OUTLINE PRESENTATION

1. Introduction TNO
2. Energy transition
3. Information need
4. Experimenting with Data driven Energy Policy Making
5. The way forward
6. Discussion
TNO CONNECTS PEOPLE AND KNOWLEDGE TO CREATE INNOVATIONS THAT BOOST THE SUSTAINABLE COMPETITIVE STRENGTH OF COMPANIES AND THE WELL-BEING OF SOCIETY. THIS IS OUR MISSION AND THIS IS WHAT WE PURSUE WITH OUR KNOWLEDGE AND EXPERIENCE FOR OVER 80 YEARS.
SMART SOLUTIONS FOR CLIENTS & PARTNERS

DEVELOP FUNDAMENTAL KNOWLEDGE
Together with universities

KNOWLEDGE DEVELOPMENT
In public-private partnership with partners from the golden triangle

KNOWLEDGE APPLICATION
Contract research for and with clients

KNOWLEDGE TRANSFER
Knowledge exploitation by spin-offs, licences, in partnership with other companies
LOCATIONS IN THE NETHERLANDS

- Amsterdam
- Leiden
- Den Haag
- Rijswijk
- Petten
- Bergen op Zoom
- Soesterberg
- Zeist
- Utrecht
- Eindhoven
- Helmond
- Geleen
- Groningen
- Eindhoven
INTERNATIONAL PROFILE

- PROJECTS IN 40+ COUNTRIES
- 30+ NATIONALITIES WORKING WITHIN TNO
- INTERNATIONAL JOINT VENTURES
WE DO THIS BY TAKING A MULTIDISCIPLINARY APPROACH
How can we accelerate the energy transition?
How can the use of data help us address societal challenges?

Team Environmental Planning
• Enhancing strategic decision-making on sustainability and spatial development;
• Studying the interaction between knowledge, people and the environment;
• Investigate the (knowledge) transfer and implementation of new technical solutions;
• Aimed at making the energy supply, mobility flow and urbanisation more sustainable;
• And embedding and justifying the technological approach in respect of new problems faced by society
ENERGY TRANSITION
OBJECTIVES AND CHALLENGES
Nog enkele sprongen te gaan

PBL: het benodigde reductie klimaatakkoord gehaald.

Necessary CO2 reduction in megaton/year

34 Mton reduction extra necessary for the CO2-reduction target of -49%.
The target for 14% sustainable energy in 2020 is not achieved, in 2018 NL has the lowest share with 7.4% in the EU.

47 Mton extra CO2-reduction needed for the CO2-reduction target of -55%
Digitalisation is essential to keep this increasingly decarbonised, decentralised energy system running in a stable and affordable way.
Resistance from society

How to socially embed sustainable energy innovations?
INFORMATION NEED FOR THE ENERGY TRANSITION
Energy transition decision making

WHAT: Integral sustainable energy system

WHO: Transition partners and stakeholders

HOW: Strategize, Plan, Implement, and Monitor

WHEN: Timing of decisions and the temporal dependencies

Technological solutions, Social and economic change

Public & private parties and citizens

Vision, Strategy, Plan

Technological, Social and Economic change

Local (municipality, district, neighbourhood, street, building level)

Interdependencies

National

Regional-Provincial

Decision support

Data and information

Models and tools

Decision dialogues

(Diran, Henrich, & Geerdink, 2020)
THE DATA LANDSCAPE FOR THE ET

Where is the knowledge related to citizens? Their preferences and drivers?

(Diran, Hoppe, et al., 2020)
DATA NEEDS AND CHALLENGES FOR THE ENERGY TRANSITION

RESEARCH AMONG 8 FRONTRUNNER MUNICIPALITIES AND 3 IMPORTANT DATA SUPPLIERS IN THE NETHERLANDS RESULTS IN:

1) THE DATA NEEDS FOR THE TRANSITION VISION HEAT AND IMPLEMENTATION PLANS

2) CHALLENGES FOR UTILIZING DATA IN THE SUPPORT OF ENERGY TRANSITION PLANNING
REMAINING INFORMATION NEEDS FOR ET

(Diran, Brus, et al., 2020)
### CHALLENGES - DATA FOR THE ENERGY TRANSITION
RESEARCH AMONG 8 FRONTRUNNER MUNICIPALITIES

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Data access, collection and processing (experienced by x of 8 municipalities)</th>
<th>Data analysis, visualization and reporting (experienced by x of 8 municipalities)</th>
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<tbody>
<tr>
<td>It is a resource (time and cost) intensive process</td>
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<td>Strongly scattered data supply</td>
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<td>Many different formats and standards</td>
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<td>Bad findability of data</td>
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<td>Lacking access to data</td>
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<td>Data quality, timeliness and detail level</td>
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<td>Missing and incomplete data</td>
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<td>Data not up to date</td>
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<td>Data not validated</td>
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<td>Data lacking detail level</td>
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(Diran, van Veenstra, & Geerdink, 2021)
### Challenge - Data for the Energy Transition

**Research Among 8 Frontrunner Municipalities**

(Diran, van Veenstra, & Geerdink, 2021)

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<tr>
<td>A lack of expertise and capacity at the municipalities</td>
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<td>The lack of supporting tools or the lack of efficacy of available tools</td>
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<td>Difficult to link, analyze and visualize data</td>
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<td>Limits to the amount of data that can be processed in the available hardware and software</td>
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<tr>
<td>Legal aspects (AVG, E-wet, etc.)</td>
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<td><img src="image" alt="Yellow" /></td>
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<tr>
<td>AVG: Proper organization and safeguarding of data protection takes a lot of time and legal expertise. (KLIC Data, Type of connections)</td>
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<tr>
<td>Legal restrictions on the exchange and use of data (Electricity and Gas Code)</td>
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EXPERIMENTING WITH DATA DRIVEN POLICY
DIGITALIZATION IN OUR HOMES
THE TRANSITION OF OUR HOMES
THE TRANSITION OF OUR CITY
Goal: to design, implement and scale up data experiments by governments and their stakeholders, where new data sources and methods of analysis are utilized.

- Exploring new data sources and technologies with an impact on policy.
- Setting up experiments to test these new technologies, methods and policy models.
- Implement and monitor this policy; formulating possibilities for upscaling.

This involves building up knowledge about the methods and preconditions for collecting, storing and analyzing data about the different phases of the policy-making cycle.

(van Veenstra & Kotterink, 2017)
Knowledge gaps for a socially inclusive heat transition

Challenges faced by local governments to acquire data, process and analyse data, and guarantee privacy and security

The importance of multi-disciplinary teams

A method to derive, store, process, share and analyse data in support of decision making

Data-driven -> Hybrid <- Expert-driven

Build from the strength and familiarity of the municipality

(Diran, van Veenstra, Geerdink & Steenmeijer, 2021), research publication pending
THE ROLE OF AI FOR LOCAL GOVERNMENTS

› Supporting the exploration of an ever increasing solution space
› Evidence based underpinning of mental models and discourses
› Connecting domains and sectors
› Improving efficient and effective data acquisition strategies
› Empowering citizens and stakeholders
› Facilitating robust decision making by means of uncertainty management
Various algorithms have been implemented and compared with each other on performance, explainability and transparency. The first implementation was a Random Forest model, which is considered suitable in this experiment for several reasons, namely:

- high prediction accuracy and interpretability of results,
- gaining insight into the most relevant variables for this task, through their predictive power,
- robustness against over-fitting, and
- suitability for datasets with many variables and not necessarily much data.

* Permutation score: the degree to which the predictive power of the model decreases when variable x is removed.
A CHECKLIST FOR DATA ETHICS

- Algorithm choice
- Explainability of the algorithm by the team to the public

- Data source
  - Data source
  - Data quality
  - Data “shelf-life”

- Need to anonymize the data
- Key to reverse data encryption and pseudonymization

- Visualization of the insights towards the team, stakeholders and the general public
  - Visualization technology

- Parties with access to the data
  - Monitoring data access

- Suitability of the data to be shared
- Conditions to data sharing and (re)use
- Risks of data sharing

Based on “De Ethische Data Assistent” by (Utrecht Data School, 2019) and (Diran, van Veenstra, Geerdink & Steenmeijer, 2021), research publication pending
A CHECKLIST FOR DATA ETHICS

- Responsibilities
  - Legislation, guidelines, etc.
  - Final responsibility
  - Clarity of the responsibilities
  - Suitability for collaboration

- Communication
  - Communication strategy
  - Communication Responsibility

- Transparency
  - Risks to the public
  - Transparency towards citizens
  - Possibility for citizens to object the outcome
  - Possibility to opt-out

- Privacy
  - Commitment of Data/Information/Security officers
  - Use of personal data
  - Insights in personal life
  - DPIA

- Biases
  - Expectations about the results
  - Concerns about the project
  - Role of the results in decision making
  - Representativeness of the data
  - Use of results for other purposes

General considerations

Based on “De Ethische Data Assistent” by (Utrecht Data School, 2019) and (Diran, van Veenstra, Geerdink & Steenmeijer, 2021), research publication pending
THE WAY FORWARD
OVERVIEW INFORMATION SUPPLY AND UTILIZATION
AN INTEGRATED APPROACH FOR ENERGY TRANSITION DECISION MAKING

(Diran, Henrich, & Geerdink, 2020)
A socially inclusive energy transition in which citizens are involved within their capacity and decision-making is tailored to the wishes and capabilities of the citizens. Call for participation!
DATA AGENDA AND PROGRAMMES

NL DIGITAAL
Data Agenda Overheid

Aan de slag met data

1. Maatschappelijke problemen oplossen met datagedreven werken
   - Aandacht voor wetgeving en publieke waarden

2. Overheidsdata kwalitatief verbeteren en efficiënter benutten

3. Kennis over datagedreven werken verzamelen en delen

4. Investeren in mensen, organisatie en cultuurverandering

VIVET
Verbetering Informatievoorziening Energietransitie

VNG
Vereniging van Nederlandse Gemeenten
REFERENCES


