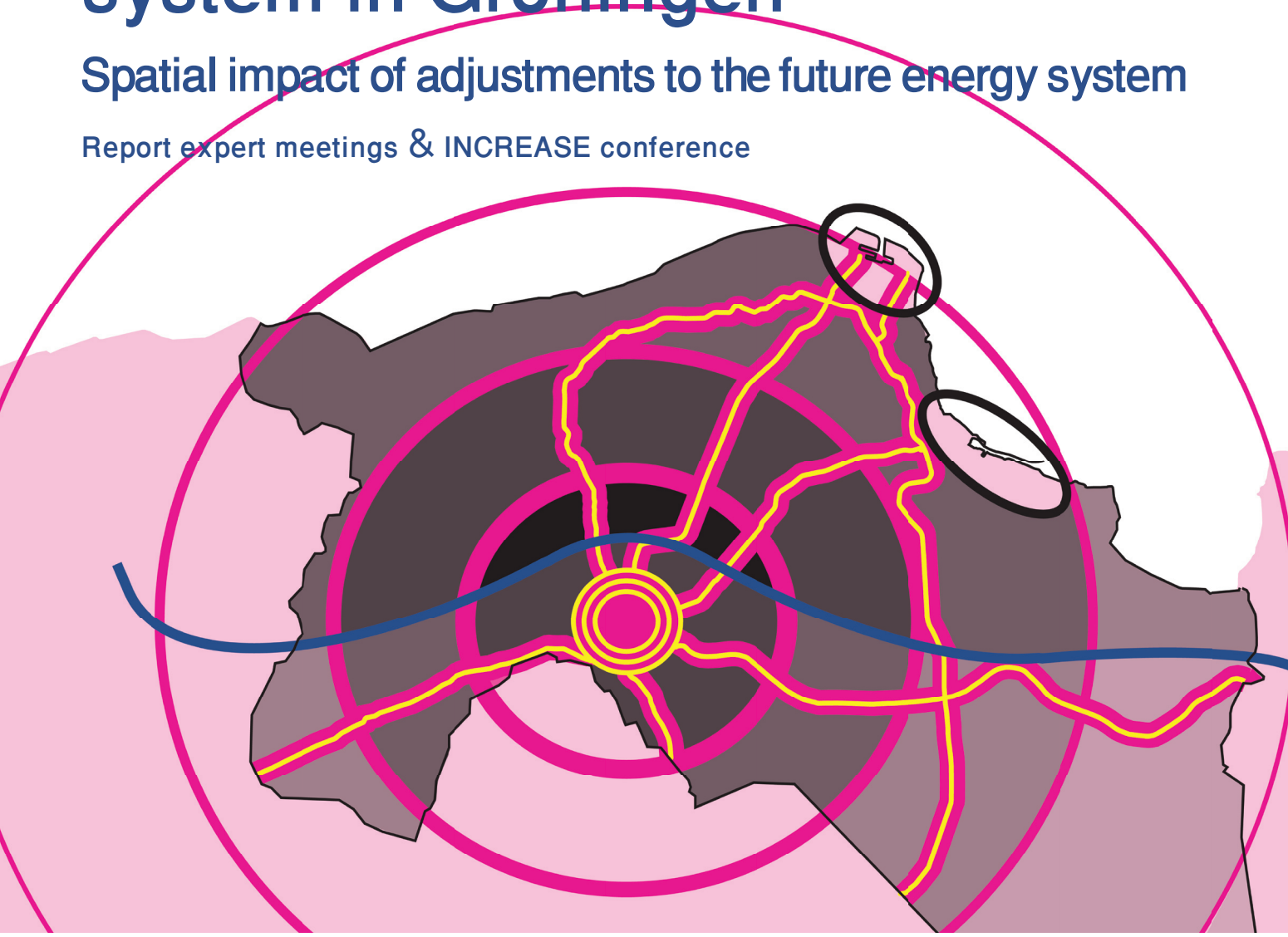
Towards a climate proof energy system in Groningen

Spatial impact of adjustments to the future energy system

Report expert meetings & INCREASE conference



Hotspot climate proof regional plan Groningen

provincie groningen

klimaat voor ruimte

Towards a climate proof energy system in Groningen

Spatial impact of adjustments to the future energy system

CONCEPT

Report expert meetings & INCREASE conference

Groningen

030907

260907

250508

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Moscow

040308

Amman

110408

until

160408

Authors: R. Roggema, W. Mallon, V. Sergeev, G.J. Swaving

Graphics & design: K. Klap

Groningen, 14 july 2008

1. Introduction

Climate change is influenced strongly by the amount of greenhouse gases in the atmosphere. Especially, the CO2 concentration increases over the last decennia. This increase is mainly caused by the extensive use of fossil resources, such as oil and gas. The way the energy supply currently is arranged, causes on the one hand side higher concentrations green house gases, and because of that, higher temperatures on earth, on the other hand is our energy system fully based on the use of fossil sources. Depletion of main reserves within the next decades leads to uncertainty and, more important, a fast increasing price of energy. Debate on oil prices were about a 50 or 60 Dollar/barrel level in 2005 (figure 1), last year we were talking if the 100 Dollar barrier would ever be reached (figure 2) and in May 2008 the 135 Dollar level was reached.

Goldman Sachs: olieprijs deze zomer op 150 dollar per vat
Amsterdam (BETTEN FINANCIAL NEWS) 21 juni 2008 –
" De prijs voor een vat olie zou deze zomer 'makkelijk' kunnen stijgen naar USD 150 per vat. Dat meldt Goldman Sachs maandag. Een krapper aanbod van olie zal de afnemende vraag overschaduwen, voorzien analisten van de bank.
De markt zal blijven stijgen totdat consumenten het genoeg vinden, zegt onderzoeker Jeffrey Currie van de bank. De prijs zal daarom na een piek niet snel dalen, maar slechts geleidelijk afnemen. Eerder ging Goldman ervan uit dat de olieprijs pas aan het einde van het jaar de USD 149 zou passeren.
De 'superpiek', die de bank eerder voorpelde, komt bovendien sneller dan verwacht. Goldman sprak eerder de verwachting uit dat de prijs voor een vat olie de komende twee jaar kan stijgen tot USD 200. Toenemende vraag, uit onder meer Azie, en afnemende voorraden zijn hiervan de oorzaak.
Morgan Stanley meldde eind vorige week al te verwachten dat de olieprijs binnen een maand de USD 150 per vat zal bereiken. De sterke vraag naar olie vanuit Azië zal een korte termijn piek in de prijzen teweeg-brengen, aldus de bank vlak voor het weekend.
De olieprijs steeg vrijdag in New York tot boven de USD 139, een nieuw record. Onder andere opgelopen spanningen in het Midden Oosten en Afrika en de zwakke dollar speelden een rol in de prijsstijging".

And specialists predict further increase.

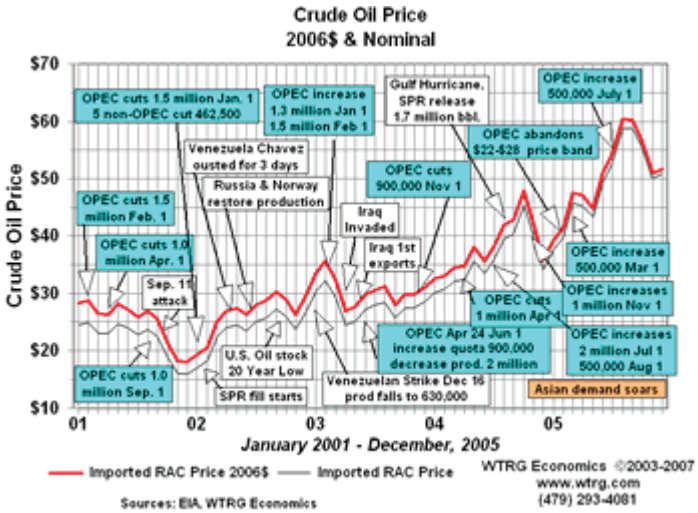


Figure 1. Rising oil prices in the beginning of the 21st century, up to 60 Dollars/barrel in 2006 [www.wtrg.com]

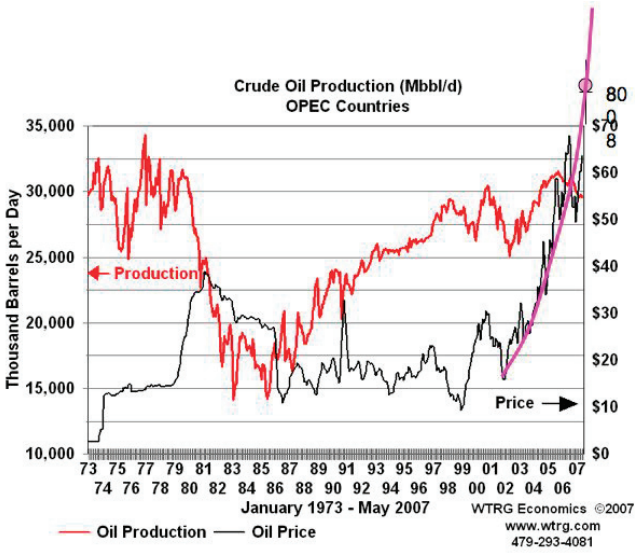


Figure 2. Oil production and price since 1973 [www.wtrg.com]

These developments urge for answers. Development of a sustainable energy system is essential and becomes more urgent in the near future.

Williams and Alhaji argue in their article [Williams & Alhaji, 2003], that current times show strong similarities with the periods just before the energy crises in 1973 and 1979. Common elements include:

- Political turmoil in oil producing countries;
- Low oil stocks;
- High import from small number suppliers;
- Declining US petroleum production;
- High dependency on oil imports;
- Low level of oil industry spending;
- Speculation;
- Economic downturn;
- Limited US-policy options for Middle East.

These elements can be seen in international developments of today. The rapid rise of oil prices makes it even more 'crisis'-like (figure 3). In day-to-day practice these developments are underestimated and put aside as a future problem. Aims and goals of European, National and Regional policies are moving in the right direction. The question is if the objectives are ambitious enough and if they will be executed in time.

Dagblad De Pers
Woensdag 25 juni 2008

Oliecrisis

Jan-Hein Strop

Van links boven met de klok mee: blokkade van Spaans-Franse grens; stakende vissers in Venetië; wandelend protest in Jakarta; boze boeren in Brussel.

Mondiale olieonrust

VERVOLG VAN PAGINA 1

...

Protesten tegen de hoge benzine- en dieselprijzen grijpen wereldwijd om zich heen. Gisteren was het de beurt aan ongeveer duizend studenten in Jakarta, die opnieuw met geweld hun ongenoegen hoorbaar maakten aan de poorten van het parlement. Bij een vorig protest enkele weken geleden viel al een dode.

De subsidie op brandstof is in Indonesië afgeschaft, wat de arme bevolking nu hard treft. In China is de subsidie pas eind vorige week vrijdag verdwenen, waardoor een liter benzine opeens zeventien procent duurder werd. Maar een daartoe op de been gebrachte politiemacht wist eventuele protesten bij de pomp te onderdrukken.

Zelfs in de VS, waar benzine veel malen goedkoper is dan in Europa, leidden de hoge prijzen vorige week tot verzet. In New York kwamen trucchauffeurs bijeen om te protesteren tegen een prijs per 'gallon' van meer dan vier dollar – een absoluut record.

Brussel was eerder deze maand het decor van grootschalige demonstraties van boeren en vissers. Vooral de laatsten trokken met hun geweldadig optreden de aandacht van de politiek. Gisteren kwamen de EU-ministers van Visserij bijeen om te kijken hoe ze de wanhopige vissers te help kunnen schieten.

Dit weekeinde heeft Saoedi-Arabië, de grootste olie-exporteur, plechtig beloofd de olieproductie op te voeren in een poging de prijs te dempen. Maar het hielp allemaal niets. De olieprijs schommelde gisteren rond de 136 dollar per vat. Analisten verwachten dat de prijs voorlopig hoog blijft of zelfs verder stijgt. ●

Truckersprotest in Albany, de hoofdstad van de staat New York. AP

Energieraad

'Hou rekening met oliecrisis'

...

Nederland moet zich voorbereiden op een nieuwe oliecrisis binnen vijf tot tien jaar. Er komt een lange periode van schaarste en daarom zijn blijvend hoge olieprijzen te verwachten, zo heeft de Energieraad gisteren geconcludeerd in zijn jaarverslag. De Raad is het belangrijkste adviesorgaan van het kabinet voor het energiebeleid.

Dat er in olierijke landen te weinig wordt geïnvesteerd in productiecapaciteit, voorspelt niet veel goeds. Probleem is dat in veel van die landen de oliebedrijven in handen van de staat zijn en investeringen in olieproductie concurreren met andere uitgaven. Bovendien geven westerse landen het signaal af dat ze hun olieverbruik willen verminderen, waardoor die investeringen onzeker worden.

De Raad stelt dat het kabinet geen middel moet schuwen om de energiezekerheid te waarborgen. Dat betekent stevig investeren in onze economische relatie met Rusland, het land waar Europa in toenemende mate afhankelijk van wordt voor aardgas. Daarnaast moeten we vol inzetten op besparing, met allerlei dwingende maatregelen zoals een verbod op zuinige elektrische apparatuur.

Nog een prettige mededeling: vermindering van CO_2-uitstoot is alleen haalbaar met kernenergie en/of schone kolen. Duurzame bronnen helpen marginaal of – in het geval van wind – kunnen de situatie zelfs verergeren. ●

Figure 3. Crisis? [de Pers, 25 june 2008]

2. Context

The province of Groningen wants to contribute an equal share to the "Kyoto" agreement, as is stated in its Regional Plan (POP (2000) and POP2 (2006)). A study on Energy Potentials (2003) showed the top three of potentials to be:

- energy saving in industry,
- energy saving in buildings, and
- renewable energy (biomass, wind, cold/heat storage)

On the 8th of October 2007 the provinces of Groningen, Frisian, Drenthe and Northern Holland signed an Energy Agreement with the national government, with the following objectives:

- 40-50 PJ renewable energy in 2011;
- 4-5 Mton CO2-emission reduction in 2011.

In this Energy Agreement, the focal points are:

1. Energy Saving in buildings, greenhouses and industry;
2. Renewable energy: e.g. biomass, wind and solar;
3. Bio-fuels and sustainable mobility;
4. Carbon Capture & Storage;
5. Promoting research and innovation in the energy field

Regional activities in Groningen

The province of Groningen has been active on mitigation during the last few years. Some of these activities are economical driven, but others have an environmental motivation.

The most important projects and programs are:

- Energy Valley
- Innovative Action Program (supporting among others high risk investments in the energy field)
- Energy Covenant Groningen (public and private parties working together on energy projects)
- Projects on:
    - Small urban turbines
    - Energy saving by optimizing central heating systems

  - Energy saving for low income households
  - Improving private ownership houses
  - Creating more strict regulations on energy for new buildings
- Wind energy (big turbines)
- Biomass Action plan (2006)
- Bio-fuels Action plan (2008)
- Carbon Capture & Storage
- (in preparation) Action plan on Energy in Buildings and Action plan on energy savings in industry

3. Aim

The fast rising oil prices and the scarcity of fossil energy resources within reach makes it necessary to think about future developments and challenges. The aim of the process is to define the perspectives for a future with a sustainable energy system, to gain insight in the spatial impacts and to check if current policies fulfil future requirements sufficiently.

4. 030907 First meeting: brainstorm

Wim van Gemert, Hanze University
Wim Mallon, Energy Valley
Rob Roggema, Province of Groningen

To start with the thinking process a small brainstorm is organised to explore the possible dimensions of a future energy system. Different directions were explored as shown in the mindmap (figure 4). Main conclusions include:

1. Transition of the energy system will have major impacts on society and peoples life;
2. The transition will take place much more rapid than expected;
3. Technology is ready, consciousness not yet;
4. The question is if the ambitions of the energieakkoord [Ministerie van EZ et al., 2007] meet future requirements;
5. The discussion group needs to be extended.

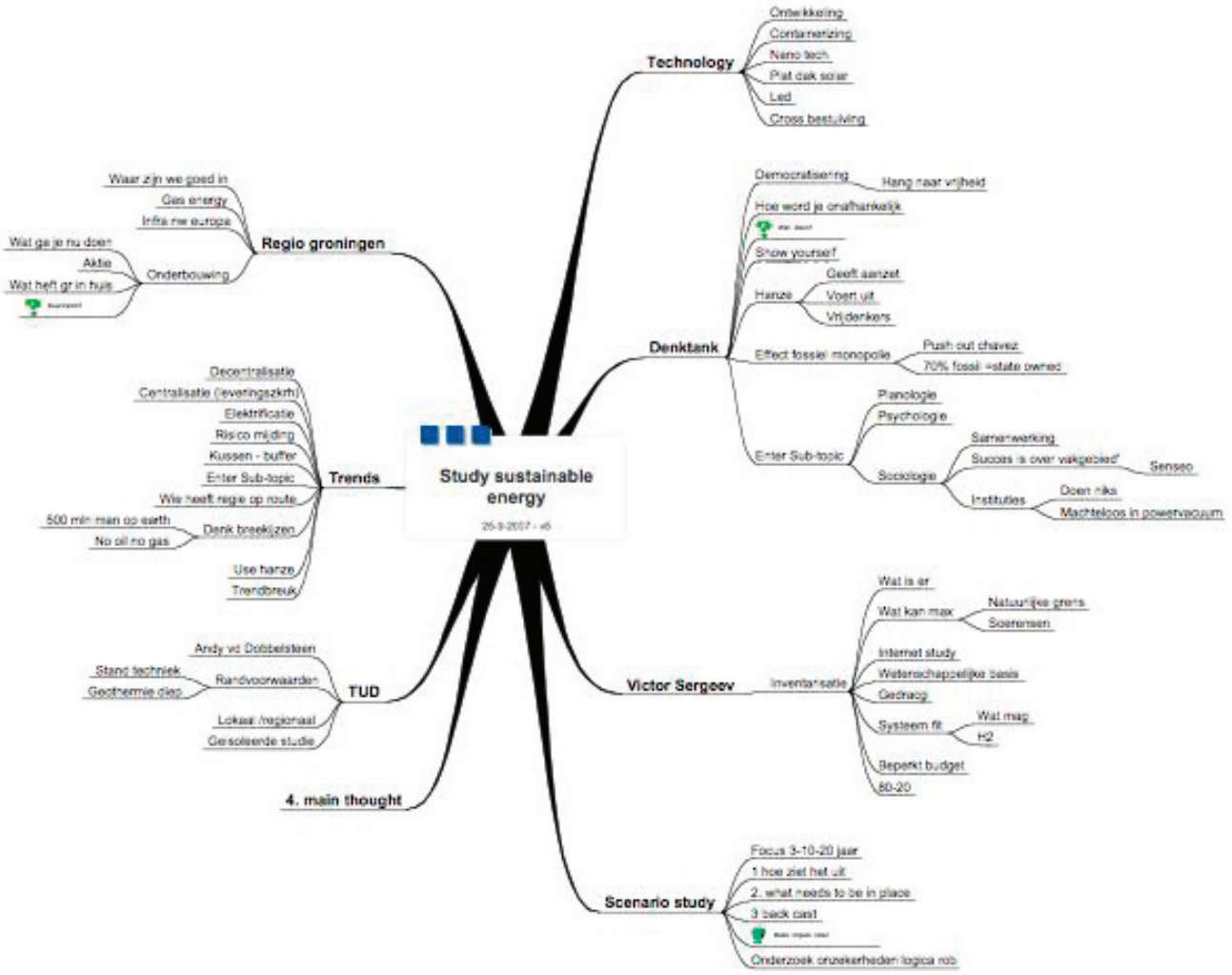


Figure 4. Mindmap as a result of the brainstorm 030907 [Mallon, 2007]

5. 260907 The second meeting

Wim van Gemert, Hanze University
Jeroen de Boer, Province of Groningen
Lotus van Nes, Municipality Groningen
Idso Wiersma, Municipality Groningen
Wim Mallon, Energy Valley
Rob Roggema, Province of Groningen

In the second meeting several directions of thinking were explored.

1. Relation with existing policy and aims.

In order to stay in touch with daily decision making current aims should be incorporated and be seen as a starting point for action. The discussion on a future energy system should not be frustrated, neglecting current ambitions. Decided is that the first four years of energy policy in Groningen remain unchanged. The actions prepared over the past and leading to actions in the upcoming years are prominent steps in the right direction. Debate and thinking should be on the middle- and long-term, starting after 2011. The approach used is to start off with existing knowledge and decisions, after which debate on further future direction can start. Consequently, the focus of the project lies on the period after 2012, taking current polices as starting point.

2. Centralised vs. decentralised energy supply.

The expectations on future developments differ between a fully centralised system and an individually based system (figure 5). The central system is hierarchical organised and the decentralised is based on networks (figure 6).

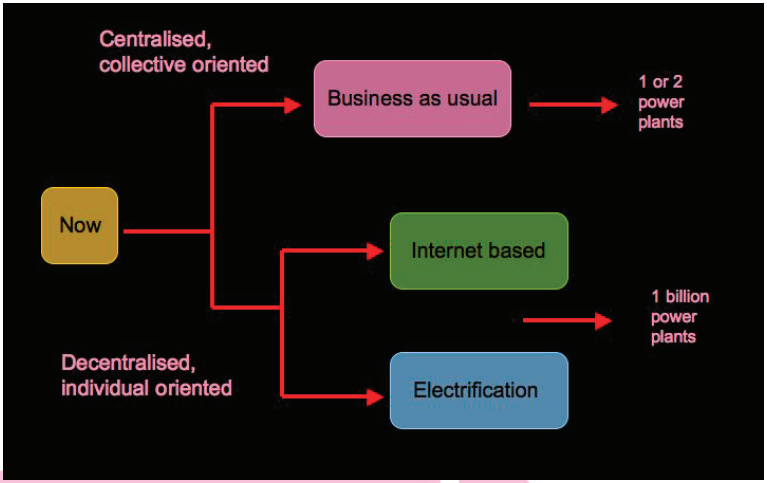


Figure 5. Possible future pathways for our energy system

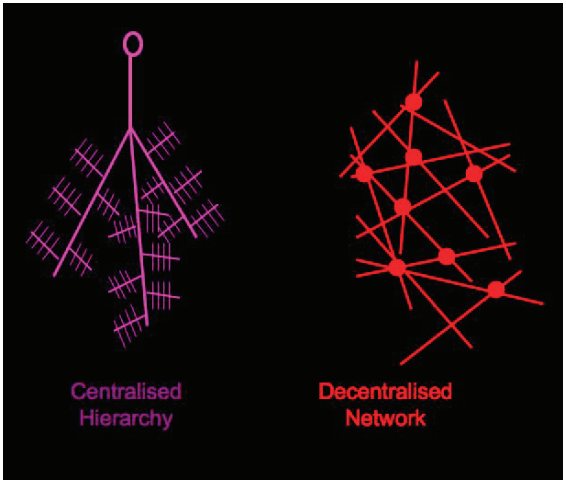


Figure 6. Decentralised hierarchical vs decentralised network system

The centralised system is more or less business as usual. A centralised network takes care of the energy supply, which is produced in one or two large power plants. Power companies try to make their production as efficient as possible in order to keep prices as low as possible. If necessary to keep prices low the combination of two smaller companies in a big one, is undertaken. The decentralised system implies the production of energy at a much more lower scale. Locally produced energy may by supplied to the grid by individuals. Doing so, they contribute to the total energy production. Two ways are thinkable: exchange of energy by the internet or transformation into a complete electrified network. In this scenario many small power plants will emerge. To find the most optimal mix of sustainable energy sources, the method of energy potential mapping may be used [Roggema et al. 2006; Dobbelsteen et al. 2007]. In the year 2006 the first, rudimentary energy potential maps were produced for Groningen for wind, solar, geothermal and hydropower energy as well as for the production of biomass (figure 7). These potentials were integrated into one energy mix map (figure 8). Figures 9-14 show a more detailed analysis on a provincial level.

Conclusion may be that, for the next decades, a combination of a decentralised and centralised system will be the practice [Timmeren, 2006]. In any case the influence of individual, or collective individual, energy-suppliers will increase.

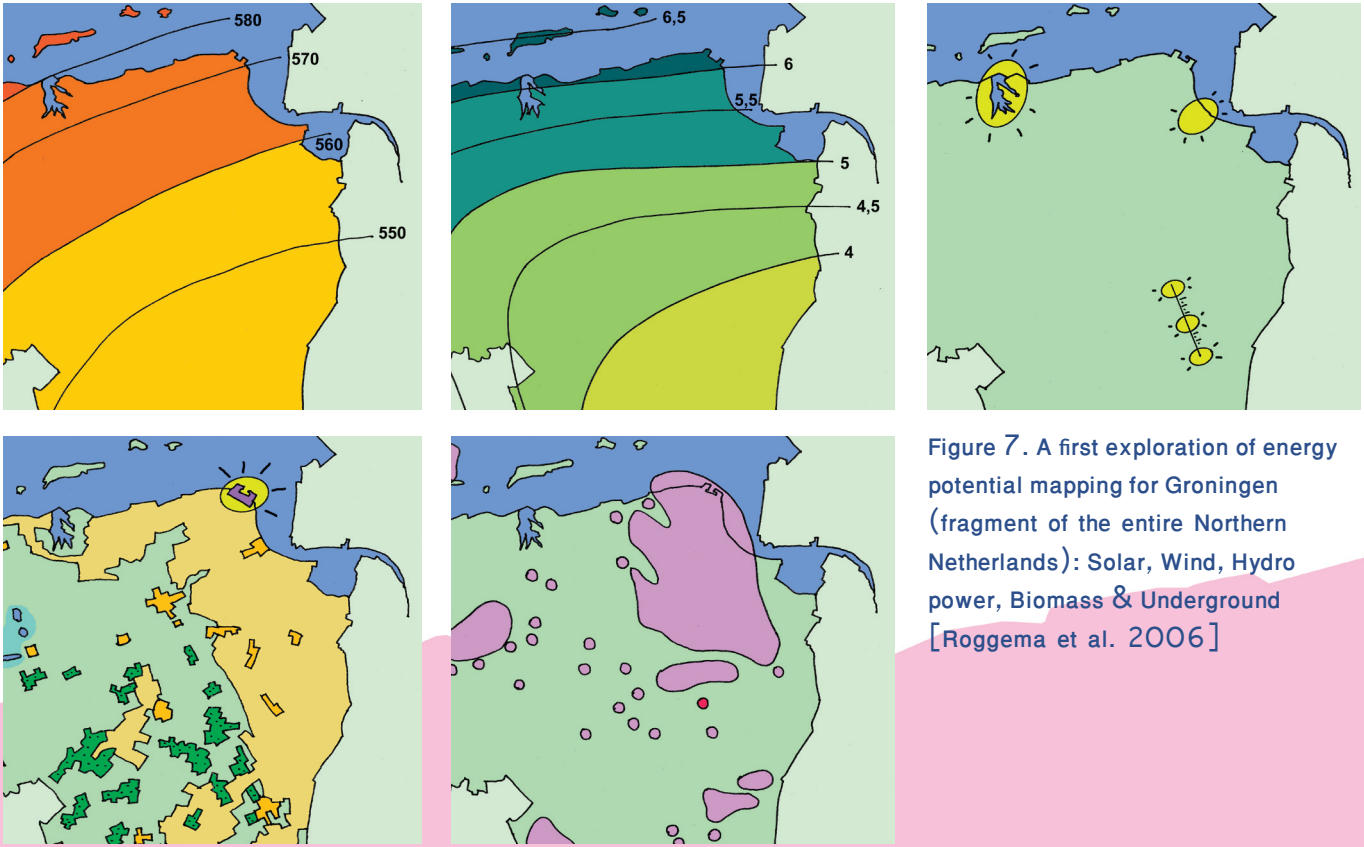


Figure 7. A first exploration of energy potential mapping for Groningen (fragment of the entire Northern Netherlands): Solar, Wind, Hydro power, Biomass & Underground [Roggema et al. 2006]

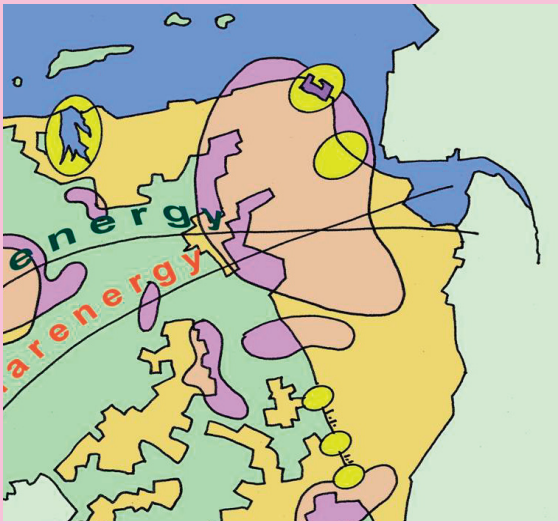


Figure 8. The energy mix map, an overlay map of energy potentials, indicating a richness of energy in the north-eastern part of Groningen: sun, wind, biomass and underground [Roggema et al, 2006]

For the new environmental plan of Groningen, the mapping method of Roggema et al. [2006] was enhanced and executed in more detail by Dobbelsteen et al. [2007]. Following a structural approach from basic information and maps depicting properties related to for instance topography, climate, land use and underground, maps were drawn of potentials for electricity generation, heat and cold, and CO2 capture.

Figure 9 gives sunshine duration (left) and solar energy content per cm2. There is a gradual decrease in solar potential from north-west to south-east, but the differences are less than 3%. Hence, no indication for a different treatise of solar energy in the various provincial parts.

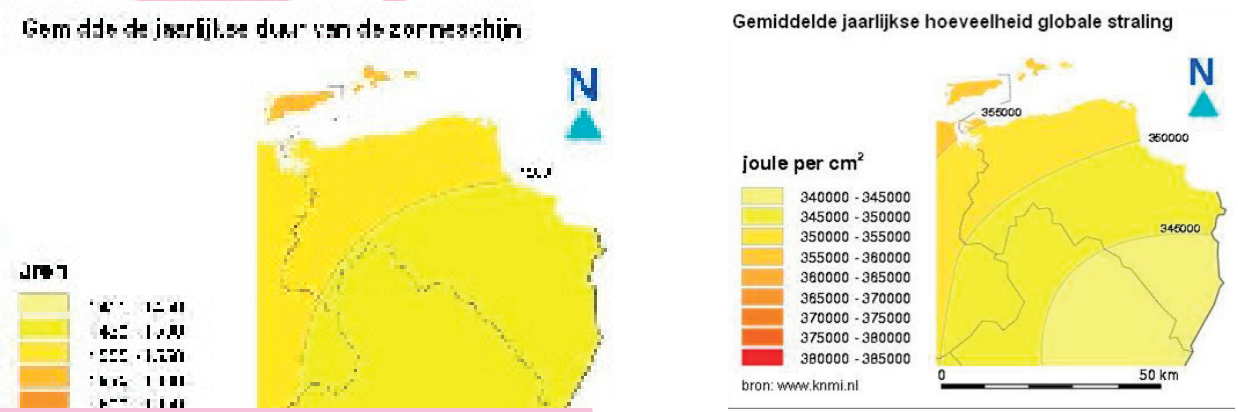


Figure 9. Detailed potentials for solar energy [Dobbelsteen et al, 2007]

Figure 10 depicts the potentials for wind energy at an altitude of 100 m, the common height for large wind turbines. The coastal strip, or even beyond that, in the Wadden Sea, has the highest yield, which can be seen in the windroses that encompass the energy content in different orientations.

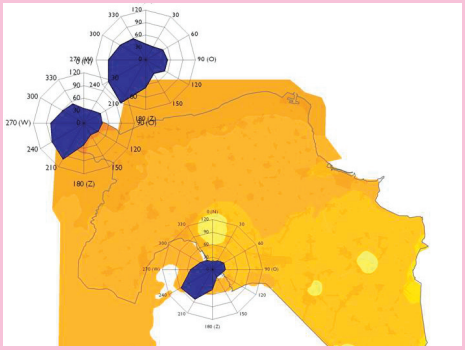


Figure 10. Detailed potentials for wind energy at an altitude of 100 m [Dobbelsteen et al, 2007]

Figure 11 shows energy potentials from water (left) and biomass, waste and fossil fuels (right). Hydro-power is particularly interesting in terms of a tidal plant (Lauwersmeer), blue energy plants (on the basis of reversed electro dialysis or osmosis) and an inundation plant that generates power from sea water inlet in cases of emergency (the inundation areas are hatched).
Especially interesting for the map to the right is the green hatched area along the A7 motorway. This indicates the best location for biomass-based industry (bio-refinery, bio-ethanol factory, bio-powerplant, etc.), based on the maximum range of transport (50 km) from outer agricultural areas and on good means of transport by railway and roads.

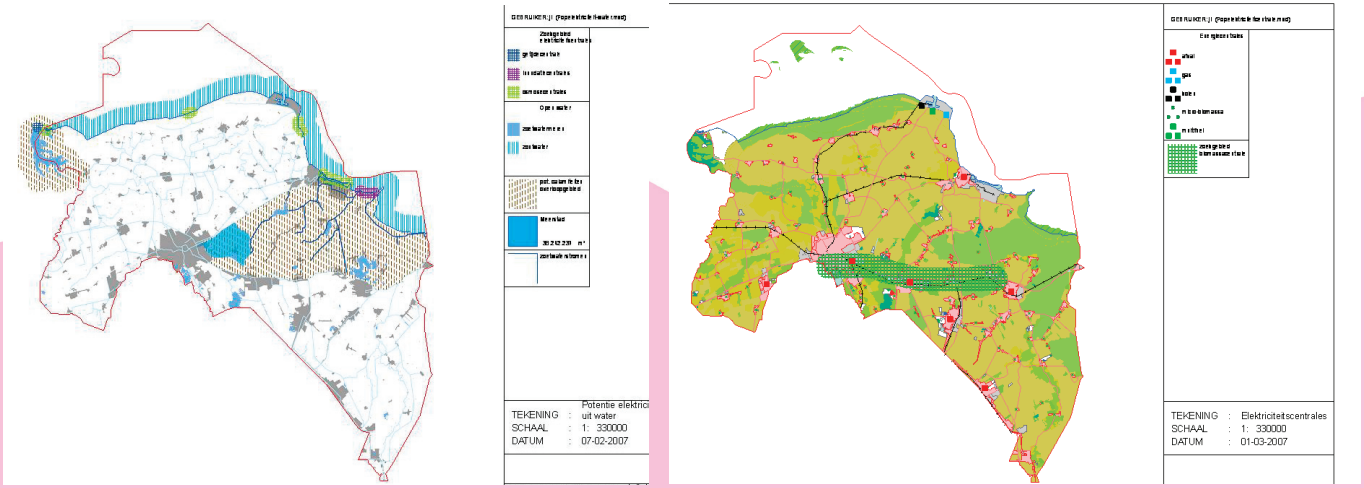


Figure 11. Detailed potentials for hydropower (left) and biomass (right) [Dobbelsteen et al. 2007]

All electricity potentials were combined to the map of figure 12, which gives the best options for the generation of power. Not visible are the ubiquitous potential of photovoltaics and small wind turbines on the local scale.

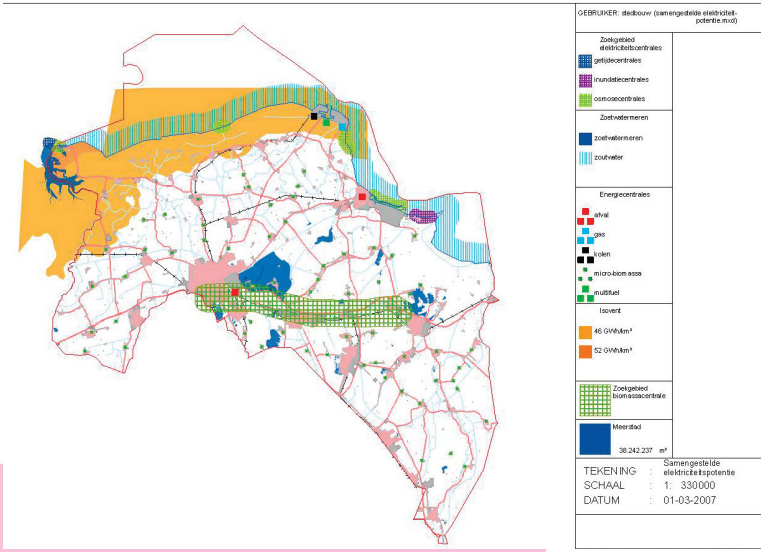
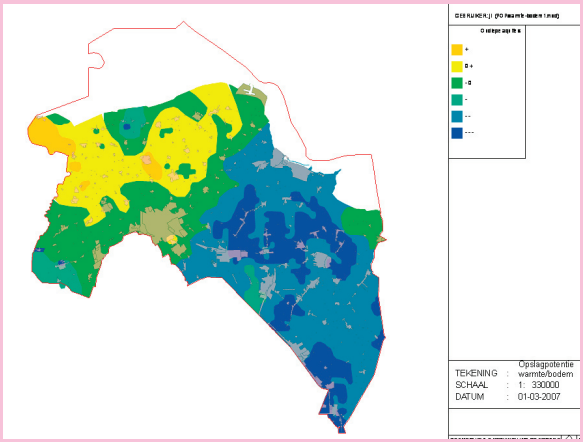


Figure 12. Combined potentials for electricity production [Dobbelsteen et al, 2007]

For the heat and cold, figure 13 depicts underground potentials at two depths: suitability of storage of heat and cold in aquifers at a depth of 30-250 meter (left), and heat potentials from the deep underground (3000 m) through drill-holes for natural gas extraction (right). In both cases the north-western part of Groningen offers good opportunities.



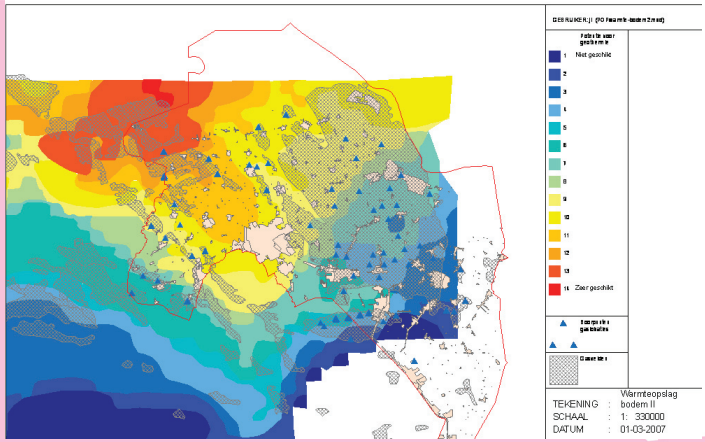


Figure 13. Detailed potentials for geothermal energy in shallow aquifers (-/- 30-250 m, left) and deep aquifers (-/- 3000m, right) [Dobbelsteen et al, 2007]

Figure 14, left, demonstrates there is a large amount of waste heat (red full circles) to be gained for heat demanding purposes (red hollow circles) in the province. The problem is the distance to be covered and in-between storage. The LNG terminal at Eemshaven (blue full circle) is not yet completed yet already positioned in the picture.

The map at right is trhe overlay potential map for heat and cold. There is a clear distinction between the north-west and south-east, emphasising to position heat demanding functions near Lauwersmeer and fine-tuning heat and cold patterns to the south-east.

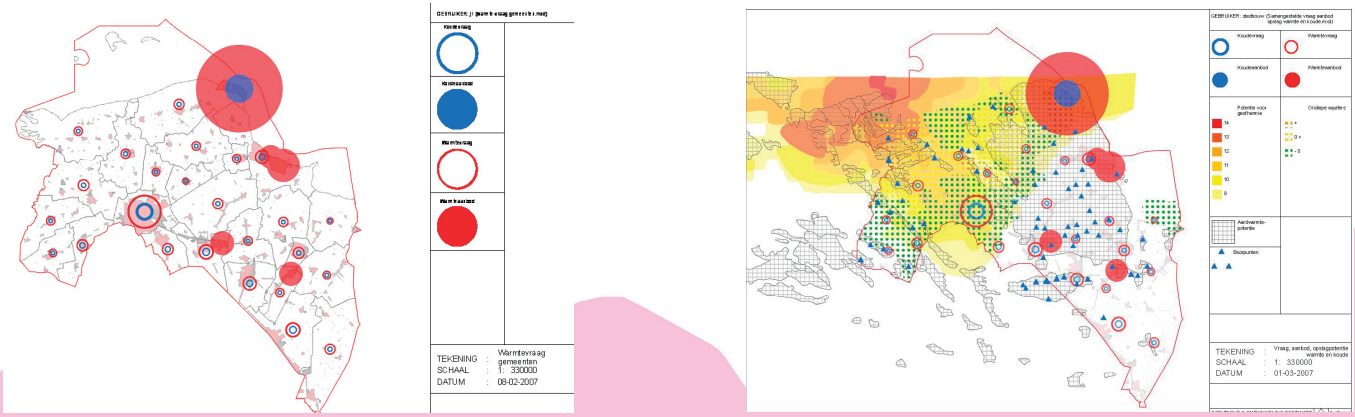


Figure 14. Detailed potential of heat supply (left) and the combined map of all heat potentials (right) [Dobbelsteen et al. 2007]

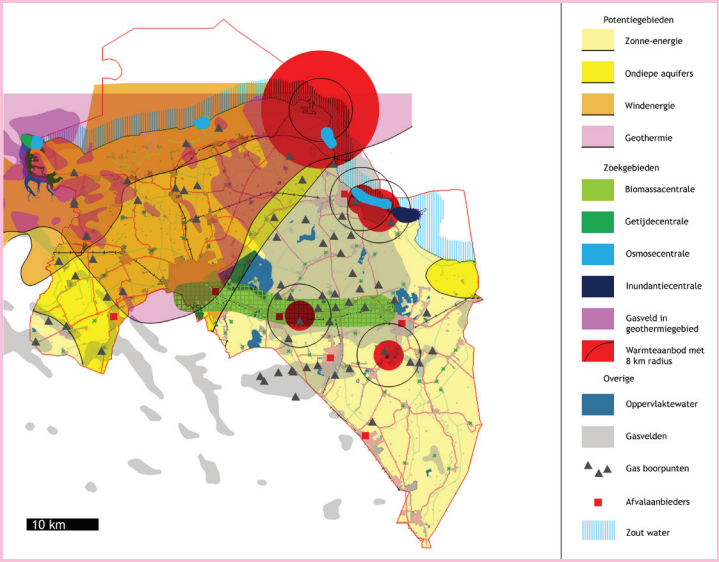


Figure 15. Detailed energy-mix map for Groningen

3. Future scenarios

To create an image of the future energy system, the existing and historical pathways are extended into the future, leading to a repetition of existing solutions. If prices of oil increase really fast, breakthroughs are necessary. Such changes in fluid timelines are not enhanced in continuous think patterns, but another method needs to be used. The think-frame (figure 16), which can be used starts with several scenarios (1) about how the world might look like in the far future (2060-2070). Once this image of the future is consistent and comprehensive, the next essential question is what needs to be in place (2) in order to realise this future image. Because, once we know what needs to be in place it is possible to back-cast (3) the measures and decide on what needs to be undertaken now (4).

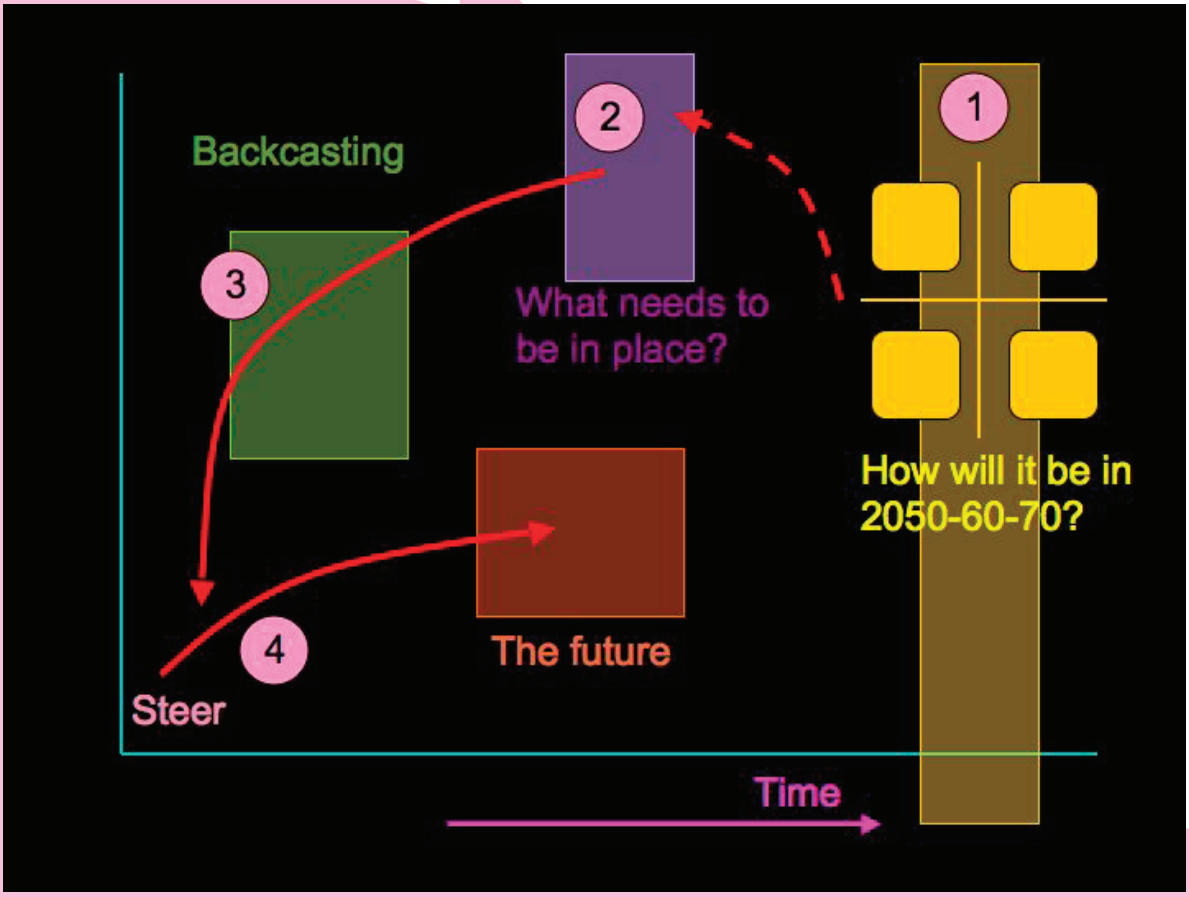


Figure 16. Think-frame for anticipating on future energy systems

6. 040308 The Moscow brainstorm

Victor Sergeev, MGIMO-University
Gert-Jan Swaving, Province of Groningen
Rob Roggema, Province of Groningen

The brainstorm in Moscow had three objectives.

1. In the first place exchange of expectations about the objectives of the INCREASE conference. The focus of the conference has to be on the mid-term (2014-2019). Current policy, which needs to be realised from now until 2013 is taken as a fact and a starting point for debate and possible solutions after 2014. For the conference it is important that proposals will be done about the realisation of general Dutch energy objectives (2% energy savings each year, 20% use of renewable energy in 2020 and 30% less CO2-emissions in 2020 compared to 1990) and that current proposals will be examined on their contributions to these goals. Furthermore, the conference aims at bringing in perspective the bigger picture of global developments and how they influence current policies or should influence them. Finally, the aim of the conference is to build up a network of experts around the world, who are concerned with the sustainability of the energy supply and are trying to develop solutions for this problem.

2. Secondly the Dutch context needs to be explained to the Russian experts. The policies of the Dutch National government as well as the Provincial ones were explained and discussed during the brainstorm. The objectives as agreed on by both the national government as well as the four northern provinces were seen as ambitious, but not unachievable. All studies on energy potential studies, energy valley programs and the energy agreement were handed to prof. Sergeev, accompanied with short English comments.

3. And finally, talk about the potential futures on energy supply ('the bigger picture'). The current centralised system of energy supply is vulnerable. On one hand, because available techniques no longer make it possible to become more efficient and have increasing problems for their fossil resources supply (at fast increasing prices). On the other hand several social restrictions occur, such as the safety and vulnerability for terrorist attacks, but also the increasing demands of inhabitants to get grip on their

energy supply and price. It is stated that these factors may lead to instability of the system and the question may be posed if, in the end, a centralised system is capable of reaching the 2020 goals. If not, it must have consequences for the most optimal system, probably a combination of centralised and decentralised energy supply. This, on its turn, has probably major spatial implications. A possible shift from people living in urbanised areas towards rural villages might be possible. This will influence the way people are educated and will encourage the development of an integrated communication system. The outcomes are uncertain, but it is sure that the levels of integration (food production, energy supply, living neighbourhoods, transport) will be significantly increases at the local and probably rural level. At this level it is possible to close food and energy cycles and increase the use of biomass in the energy chain. The question remains how this thinking can be implemented in the province of Groningen.

7. 110408-160408 - INCREASE conference Amman, Jordan

Participants

Wim Mallon, Energy Valley

Kasper Klap, Province of Groningen

Gert-Jan Swaving, Province of Groningen

Ronald Eenkhoorn, Project Office Meerstad

Desmond de Vries, Province of Groningen

Alexey Kuzmin, Advanced school of Management, Moscow

Sevak Sarukhanian, Dep Director of Noravank Foundation, Armenia

Abdulsalam Alshboul, Energy Centre, Jordan University

Mohamed Al-Ta'ani, Jordan University

Yuri Kosov, St. Petersburg State University

Victor Sergeev, MGIMO-University, Moscow

Kamal Khdier, Hydrotech International Consulting, Jordan

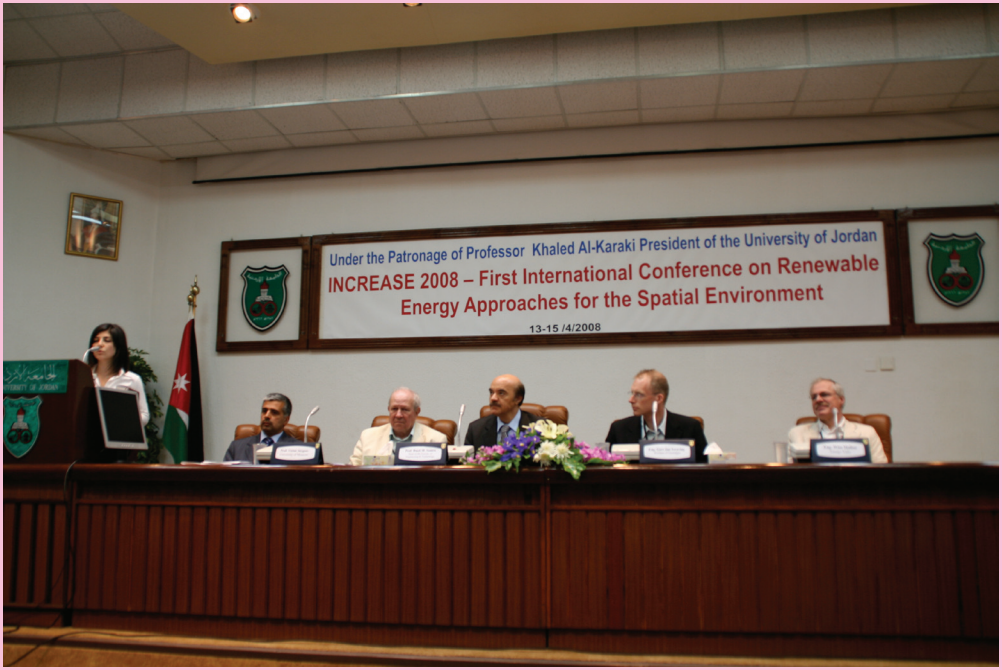


Figure 17. Impression of the INCREASE conference Amman

Program

Activity	Speaker	Session
Friday April 11th		
Arrival of delegate • Shared dinner • Getting to know each other, short presentations by participants (expertise, expectations) – *each participant* • Briefing of the upcoming days		20:00
Saturday April 12th		
Excursion, site visit Petra Leave for Petra		7:00 in the morning
During lunch: Debate on probable futures	▪ *Victor Sergeev (Centre for Global Studies, MGIMO), international developments* ▪ Gert Jan Swaving (Province of Groningen), national and regional policy goals ▪ *Ronald Eenkhoorn (Projectbureau Meerstad), Meerstad plan and energy goals* ▪ Wrap up, first conclusions: Wim Mallon & Gert-Jan Swaving	
Sunday April 13th		
Official welcoming ceremony	▪ Gert-Jan Swaving, Aim and theme of the conference: spatial planning, energy supply and climate change in the province of Groningen ▪ Victor Sergeev, Short assessment of existing Groningen documents ▪ Wim Mallon, The aims and initiatives of Energy Valley ▪ President of Jordan University, Prof. Khalid Al Karaky	9:00 – 10:00
Coffee Break		10:00 – 10:30
Plenary session, open for audience Summary discussion day 1		10:30 – 11:00
Presentation existing energy system and potentials, Andy van den Dobbelsteen, including panel-discussion (Dutch energy	Wim Mallon	11:00 – 12:00

experts: Wim van Gemert, Gert-Jan Swaving Desmond de Vries, Wim Mallon, Ronald Eenkhoorn)		
Lunch break		12:30 – 14:00
Working session, groupwork, closed session	• Design first concept for Groningen, regional scale (group A) • Design first concept for Meerstad as well as Jordan Housing project, local scale (group B)	14:00 – 17:00
Sharing first results, plenary, closed session	each group presents short	17:30 – 18:00
Dinner		19:30
Monday April 14th		
Preparation of presentations and preliminary reports		9:00 – 12:00
Lunch		12:30 – 14:00
Presentations result workshop, by invitation only	• Assessment aims and means, Victor Sergeev • Concept Groningen, Gert-Jan Swaving • Concept Meerstad, Ronald Eenkhoorn • Concept Jordan housing project, **Discussion**	14:00 – 17:00
Dinner		19:30
Tuesday April 15th		
Plenary session, open session Presentation of participating countries (20 minutes each)	• Regional energy activities in Groningen, use of renewable and energy saving, by Gert-Jan Swaving • Russian presentation on "the use of renewable energy and socio-economic impacts", by Vicor Sergeev (or colleague) • Jordan presentation on "the living desert geology, ecology, hydrology, climate and social life", by dr Kamal Khdier	9:30 – 11:00
Closed Session, Groupwork	• Elaborate on the design concept for Groningen and Meerstad/Jordan housing project (2 groups) • Draw Maps, Define resources/ amounts, models on Individuality – collectivism – centralised, Networks requirements, Sizes	11:00 – 12:30
Lunch	UM QAIS	12:30 – 14:00

Working session, groupwork, closed session **Sharing results, plenary**	• Capacities, design the concept in more detail • Energy calculations: usage, part sustainable/renewable, improvements compared to set goals, included the implementation	14:00 – 17:00
Dinner in the honour of the President of University of Jordan, Prof. Khalid Al Karak	Main Restaurant in the university of Jordan	20:00 – 22:00
Wednesday April 16th		
Delegates leave		

Table 1. Program INCREASE conference, Jordan, Amman

Welcome and objective of the conference

Gert-Jan Swaving

The INCREASE conference is organised by the Energy Centre of the Jordan University in Amman. There are participants from Russia, Armenia, Jordan and the Netherlands. Before it starts it is from a participation point of view already a successful conference, which certainly asks for a follow-up.
General objective for the conference as far as the Dutch perspective is taken can be formulated as follows: "Give guidance to the kind of concrete policy decisions to be made in the second part of the regional planning period (2014-2019), both on the field of Sustainable energy as well as Climate Change". This requires a sharp eye, in order to loo where the chances are (figure 17).

Figure 18. Look for the chances! [Photo: Gert-Jan Swaving]

General introduction on climate change

Dr. Kamal Khdier

There is no discussion on the issue of climate change whether the climate changes or not. Scientifically it is proven that global climate is changing and that this is caused, by a 95% rate of certainty, by humans [IPCC, 2007]. At the same time it is clear that the existing system of energy supply cannot be erased and replaced by a new, more sustainable, system.

The world needs all forms of energy — from conventional crude oil and natural gas to the emerging sources of the future. Diversifying our sources of energy is essential to meeting the world's growing demand in an environmentally sound way. Developing the infrastructure to produce and distribute new forms of energy such as bio-fuels on a large scale is a significant challenge.
The use of fossil fuels to meet the world's energy needs has contributed to an increase in greenhouse gases — mainly carbon dioxide (CO_2) and methane — in the Earth's atmosphere. There is a widespread view that this increase is leading to climate change, with adverse effects on the environment.
One of the most critical environmental challenges facing the world today is finding ways to provide and use reliable, affordable energy while reducing long-term growth in greenhouse gas emissions. Technology offers a variety of potential solutions, including efficiency improvements; CO_2 capture and geologic storage; the use of trees, plants and soils to store carbon; and the development of commercially viable non-fossil-fuel energy systems. These advances can also enable the potential evolution to an economy based on hydrogen fuel.
To effectively manage our greenhouse gas emissions while growing our business to meet the world's energy needs, we have created a comprehensive plan, known as the Climate Change Plan of Action.

Developing solutions of the scale required by the climate change challenge will be a complex endeavor. It is vitally important to understand and fully communicate the economic and social costs of various policies and the projected environmental benefits, both in the near term and the long term, so we can agree on solutions that are fair, balanced and effective.
Greenhouse gases (GHGs) do not recognize sovereign borders. It is the cumulative effect of GHGs in the atmosphere that affects the climate, and it will require integrated and flexible global carbon management to effect change. Most emissions come from a relatively small number of countries, with absolute levels

currently highest in developed countries, but emissions rising the fastest in developing countries. Equitable sharing among all top emitting nations will promote the efficacy of GHG reductions and will help ensure that individual countries are not put at competitive disadvantage

To effectively manage our greenhouse gas emissions while growing our business to meet the world's energy needs, we should create a comprehensive plan, known as a Climate Change Plan of Action, which includes:

1. Reduce Emissions of Greenhouse Gases;
2. Capitalisation of Energy Efficiency;
3. Reducing Flaring and Venting;
4. Investing in Research, Development and Improved Technology;
5. Pursuing Business Opportunities in Promising Innovative Energy Technologies
    - Pursuing Innovative Energy Solutions
    - Renewable Energy for Power Generation
    - Solar
    - Alternative Transport Fuels
    - Hydrogen
    - Biofuels
    - Advanced Batteries
6. Supporting Flexible and Economically Sound Policies and Mechanisms That Protect the Environment
    - Global Engagement
    - Energy Security
    - Maximize Conservation
    - Measured and Flexible Approach
    - Broad, Equitable Treatment
    - Enable Technology
    - Energy Efficiency
    - Natural Gas
    - Bio-fuels and Renewables

- Nuclear Energy
- Carbon Capture and Storage

7. Transparency

The international engagement

The United Nations Framework Convention on Climate Change (UNFCCC), was adopted at the Earth Summit in Rio de Janeiro in 1992 to effectively manage global greenhouse gas emissions.

- Adaptation to the impact of climate change
- Mitigation of the impact of climate change

The Kyoto Protocol is a protocol to the international Framework Convention on Climate Change with the objective of reducing Greenhouse gases that cause climate change.

- As of January 2008, and running through 2012, developing countries have to reduce their greenhouse gas emissions by a collective average of 5% below their 1990 levels.
- Kyoto includes "flexible mechanisms" which allow developed countries economies to meet their greenhouse gas emission limitation by purchasing GHG emission reductions from elsewhere. These can be bought either from financial exchanges, from projects which reduce emissions in Developing countries economies under the Clean Development Mechanism (CDM), from other developed countries under the Joint Implementation Scheme or from developed countries with excess allowances. (A similar scheme called "Joint Implementation" or "JI" applies in transitional economies mainly covering the former Soviet Union and Eastern Europe.

Conclusions

1. One of the most critical environmental challenges facing the world today is finding ways to provide and use reliable, affordable energy while reducing long—term growth in greenhouse gas emissions. Technology offers a variety of potential solutions, including efficiency improvements; CO2 capture and geologic storage; the use of trees, plants and soils to store carbon; and the development of commercially viable non-fossil fuel energy systems. These advances can also enable the potential evolution to an

economy based on hydrogen fuel.

2. Fossil-fueled energy use is climbing, both in industrial nations and in the developing world, adding to atmospheric carbon. Efforts to enhance energy conservation and improve efficiency are much hindered by low energy costs and by perverse incentives that encourage waste. Without firm commitments, most industrial nations will not meet the carbon-emission goals they agreed to at the 1992 Rio conference. The transition to renewable, non-fossil-carbon-based energy sources is feasible but is not in sight for lack of aggressive political will. The insurance industry has recognized the risks posed by climate change. Leading economists have identified viable policies for reducing these risks. Markets undervalue ecosystems worldwide and inflict few penalties against practices that do long-term environmental and resource damage. Political leadership must introduce incentives that reward sound practices

3. The use of fossil fuels to meet the world's energy needs has contributed to an increase in greenhouse gases — mainly carbon dioxide (CO2) and methane — in the Earth's atmosphere. There is a widespread view that this increase is leading to climate change, with adverse effects on the environment.

4. Climate change is real and it is happening right now. The good news is that the solution exist, but what is missing is leadership. We need our leaders to make climate change a priority.

5. The solution to climate change is available. The technologies are available right now and there are enormous economic opportunities from expanding their uses. The only real question is: How can we make it faster?

6. As global warming leads to ever more critical environmental conditions, the time has come for designers, architects, and builders to become committed students of sustainability and vigilant stewards of the natural world.

Context: Upcoming global problems

Victor Sergeev

Two big problems of the near future will emerge, probably rapidly: climate change and energy crisis. Climate change will transfer the process of agriculture and will change the food market. The energy crisis is the result of depletion of oil and gas resources. To cope with these problems the world economy needs technical innovations, like nuclear fusion energy, fuel from coal and different kinds of renewable energy. On the other hand social innovations may be required, like the restructuring of international relations, the question how to deal with migration flows and the restructuring due to structural energy saving. These innovations need serious social, political and international changes, but it is hardly predictable if and when radical technical innovations will occur. For example: we do not know when commercial use of nuclear fusion will be possible. The same unpredictability of social innovations exists. For example: what is the impact of the shift of the zones of wheat production as a result of climate change and is it possible to predict the changed role of African states in case of massive bio fuel production on their territories.
Technical and social innovations depend on different characteristics. Technical innovations are mainly a problem of skills and money and social innovations are the problem of legitimacy. Any technical innovation requires its own social machine to implement the project: therefore technical innovations are impossible without the support of social innovations, which constitute the 'social context'.
The conclusion is that future changes in climate and energy supply are impossible to manage without the serious transformations of attitudes towards social innovations. Therefore, conservative societies will have much more difficulties than flexible ones.

Regional development, a global, mankind perspective

Wim Mallon

The problems the world faces are mostly complex and long-term ones. On top of that, these problems have a global nature, spread out and influencing the entire world. Main problems include: Climate change, energy supply (fossil and sustainable), supply of raw material, developments in the financial markets, economic development, religion and social changes.

Figure 19. Global problems of energy supply and climate change

The consequence of the fact that energy supply and climate change are global problems is that all efforts to solve these problems have to be seen in global perspective. The boundaries set by natural capacities in fulfilling human demands are limited and there is a world wide and shared responsibility. This means that all people of the world must formulate common goals and commit themselves to their attainment. Beside that, there is a need for laws and institutions that are universal in character and authority. Because there is only one planet and one mankind with a collective destiny, mankind is forced to develop a global society. The implication of this statement is that problems are not of a technical nature, but are non-material of character. Any development, which does not follow these principles, will not work. Thus, problems may only be solved in a non-material, societal, way and if they are put in a global perspective.
If this is true for general problems, it certainly can be sustained for themes like climate change and sus-

tainable energy. The rules to implement a sustainable energy system can be formulated as a logical result. It has to fit in the observed trends, like global context and societal adjustments, it has to fulfil regional and local demands, it has to follow the development laws and it has to address real issues, like a accelerated energy price and increasing scarcity and the fact that in short term people are no longer able to pay easily for their energy use. It is no longer only an environmental objective to use more sustainable energy, but the use of sustainable energy has to be sustainable under changing societal conditions.

Figure 20. Integrated management of sustainable energy sources

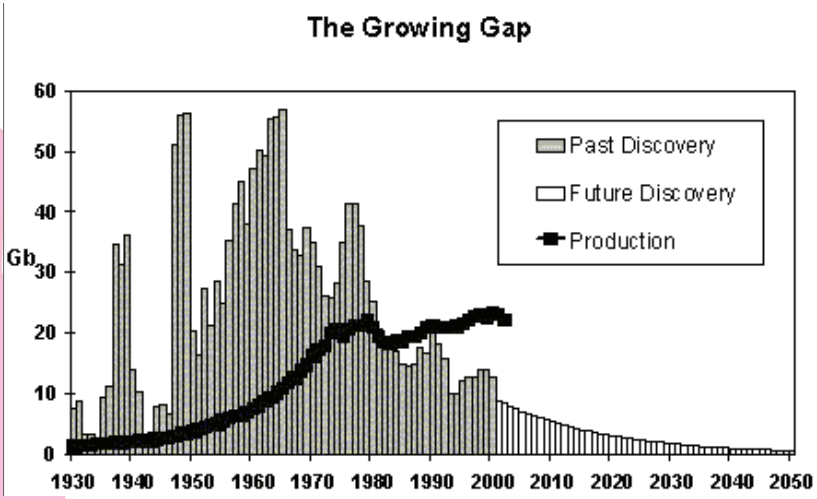


Figure 21. The growing gap [Campbell, 2003]

The changes in the energy world is going to be huge. First of all, Hubert's peak world oil production is expected [Campbell, 2003]. This means that in an era of increased use of energy, the production capacity of energy is over its top end in the near future going to decrease: a growing gap (figure 21). Because of that alternatives need to be developed. However, no real alternative in proven technology has been realised so far. One of the reasons is that for a real alternative to be competitive, actions have to be taken at a global level. This requires political consensus and huge and coherent investments. Only this may lead to a global impact on the energy, economy, political, technical, social and infrastructural system.

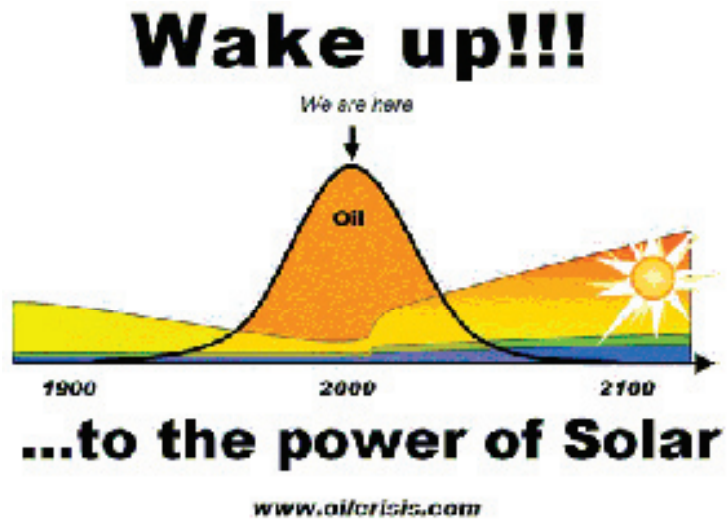


Figure 22. The power of solar is absolutely necessary in the after peak oil period

To meet these future circumstances and demands several opportunities remain. These capabilities require study and action on a broad, new and unexplored, multidisciplinary terrain. In order to get some more grip on these subjects the internationally accepted and coherent CMM-model is available (Capability, Maturity, Modelling). On technology questions this method can be sustained, but the non-material, societal aspects are completely new. Experience and tools need to be developed from ground zero.

The first steps to take regarding these issues include both technological and policy analyses as well as the non-material approach. Within the technological context the CMM-method starts off with several assessments need to be made: on the status of the global energy market, on the trends and on the possible stretch of technology and resources. If these assessments are made and there is some perspective on a future potential the next step would be to determine, what needs to be in place to make the formulated future system a realistic one. Then, the next step may be to advise on required actions to realise the improved system. The final step is to define the required overall investments and describe the social impact. This non-material aspect is a separate study subject.

The key questions for sustainable energy must be defined and on a global level be described. Based on this global description an integrated vision on a local and regional level must be developed and the specific driving forces for change must be explored. If the CMM is described for every form of alternative energy (Hydrogen, Solar, Wind, Tidal, place and potential of Biomass), the pathways for a transition can be developed.

Figure 23. Solar, solar and solar....

Use of CMM methodology: Capability, Maturity, Modelling

Wim Mallon

CMM (Capability, Maturity, Modelling) is a method, developed by Carnegie Mellon [www.sei.cmu.edu] Mellon, for software development, but it may be used for the problems like sustainable energy.
The method defines a clear order in the development of capabilities. It defines that one certain step must be taken before the next step can be taken. This means that certain things need to be in place before a development can take place. There is no shortcut possible and the stair needs to be walked step by step (figure 24). Besides this the various area are interdependent and influencing each other. Moreover they are determining each other. For example: without electricity no computer, without power plant no electricity, without building materials no power plant, without a road no power plant, etcetera. This idea of multi influencing is new and challenging.

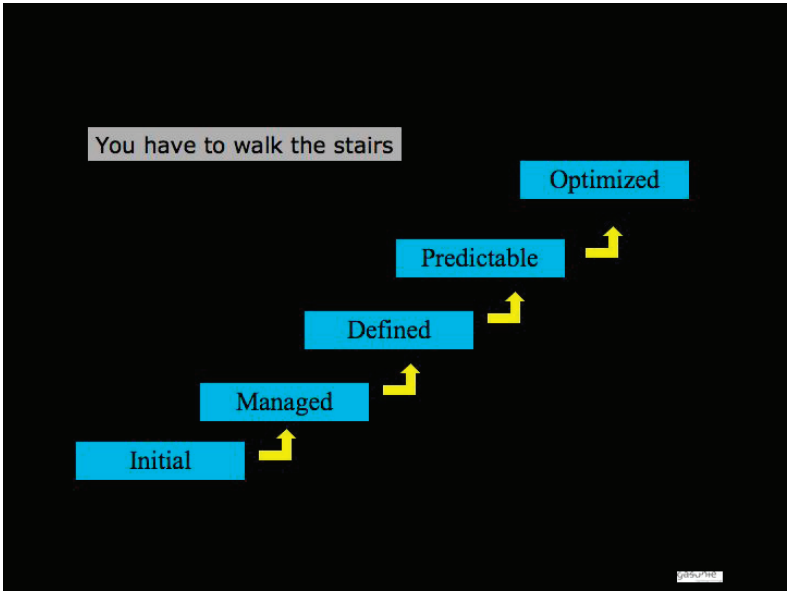


Figure 24. Walk the stairs, there is no shortcut

The CMM method defines five levels: The first level is the initial one, the second the managed, the third the defined level end the fort the predictable level. The fifth and highest level is the optimised one. For several field this CMM method is defined (table 2).

	Transport	Politics	Legal	Social	Finance	Energy
5 Optimizing	DHL, optimised transport, optimised transport means, automation, remote controlled transport, computerisation, free trade area	Self supporting local communities, decentralised power, Cooperation, self decision, responsible action Integrated society, global values and rules, non personal power	Continuous improvement of law to support society; Global set of laws defined,; international support, international recognition	Continuous improvement of security; Care on demand, used when needed; Relation with social responsibility	Continuous improvement of market, new derivatives, secondary products, integrating currency systems, international currency	Sustainable energy supply, optimized systems dedicated for function, Integration of energy systems, energy efficiency, environmental care
4 Predictable	Standardisation of road lay out, signs, timetables, booking systems, integrated transport, container transport, customs union	Democracy, parliament, responsibility in government Well developed civil service, constitutional law International interdependency	National law through parliament; International co-operation and tuning, harmonisation	Social security in (inter) national law, international harmonisation, bureaucracy; common understanding of social rights and duties	Exchange rates managed, monetary management, interest controlled, monetary derivatives established, international central bank	National fuel standard, international standardisation of fuels starts, free trade of fuel, regulation harmonised, Infrastructure in place, multi national companies
3 Defined	Standardised railroad tracks, ocean liners, ferry services, roads, development of automobiles, trucks Stage coach	Elected leadership party forming, state controlled parties, restricted voting right, Regular elections,	Law defined (decree / council), nationally applied, enforcement through police / army	Social security regulated, legal framework, national programmes, pension funds, public elderly care, educational system, religious system: human rights	Monetary system defined, money, interest and currency established, local / regional defined Monetary policy defined and established; Central bank	Standardised fuels,fuel delivery, local energy distribution, Institutions initiated, local markets, dedicated companies
2 Managed	foot paths, initial roads and waterways, mapping developed,	Dictatorship, nepotism, national boundaries; Army supported government; Central control	Rules/ laws understood, enforcement, local law (sheriff) institutionalised	Local / community support, based on demand / need	Common definition of value, international trade, common value of scarce metals / valuables	Fuel trade, organised supply of primary fuels. Set up of local fuel supply; coal mining
1 Initial	On foot, horse-back, paths through the woods,	Strong man, survival of the strongest, warlords, tribal communities	Law of the strongest man, personal force and power warlords	Every man on his own. Family ties, tribal society	Barter trade,	Wood, peat, cow dung, self search heat per family

Table 2. CMM –levels for transport, politics, legal, social, finance and energy

If gas and sustainable electricity are compared on the ladder of CMM, some conclusions may be drawn. The first thing is the value of gas (primary/fossil source) compared with electricity (secondary form of energy). Besides this the two forms of energy are in competition with each other. Electricity has a 'global quality' with higher multi values. In figures 25 and 26 both are compared on the ladder. Both of them are badly prepared for the future. They are positioned on almost every theme at an initial level. Electricity is somewhat better positioned than 'green gas'.

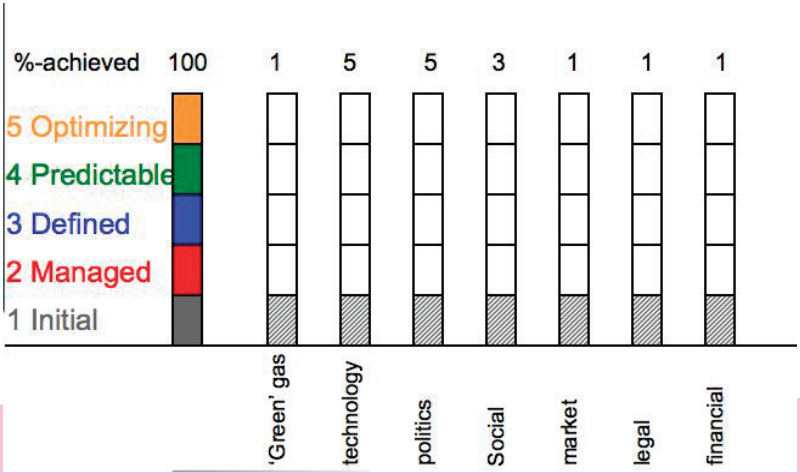


Figure 25. Estimation of position of sustainable energy: 'green' gas, on the CMM-ladder

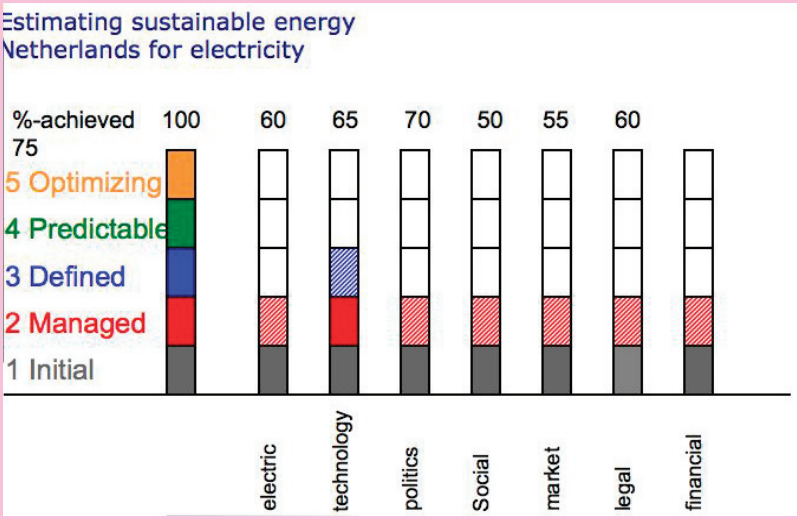


Figure 26. Estimation sustainable energy: electricity, on the CMM-ladder

This shows that the situation is catastrophic, taking into account that the gas and oil reserves are depleted rapidly and sustainable energy, nor green gas has everything what needs to be in place for a transition is not yet there, by far. There is no sense of urgency and no incentive to save or make efficient use of energy. The oil companies have a financial interest not to take any action, the government is ignorant and developments, if there are any are slow and (too) late and only taking place at a local level (and not at the required global level).
The research and development of the use of sustainable energy is not synchronised and there is no cohesion in developments. A strong and broadly felt commitment is necessary to become successful, but without even having a clue of the required amounts of energy it is hard to reach a common political sense of urgency. The question remains how we will be able to convert to green electricity: not in a technical manner, but in a societal-political way.

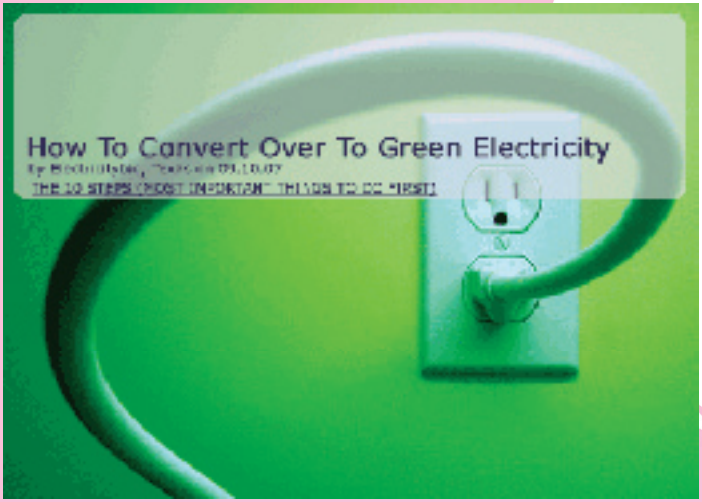


Figure 27. Conversion to green electricity?

Several actions need to be undertaken:

1. Stop giving false advice: going on the way we do does certainly not solve the long-term problems of energy scarcity and increased price level. We will be in trouble way before the fossil resources will be depleted completely;
2. Educate young people: learn young people how future developments may be treated and invite them to come up with unexpected innovations, which might resolve the problems in an unexplored

way;

3. Take energy for efficiency as a central focus. The CMM modelling should enhance and include efficiency as the major aspect;
4. The CMM method needs to be adjusted to a multi subject approach, which cannot be anything else than integral;
5. Take into account additional influences, like the market, economic laws, institutional aspects and regulation.

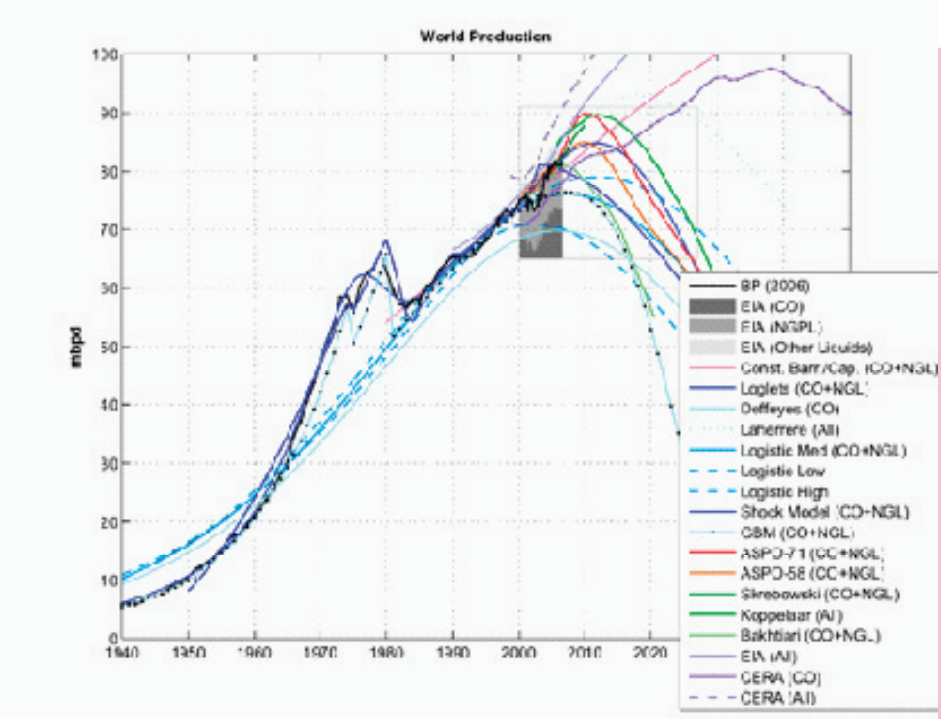


Figure 28. World-production according to several scenarios

Thus, what needs to be done is to prepare a description in CMM terms all forms of alternative energy (hydrogen, solar, tidal, wind, biomass) and related processes (legal, political). If the levels are known, the needed transition can be described.

For a hydrogen economy to be developed in the Netherlands the following things need to be in place (quick and dirty, per house):

- Solar collectors: 40+500 m2, electricity and gas average;
- Investment: 450.000 Euro per house;
- Triple pipeline capacity;
- A 'cold turkey' switch over, no transition time available;
- Hydrogen factories for 60 billion cubic meter;
- Electricity transport to factory;
- Hydrogen storage.

And much more ....

The real shift shall not be made on material, nor technology, but it is all about people.

Figure 29. All about the people

Regional objectives and policies in the province of Goningen

Gert-Jan Swaving

The provincial policy aims to: "Contribute an equal share in meeting international obligations concerning the lowering of CO2 emissions caused by the use of fossil fuels" [Regional plan, POP 2, 2006]. To meet these objectives two different lines of approach are used: an environmental perspective and an economic perspective. The 'trias energetica' is used to define which measures should be taken first and which ones later. The first step is to decrease energy demands (saving). The second step is that if energy is used to make use of renewable energy sources (biomass, solar energy, wind, etc.). and if non-renewable sources are used, use them as efficient and as clean as possible. The province carried out a potential study [KNN Milieu, 2003]. In this study the best chances for CO2 emission reduction were defined. Energy saving in the build environment, energy saving in the industry and the production of renewable energy came out as the best options.

For the build environment, the province started several projects to save energy:

1. Living ++, in which private owners were encouraged to improve their energy performance of their houses;
2. Better energy, in which free energy boxes were delivered to people with low incomes;
3. Optimalising Central Heating: CV Optimalisatie (figure 30)
4. School++, in which the indoor climate and energy performance in schools is improved;
5. Action plan for the Build Environment for 2008-2011, in which the objectives were sustained for the next planning period.

Figure 30. Logo of the central heating optimising project

Wonen ++ (Living ++) project

The Wonen++ project aims to increase the energy performance of existing houses. The project starts for a certain area with a meeting in the neighbourhood. The meetings include a discussion on health care, social aspects as well as energy. The meeting is followed by the possibility for inhabitants to scan their house on energy use (the energy scan).

wonen++
PROVINCIE GRONINGEN

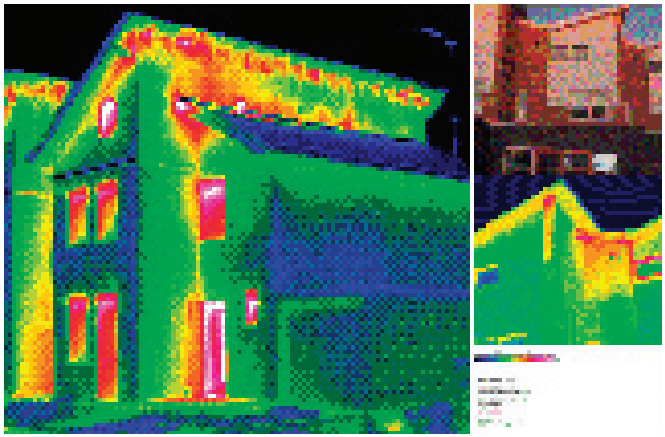


Figure 31. Logo of the Wonen ++ project and a house undergoing an infrared thermal scan

After the scan an offer with smart measures is been made. This offer includes also a financial offer about how the measures can be realised and incorporated in the mortgage. Finally the measures are installed.

At a provincial level the production of renewable energy is encouraged. Both big wind turbines (165 MW up to 400MW) are been realised in a couple of wind parks. Besides this the installation of small urban turbines is stimulated as well as photovoltaic panels (figure 32).

Figure 32. Small urban turbine and the photovoltaic panels oat the roof of the provincial building

Besides the production of wind and solar energy the province has also strong ambitions on the biomass theme. The Biomass Action plan includes the increase in use of biomass, both at a local and regional level. The Costa Due project specifically researches the use of biomass in combination with the development of jobs in the Eemsdelta area [Province of Groningen, 2004].

Several other functions are encouraged to develop more sustainable energy patterns. The program on a sustainable transport system 2008-2011 for example, or the way industries are treated. Not only are strict demands formulated in industrial permits, also CO2 emission trade is stimulated and CO2 capture and storage is researched. All objectives are summarised in the Action plan on energy saving in industry 2009-2012.

Energy Agreement Northern Netherlands

In 2007 the provinces of Groningen, Friesland, Drenthe, North Holland and the National government signed an Energy Agreement. In this agreement the main objectives are the realisation of 40-50 PJ renewable energy and the reduction of 4-5 Mton CO2-emission in 2011.

Figure 33. The logo of the energy agreement

Finally, the province of Groningen agreed with the National government that the standard for energy use in buildings should be more ambitious in the Energy agreement region. This standard can be realised by realising some of the following measures:

- Good insulation (30 cm layer)
- Heat & cold storage in the soil, heat pump
- Retrieving heat from ventilation system and shower
- Solar energy (both electrical and thermal)

Developments in Meerstad

Ronald Eenkhoorn

Meerstad is the largest building activity within the province of Groningen. Just several kilometres from the city centre of Groningen City a large area is developed for living, recreation, water storage and nature. The 10.000 houses will be realised between 2010 and 2025 (figure 34).

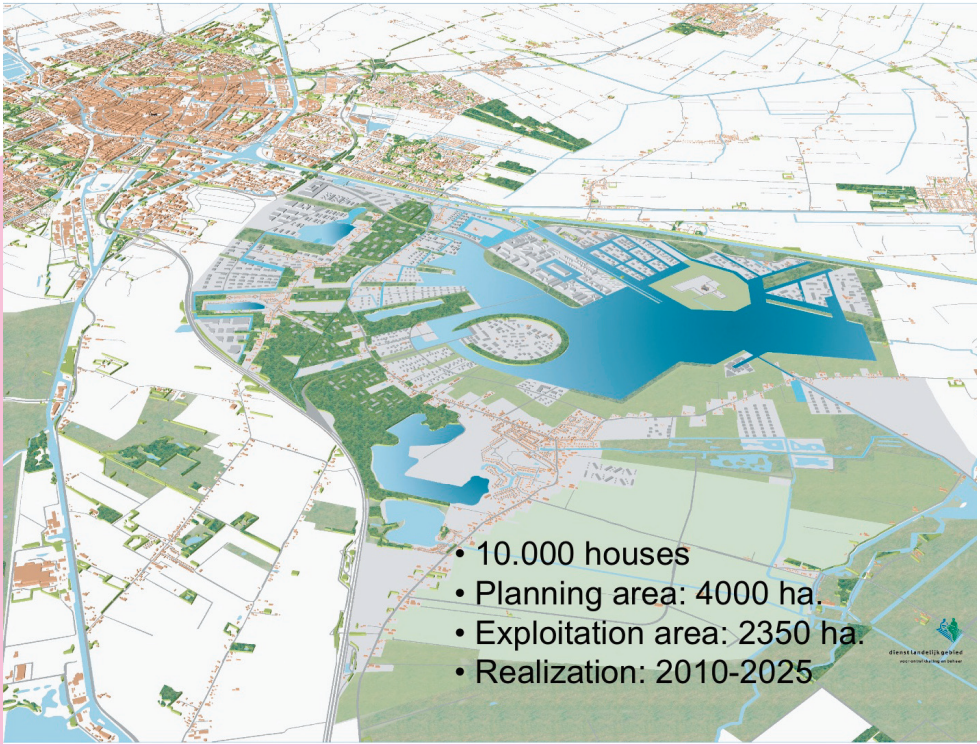


Figure 34. Development of Meerstad

The development of Meerstad takes place in several phases. The activities start with the realisation of the first part of the lake (water storage) and ecological structures and the first building part. In the second phase the lake is enlarged and the next building parts are realised, together with more ecology and recreation. Finally, in 2020, the plan will be realised entirely (figure 35).

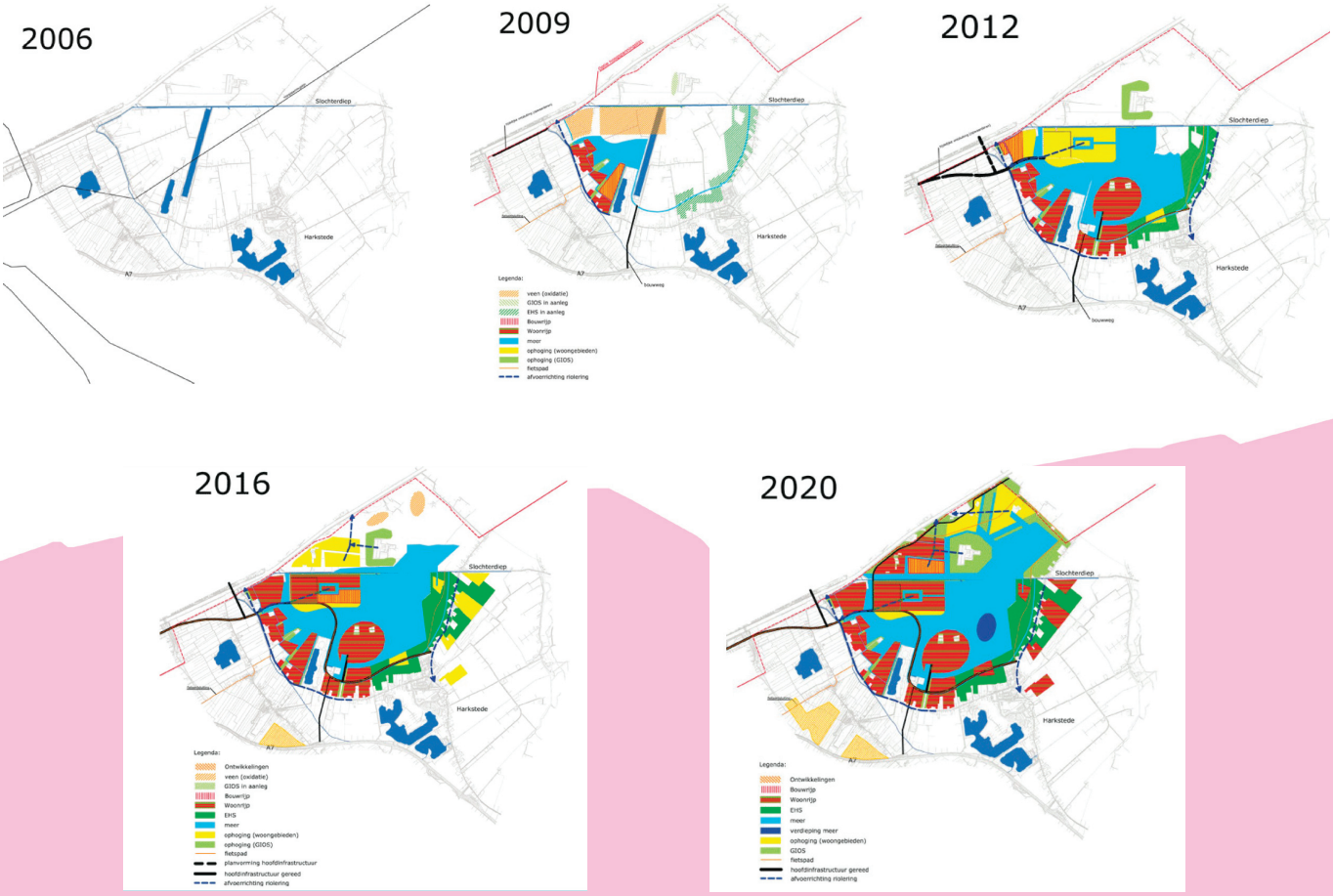


Figure 35. The different phases of the Meerstad development

The energy strategy is quite interesting, because the energy performance in not only steered by saving or renewable objectives, but with a more qualitative trias marketing in mind: minimal environmental impact, affordable and comfort (figure 36).

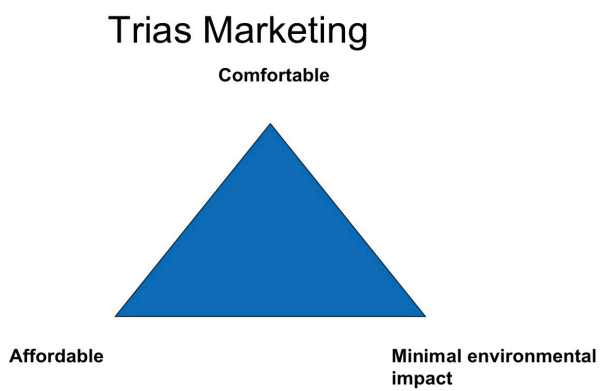


Figure 36. The trias marketing of Meerstad

The qualitive objectives, which will be realised in Meerstad are:

- Preparedness: architecture, use of materials, functionality and affordability
- Comfortable in winter as well as in summer
- User friendly
- Healthy & Silent
- Hot water always available
- Affordable (also with rising energy prices)

In every part these qualities will be realised in a tailored way (depending on the specific circumstances and the timeframe. Every part has its own energy concept. In these concepts several measures are combined: insulation, climate control without health risks, avoid over-heating, use of sustainable and cost-effective energy resources and the use of high quality materials. In this way, every part will develop its own identity.

In Meerstad it is a challenge to implement the transition to a sustainable energy household. The established parties are willing to participate in energy transition, but there are some questions about the way the necessary investment costs (now) and benefits (in the future) are distributed among developers and future residents of the houses. The introduction of a new party, a local exploitation agency, seems to be a way to avoid this problem. This workshop made clear why this solution might work. When dealing with innovations and new techniques or energy transition there are three major processes/ issues that are important:

1. Dissymmetry of information

The selling and buying parties do not have the same level of information. If you want to implement the techniques for the energy transition, the buyers should appreciate its value. They ought to know about it, and also to trust the seller. In the field of energy techniques this is often not the case. In general the rule is that asymmetric information makes it possible to sell rubbish at higher prices. The solution is to create a trust network. A social network of people who are interested in construction of zero energy use. Inform the buyers about the future benefits. If there is asymmetry they will never pay the normal (higher) price, informed people will maybe invest.

2. Discount of the future

Discount of future means that people tend to not fully count future benefits. That makes it difficult to make them invest in expensive equipment, even if this equipment means they will have lower costs in the future and therefore "earn money" within a short period of time.

3. Redistribution of political power

Innovation means that parties that have the power will lose some of it and they don't want that. They are already in an optimized state. Innovation always means leaving this optimized state, and they don't want to do that. This means that the established companies never are at the source of these innovations. The solution comes from the analysis:

- Who has the risks?
- Who had the benefits?

Combine risk and benefit, but do not combine this with existing roles (no combined selling).

The solution for Meerstad therefore may be to create an energy exploitation agency, that is not linked to an

existing (energy) company. This agency understands and appreciates the value of the new techniques, has to take away the initial extra investment for the buyers, doing so combining risk and future benefit of this extra investment.

	Initial	Managed	Defined	Predictable	Optimized
Social				X	
Economy				X	
Financial				X	
Legal code				X	
Cultural				X	
Political					X
Environmental	not possible to influence				
Technology				X	
Diversification/town planning				X	
Risk evaluation				X	
Energy				X	
Management				X	
Network / infra					
- Autmobility			X		
- Electricity					X
- Natural Gas					X
- Green Gas	X				
- Grid ready for decentral electricity production	X				
- Wasteheat/ co-generation	X				
Water				X	X
Communication				X	

Table 3. The CMM-analysis of Meerstad

The city of Irbid

The developments for the city of Irbid have a new dimension due to the fact that energy prices are souring. This presses the need of energy efficiency and rethinking the concept of housing. The minister of public works and housing has great interest in the results and the activities of the INCREASE group. The INCREASE group in heartily invited to participate in the developments of the new city Medinatuna. The Medinatuna development is the explicit wish of his majesty King Abdullah, where in 5 years time 120.000 houses will have to build to house 1 million people. The aim is to realize a city with zero CO2 emission in 5 years along the lines as developed for the Masdar city in the United Arab Emirates. For this a support form World Bank of $ five billion is available. The task for this is a huge challenge for which information exchange and cooperation with international institutions is welcomed. This is part of the development of Amman where there is an expectation to have a population of 6 million in 2040, which is a factor of three of the city of Amman. The development of Medinatuna may be expected to have serious influence on the developments in Irbid and Amman

The CMM (Capability, Maturity, Modelling) methodology can be introduced and has to be leading to prevent setbacks and disappointments in progress in these huge projects. The discussion on development in cities, new as well as development of existing housing, will have to be put in the different aspects of CMM modelling, like legal, social, financial, (sustainable) technology, political, (local and regional) economy, national, regional and local transportation systems and even population distribution issues. A project of such magnitude might work out to be a regional hub due to the fact that sustainable energy makes this city independent. This calls for a national and international assessment of the consequences of a project of this magnitude. Other dimensions are industrialization, employment and the development of national institutions. Discussion about the capability, maturity and modelling for the projects Meerstad and Medinatuna have shown that there is a similarity in the dimensions that play a role in these projects. these dimensions can be applied to the larger national project also.
In the following table the results of the discussion is presented.

	Initial	Managed	Defined	Predictable	Optimized
Social		2			
Economy	1				
Financial					
Legal (code earthquake Richter 5)	1				
Cultural (integration tolerance)	1				
Political	1,5				
Environmental	not possible to influence				
Technology	1,5				
Diversification/town planning	1,5				
Risk evaluation	1				
Energy	0				
Management	-				
Network / infra	-				
Water					
Communication					

Table 4. Energy efficient and sustainable housing in Medinatuna

Subjects of Greater Irbid

Following the maturity method the following subjects were of special interest:

- Social
- Economy
- Financial
- Legal (code earthquake Richter 5)
- Cultural (integration tolerance)
- Political
- Environmental
- Technology
- Cultural diversification and, for instance, design integration
- Water/energy/natural resources
- Management

Main disadvantages of the location are social and economical aspects and risk evaluation (earthquakes / energy).

For developing countries, the solution should be found in a direction where the most renewable energy can be generated at the lowest possible cost. In Jordan this means that nuclear energy is in direct competition with renewable solar energy. Innovation in the field of technology must be carried out but innovation in social sciences has an equal importance. The innovation of social systems is at present not carried out but it is recommended that this be started up to get a view on possible effects of shortage or high prices of energy in the near future. There are no radical technical solutions to be expected in the near future. Social changes are to be expected also through effects of climate change and shifting agricultural areas and the accompanying wheat production Because of the radical changes that lie ahead in time, flexible social systems can be expected to be better equipped to cope with these changes than conservative ones. The project to generate energy based on difference in water level between the Red Sea and the Dead Sea is a good and reliable solution for solving the energy need of Jordan. The technology involved is proven and technologically relatively simple. All energy options that are available for Jordan must be evaluated and an optimisation must be made according to the dimensions that play a role in making a choice.

This optimisation will have to be made in different dimensions that need to be compared and weighed. High ambitions in building new houses that are energy and CO_2 neutral on a scale that is planned for in Jordan will prove to be a challenging task.

It is advised that a CMM analysis conducted for every energy solution that is available for Jordan and the Netherlands. This includes that choice for nuclear power and solar energy as well as green gas and other bio-fuels or hydrogen. The idea of energy independence has to be considered in the context of global energy shortages and global energy crises that can be expected in the near future.

Changes in the energy supply system on a national scale will influence the power-balance in the region. This goes for all forms of sustainable energy as well as nuclear power. Optimisation of choices will be done from the perspective of the established power, this does not automatically mean that this is the optimal solution for the nation. For the generation of nuclear power, it must be realised that there will be huge consequences that will not make the country that installs nuclear power less dependent of foreign know how or operational expertise. When there is no expertise in place huge cost will be needed to run such systems safely and economically.

Main conclusions

The first international conference on renewable energy and spatial effects (INCREASE) has reached the following conclusions:

1. The international developments in the field of energy are of a global nature and will have effect on the local and regional scale;
2. New fundamental scientific developments have proven to have a catastrophic impact on social systems and society of nation states;
3. In current society in the western world there is little attention for fundamental sciences. It is therefore very difficult to predict the route developments will take.
4. It is clear that the current route of energy use is not sustainable in the near future, so a fundamental sociological shift may be expected when the alternative for fossil fuel will become of age.
5. The changes in society will have effect on three scales, global, regional and local.

a On a global scale, the shift from fossil fuel to sustainable fuel will have profound effect on global trade, distribution of global political power and trade.

b On a regional level, a shift will be experienced in impact of food markets and resulting price increases. Also a decentralization of energy production has impact on the current way these commodities are distributed. Especially the grids for distribution will have a different function in accepting de-centrally produced electricity and gas

c Local influence will follow on the social restructuring due to the fact that people might leave the cities in favour of a country life with self-supporting agriculture.

6. Big energy distribution companies are not likely to promote fundamental research and out of the box innovation as this will be an anomaly to the current operations and therefore a threat to existence. The fact that changes will occur none the less and will have impact is ignored and denied.
7. Placement of advanced energy technology in currently less developed countries bears the risk that the capability to run and maintain advanced systems is not in place and puts a risk to save and reliable operation.
8. The scientific support for the causality between CO_2 and global climate change needs further thorough fundamental research since paleoclimatology indicates rather accurately that

past climate changes have occurred without human interference, and with similar impact as now is occurring.

9. The effect of climate change is expected to have regional impact rather than a global. A temperature rise in the range of two degrees is far more likely than five degrees. This temperature rise is never observed in the last 10.000 years. Currently scientists agree on a faster rising temperature up to three to four degrees. Research is needed in the global effects of human action compared to global, natural occurrences that influence climate and temperature.
10. Due to climate change, social innovation will be needed to be able to handle the effects.

8. 250508-260508 Expert-meeting Groningen

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Kasper Klap, Province of Groningen
Wim Mallon, Energy Valley
Rob Roggema, province of Groningen

Objective
A two-day workshop was organised to elaborate on the outputs of the INCREASE conference of Amman. Especially the spatial impacts of fundamental changes for the province of Groningen were discussed and probable follow-ups were explored.

Discussion and conclusions

Defining the problem
Real estate developments can be related to increasing cost of transportation leading to dropping values of houses that need to commute to work. Also, a high level of energy prices will have social consequences. The prices of real estate will be indicative of these developments. The same goes for growing and transporting crop and other life support goods and the production of energy intensive products. This may change the economic structure of countries around the world. The consequences for Europe will be extra fierce because of the dense energy systems and dense and centralised industrial areas. Infrastructure is also centralised, like gas, electricity and other community services.
Therefore, decentralisation is the buzzword.

Apart from that there has to be massive energy savings, limitation of energy intensive production, and emphasis on crop and food production. The effects of growing crop, decentralisation of food production, closer to the place people are living, lead to dissolution of big cities, back to the countryside. This means a

revival of small-scale farming and increased urban agriculture. An example of this has been experienced in Moscow at the time food prices exploded due to hyperinflation. This will have effect on all aspects of life. Construction of houses will have to anticipate food storage, energy producing greenhouses. In general this will result in a total social restructuring and a revaluation of functions, with huge consequences.

The development of cities and small communities still depends on transportation. The set up of these modern cities might help in making a transition to a society less dependent on energy. The new cities lack jobs and employment opportunities and possibilities to grow crop. The challenge is to find concepts that give support to expected developments in energy and food demands. The question is if they will be self-supporting and how far they will be self-supporting. The land around the cities is in the past always responsible for supplying the food needed for the city.
Not all functions can be spread out. Centres still will be needed for some functions, like culture, trade and banking, R&D, education and health services.

What can be derived from this is that decentralisation will be inevitable and the redistribution of functions that are now centralised has to fit these forces, given the boundaries that are coming up due to energy and climate change.

Another complication is the difficulty to convince people of the changes that are ahead. People understand the situation if the consequences are real and concrete. Even then the direction of change is uncertain.

Rising energy prices
Changes in energy prices lead to significant effects and this will lead to innovation which is in turn leading to destruction of the current situation. This will be beneficial for actors that understand the direction of the development and the inevitable collapse of the current society. The development of real estate leads to evaporation of economic value and this will be macro economic in effect. For these developments there are no validated economic models and no international experience. When a national sector of wealth is collapsing the economic system will follow. The question arises why economists do not understand these developments. The processes are of another abstract level and the real terms than the world is living in.

Footprint

Giving the stress on decentralisation there is an effect on density, the dispersing of people and the amount of people can be supported per square km: the ecological footprint. Decentralisation of means leads to areas that can support a certain area. On a regional level a spatial plan can be drawn, based on a spatial-economic model. In order to do so, some numbers are needed, such as the fertilisation of the soil. A guess can be made of the footprint per person. In the Netherlands the footprint is between four and five hectares per person. What is ecologically desired is 1.8 hectares, being the average of the world. It is estimated that a minimum for the Dutch situation is around two hectares. For the Groningen City situation, with around 180.000 people living there, a footprint of 810.000 hectares is required: i.e.a circular area with a diameter of 114 km, encompassing a larger part of the Northern Netherlands.

The valuation of houses and property is also based on energy prices for transportation and heating houses. In case of moderate energy prices the southern parts of Groningen province is the most expensive part. This might change when growing crop is valued higher than nice living. Some villages will be disconnected from the central city because transportation is too expensive, especially those who are away from the central city (south-eastern parts). In a worst case ghost towns will emerge when transportation cost gets too expensive. The question is how the price of energy influences other costs and in which prices it is hidden. When the energy prices keep rising these processes might increase in a severe way.

Provision of the central city

An eco living behaviour will require still more space than the area of one province. To be able to support the city in another way than local food production, a high value of activities is needed that might provide enough added value (knowledge, innovations) to be able to import these required goods. What value can be created on a global level to export the knowledge in exchange for required goods. This depends on the added value per person that can be achieved in the city.
It is not yet known what is the value measuring stick at this moment. This is crucial.

The combination of climate and energy is paramount. Cooling is expensive and heating will become less so. In the end, no use of energy is best. Cold areas that cannot support human life support the energy supply, raw materials etc. The question is how this can be supported.

Market mechanism as a way of social regulation will collapse because it is too slow, and anti social, the only solution is a global regulatory system one way or another. But the transition to this is going to be extremely difficult. The transaction costs will be huge from on type of economy to the other.
Transition from oil to another form of energy is extremely expensive. This will lead to a new type of economy. On the level of the province there will be restructuring and the cost will be huge. Who is going to provide the money? The bottom line is that probably this cannot be done in the financial system. Thus a social change is inevitable. People in the eastern parts of the province are already leaving their villages: a shrinking process is taking place. The question is what is the driving force? Is it energy or something else? And does it have to be influenced?

A rough figure for the influence of energy prices is that rising energy prices leads to a 2/3 influence on daily costs. An increase of 10% in energy price leads to an increase of 6-7% of daily cost. This means that the cost of living doubled already recently and will increase, given the fact that oil prices have increased a factor 2 in one year.

Making public what is happening
Another conclusion of Amman was the difficulty of convincing people what is happening. Banks and insurance companies should want to know, they deal with money and valuation and capitalisation. The financial system has to react on the energy price settings. The question is: are they able to? Or are they in a process themselves? The moment of catastrophe is not known, but there is no planning for it either. A conclusion for solar energy is that it is not economic now, but it will probably never be economically, because of rising steel prices and other raw materials. So the best time to start is now, it will never be better. Applied science and R&D will have to be supported and stimulated.

What needs to be done in Groningen in spatial planning?
Formulate the basic problems in a simple way that can be understandable for a high-school level of education. Capitalisation depends on energy prices and rising energy prices result in a new way of calculating the value of the assets in the province. Formulate carefully in simple terms that shows that the problem is unavoidable. Spatial planning is affected by energy process in a way that is unprecedented and unknown yet. During the expert meeting the first map, which shows the possible relation between energy prices and spatial effects (figure 37).

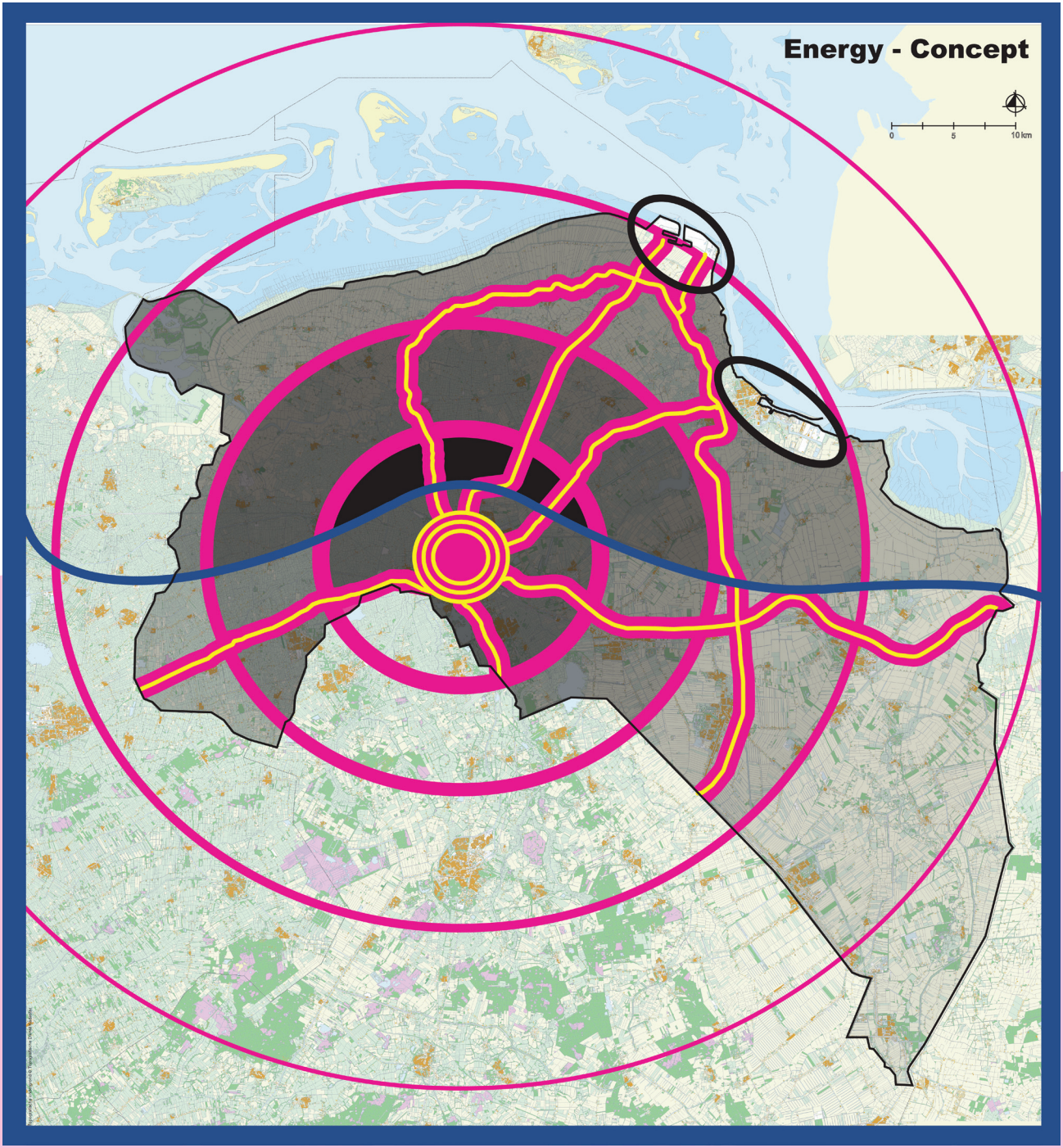

Figure 37. First spatial map indicating the relation between spatial differentiation, energy prices and economic values

Some conclusions were drawn:

1. Energy for transport and energy use in households will be linked strongly with global developments and price developments;
2. The density of people will shift, under the condition of self-provision. It becomes more difficult to provide energy in peripheral regions;
3. Small communities might become self-supporting and supporting the surrounding area with services that can be bundled and shared;
4. There will be a socialisation effect and this will fit the human nature and the social needs of the individuals;
5. There is a natural size for the amount of space that people need and feel comfortable with;
6. What is needed is not to compress too much but rather take the social aspect into account.

Transportation cost will influence the way the way of living is organised. Further away from the centre with amenities a farm with some houses will be the typology, a bit nearer a street with a small community might be the specific identity and even nearer a community and the street itself might be developed. For each defined area, a typology should be made including an advice for connecting to existing policies and a connection with current policy

An integrated spatial-economic energy model

An integrated assessment model (description in appendix) might be developed in order to define the different typologies possible, the level of self-sufficiency, the value of real estate and affordable transportation costs related to different energy price levels. This economic model can be constructed, which shows the effect of energy cost including the capitalisation effects. The model calculates and shows the survivability and capitalisation of the region. Such a model will be convincing towards politicians to see what might happen in different areas in the province and what influences what. Given the rising energy prices, the ration between housing cost in loans and the real estate prices will shift. Such a model is also valuable for banks, insurance companies and policy makers

The typology must be simple with included parameters, such as the energy price, population density, type of soil and fertility, businesses, distances, real estate price, productivity, renewable energy potentials (solar, wind), investment and maintenance cost and potential biomass production.

The visual representation in maps must be programmed and made convincing. It is noted that to start with,

a rough guess is good enough and the calculations can be rough and simple. It is the message that counts. After such a rough model is constructed, the capability and maturity can be discussed, as this will show what needs to be in place and what needs to be undertaken to reach the desired results. Thus, it is able to show the transition from what is in place already vs. what needs to be in place. This will even make clear the markets for new technologies and hardware. An image of the energy demand and production would show directly the spatial effects of energy demand and supply. The model will show the level of danger as a result of energy price. The vulnerability must be shown.
If shift are proposed the natural time scale of a working generation will have to be taken into account. It is difficult to change habits, notions, world models, and main skills in a shorter period of time. 20 years will be a minimum time frame. The production of added value will influence the survivability of the city and the size that is needed. The next step is to think what can be done. In terms of agriculture, food production, people moving etc. The model can also assist in making choices and showing survivability in the new situation.

Uniqueness of such a model

The question is who can afford the building of such a model and who is interested in the results. The model can be set up in such a way that it can be used in other countries and areas also. Simple calculations for energy vs. economic development need to be developed. The model might be marketed as a commercial product when the results are good enough. Other parties are welcome to participate of they assist in the development of the model. This kind of modelling has not been done before and might be fit for publication and presentation in the scientific world. The shell of the model can be used in other regions also.

9. General conclusions and follow up

Some general conclusions based on the series of meetings and conferences may be drawn here. The conclusions are drawn on the follow up and process-like aspects as well on severe content.

Conclusions on the content of sustainable energy systems:

1. Due to fast rising oil process the energy supply will become a problem in the near future;
2. For the first four years the measures and policy is sufficient (2008-2011), but during this period fundamental choices need to be made and a shift towards a true sustainable energy system must be initiated;
3. It is doubted if current policies are sufficient enough to cope with the consequences;
4. The shift to a sustainable system requires technical and social adjustments;
5. In order to realise these, several measures need to be in place. For several energy-systems (green gas, sustainable electricity) this is currently not the case;
6. The spatial impacts of rising oil prices are not yet represented in maps; it would be an advantage to produce such a spatial representation;
7. The potentials of local sustainable energy production may be part of a solution to cope with developments;
8. A regional economic energy model (See appendix one) may be a very useful tool to base policies on.

Conclusions on the process and follow up:

1. International exchange of knowledge has proven to be very fruitful;
2. Second and third INCREASE meetings are foreseen for 2009 (Switzerland) and 2010 (Yemen);
3. Further exchange between Jordan and Dutch experts and politicians will be further explored. The Jordan Minister of Housing would be honoured to visit Groningen and scientific exchanged is being organised between the Hanze University and Jordan University.

Appendix

Exploration of a model indicating the spatial-economic consequences of a fast increasing energy price in the province of Groningen

History

Supported by the hotspot climate proof regional plan Groningen an expert-conference took place in Amman, Jordan. Besides a Groningen delegation scientific experts from Russia, Armenia and Jordan took part in the conference. One of the most important results of the conference was the huge impact rapid rising oil prices might have on the economical and social system at a regional level. It is expected by energy experts that the price of 100 dollar per barrel in January will increase via the current level of 135 dollar per barrel (in May 2008), towards 175 at the end of 2008 and 200 dollar per barrel at the beginning of 2009.

These developments and possible consequences were discussed in an expert meeting in Groningen and were put on a map in a conceptual way. A first spatial sketch was drawn on the level of the province of Groningen. Possible effects, like reach ability of amenities and mobility of people as well as consequences for real estate values were translated spatially. Land use was also seen as an important factor, which might change due to decreasing mobility. The first sketch shows lots of uncertainties about the inter-related ness and correlation between the factors and the outcomes are rudimentary. Therefore, a better computer based model needs to be developed, which makes it possible to show the effects of different price development scenarios on maps.

Analysis

Developments in spatial economy and the regional social structure are mostly based on a never chang-ing pattern of jobless percentages, food-prices, real estate prices and house prices. Policies need to be adjusted, in these kind of scenarios, just a little bit. In case a sudden change in energy prices takes place (and most raw material prices as well) the basic economic system is challenged and continuation of policies is risky. A new way of thinking and new solution strategies must be explored. This unexpected change takes place right now; reason for a changed perspective on the future.

Objective

The socio-economic future of Groningen is been modelled spatially, based on rapid changing energy prices.

Higher energy prices imply higher transportation costs. Not only the transport of goods becomes more expensive, also the price for commuting increases. Part of the inhabitants (living far from work, low income) are to be confronted with such high transportation costs, that it willl be no longer affordable to live at such a big distance from work and the central city (Groningen City) or centres of amenities. Because of this, the value of houses will decrease and unattractive areas emerge and might even collapse. The social networks will be suppressed and villages might be abandoned. The result might even be that the province as a whole becomes less attractive and loses value.

Proposal

Development of a computer based model in which the most important variables related to energy prices are spatially mapped. Different phases and different energy price levels are judged on their consequences.

The model will be based on the following parameters:

Related to the increasing energy prices:

- Costs of transportation and energy costs for living, depending on the world energy price\
- Costs for energy use in houses
- Transportation costs and energy costs or different basic products for inhabitants: food, water, energy

Related to solution strategies:

- Fertility of different areas and potentials for biomass and bio-fuel production
- Potential for local production of wind and solar energy

Results

The results of the model include a spatial translation of the changes of real estate value, the potentials of different areas of the province (such as the possibility to support inhabitants), density of the population and the level of independency of the province related to different energy price scenarios

Development of this model is unique in the world and has the potential to be beneficial for the province and might be an export product.

Consortium

To execute the project a consortium of the following partners is put together: University of Moscow (MIGMO), VU-Amsterdam, the provinces of Groningen and Drenthe and Energy Valley. Most of the work takes place in Moscow. A Dutch project team will steer the execution of the study: Provinces of Groningen (OMB, VV, MB, RP & EZ) and Drenthe, Energy Valley and VU-Amsterdam.

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