VGLO, LAVO)
    c. Lower Vocational (MULO, MAVO, VMBO)
    d. Vocational training (MBO, MTS, UTS, MEAO, INAS)
    e. Higher overall training (HAVO, MMS, VWO, Atheneum, Lyceum, Gymnasium)
    f. Higher acadamic education (Universitair)

4. How far is the distance of the planned windmill park to your house?
    a. 0 – 3 km
    b. 3 – 6 km
    c. 6 - 9 km
    d. 9 – 12 km
    e. 12 km and above
5. Do you agree with the windmill park?
    a. yes
    b. no
    c. others, name:

6. Do you have experience with touch devices, like IPAD?
    a. yes
    b. No
    c. Others,name:
7. Do you have experience using topographical maps? (1 = very a few, 5 = a lot)?

    1 2 3 4 5

8. How difficult do you think the touch table is for you ?(1 = very difficult, 5 = very easy)?

    1 2 3 4 5

9. What is your view regarding the touch table ? (Describe it briefly in one sentence)?

10. How do you think the touch table can contribute to the discussion regarding the Village Energy Plan (Describe it briefly in one sentence)?

Evaluation of the use of the Touch Table

11. What was your ID number?

do you agree with the following statements ?

12. value	*fully Agree*	*Agree*	*average*	*Disagree*	*fully disagree*
is it useful?	1	2	3	4	5
is it practical?	1	2	3	4	5
Is it convinent?	1	2	3	4	5
Is it helpfull?	1	2	3	4	5
Is it efficient?	1	2	3	4	5
Is it special?	1	2	3	4	5

Additional Comments: ..

13. ***User friendlyness***	*fully Agree*	*Agree*	*average*	*Disagree*	*fully disagree*
Is it structured?	1	2	3	4	5
Is it understandable?	1	2	3	4	5
Is there little technological knowledge?	1	2	3	4	5
Is it easy to use?	1	2	3	4	5
Does it what it is expected to do?	1	2	3	4	5
Should the Touch Table be able to do more?	1	2	3	4	5
Is it tiring to use?	1	2	3	4	5

Additional Comments: ..

14. Was the explanation before half enough according to u?
    a. yes
    b. no, because:

15. Experiental value	fully Agree	Agree	average	Disagree	fully disagree
Is it adventurious?	1	2	3	4	5
Is it boring?	1	2	3	4	5
Is it exciting?	1	2	3	4	5
Where there to many peaples?	1	2	3	4	5
Is it unique?	1	2	3	4	5
Is it interesting?	1	2	3	4	5
Is it trustworthy?	1	2	3	4	5

Additional Comments: ..

16. Elements which are good the way they are::

	fully Agree	Agree	average	Disagree	fully disagree
Size individual map	1	2	3	4	5
Colors	1	2	3	4	5
Readability	1	2	3	4	5
Menu structure	1	2	3	4	5
Clearness of symbols	1	2	3	4	5
Clearness of legend	1	2	3	4	5
Map is good for orientation	1	2	3	4	5
Map is clear	1	2	3	4	5

Suitability maps give enough information to place the energy options

1 2 3 4 5

Additional Comments: ..

17. What part(s) of the touch table are working well?

18. What part(s) need adjustments? What was not good?

19. What maps are missing? (If u think there are, name it)?

20. How far do you agree with the following statement: The touch table is valuable in the planning of a Village Energy Plan. Fully Agree = 1 and fully disagree= 5

    1 2 3 4 5

21. Does the Touch Table meet your expectations regarding the Village Energy Plan?
    a. yes
    b. no, because

22. Would you recommend this method in other projects?
    a. yes
    b. no, because ...

23. Is your view on the Village Energy Plan changed after this session??
    a. yes
    b. no, because ...

24. What rating (from 1-10) would give you like to give the use of the Touch Table in this project?

Appendix 9. The Touch Table as used in this project

The touch table that will be used and provided by the WUR during this project is a Samsung SUR40 Full HD 1080p multi-touch computing device for Microsoft Surface. It uses PixelSence [tm] technology to see and respond to touch and objects with optical tags. Furthermore, it recognizes and reacts to more than 50 points of contact simultaneously, letting several people use the SUR40 at one time. (Samsung 2013)

The GLEE application will be used and is already installed on the Touch Table used. This GLEE application makes it possible for up to 6 persons to select maps individually and draw in those maps individually. It is possible to make a joint sketch and to analyse those drawings. (WageningenUR, 2013)

However, for this specific project specific basic maps are needed which need to be prepared with ArcGIS before they can be used as input for the GLEE software. Furthermore, scripts need to be used in order to connect the maps with the specific legend and the stamps used by the participants to indicate where different energy devices should be placed according to them. Also scripts are needed for combining all the maps created into one map and for connecting the drawings with the feedback system based on the calculation model of the VHL students about the costs and energy produced by the particular devices. Most scripts will be provided by Wilco van Haaren and Aldo Bergsma.

As can be seen from the text above, the people who want to use the touch table together with the GLEE software need to program and develop the visualisation generally themselves. There is no general method on how to do this. What is done, is some research about the use of a touch table in museums and art gallery exhibitions. The program focusses on the exploration of an image database by use of handling digital pictures or by use of a particular kind of stamps which are recognized by the program. A usability test was also done: it appears that users consider the touch table application to be interesting and attractive. (Ciocca et al., 2012) So what is already known is that users like it as an informative application and that it is possible to interactively let the user create and manipulate image clusters.

The study of Berkham and Karahoka (2012) also focussed on the functionality of the touch table as an information device. However, there is no research known on how the touch table could be used in discussion sessions. So, here lies an opportunity for the student group. Furthermore, a general method for using the touch table in a discussion session is also not available. This will be studied also during this project: how should such a discussion session be organised, how should it be done during the discussion session and how can such a discussion session and the tool be evaluated.

Appendix 10. Alternative energy options with possible placement ,Amount of energy and Costs

Energy Options	Symbol (Legend)	Place (Locations)	Amount of MWh / year	Total investment in euro/unit	Annual Revenue in euro /unit
Large Windmill		Fields	10950	6000000	-172750
Small windmill		Buildings and Fields	2.464	9950	-1.149
PV panel		Buildings and Fields	0.228	258	-0.46
floating PV	 	Water -ponds -rivers	29.3	28531	-1312.79
Soltech		Buildings	0.166	150	-6.23
V3		Buildings and fields	5.49	1369.5	147.88
Co-digester		Fields	11200	3432208	222163
Isolation		Buildings	1.626	12500	-483.49

Appendix 11. GLEE software for Touch Table

The GLEE is multi-touch and multi-use interface, which allows to offer multiple users a sketch instead of a GIS-editing interface. The multi-touch is based on so called pixelsense technology (http://www.microsoft.com/en-us/pixelsense/pixelsense.aspx). (Ron van Lammeren et al.)

The GLEE software was developed in Wageningen University under Education Innovation program (Ron van Lammeren et al.). GLEE have user friendly interface, and made as soft as possible, what makes it available for any users. To use GLEE, users do not need to have special knowledge about GIS.

The interface of GLEE contains of window frames, which make possible to work in same time with own window frame. Each window have own ID number. There are several option are available in using of it (figure 1).

Which are:

- Clear
- Fill
- Select
- Switch background maps
- Minimize window
- Undo
- Combine
- Save
- Erase
- Sketch
    - Transparent bold
    - Transparent
    - Non transparent bold
    - Non transparent

Also available to see separately and adjust size and position

- Scale bar
- Legend

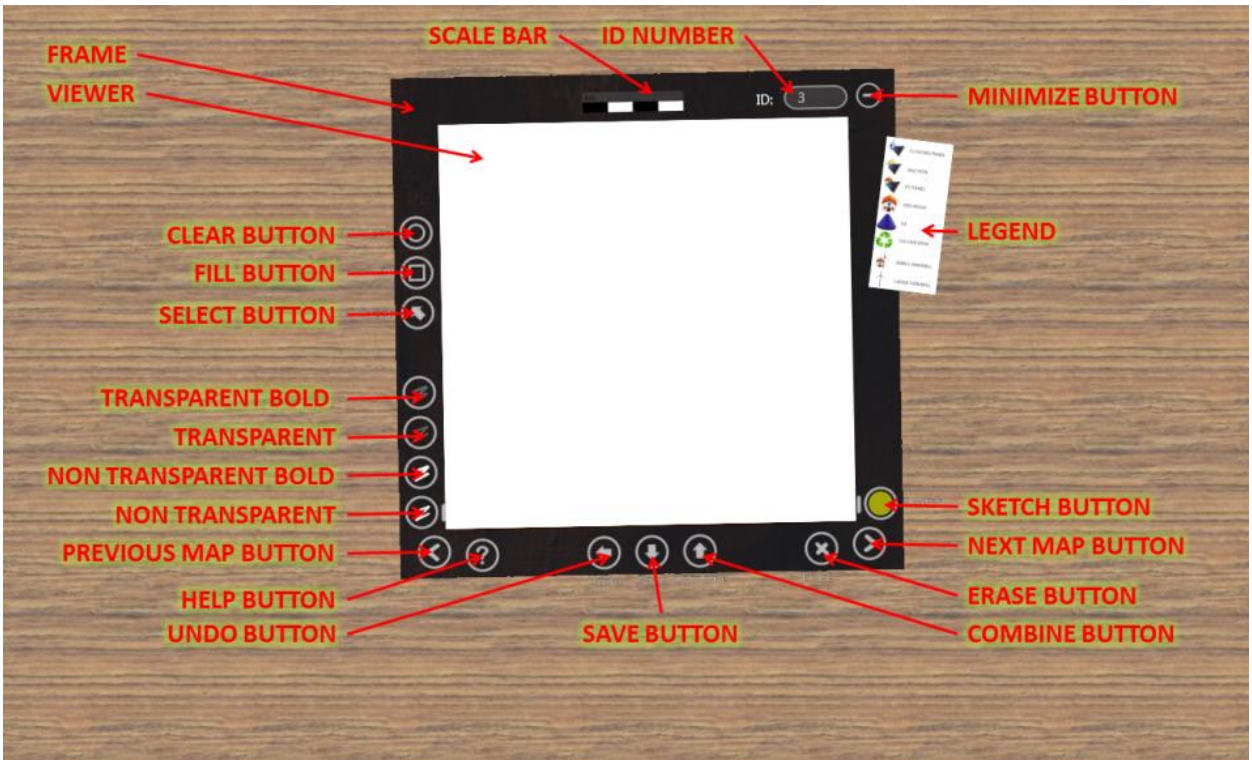


Figure 7: GLEE window frame interface

Reference6

Ron van Lammeren, Arjan de Jong. GLEE* | client-server interface. June 2013