Meeting discussion - updated:

Mention two points:

- Master Thesis Design

Thesis Design structure:

1. Title, student name, ID, email, supervisors with emails, abstract
    - Add a link to the private Github repository for DS-related projects
2. Short introduction defining the problem, context and stating the Research Question
3. Literature review indicating how your work is grounded in the literature and builds upon the state-of-the-art research
4. Methodology
    - Resources where applicable (datasets, software, etc.)
    - Approach: choice/justification of research method(s) to answer the research question
    - Describe how you evaluate your results
5. Risk assessment
    - Describe the risks, and describe your plan B
6. Project plan
    - Timeline (Gantt chart with results per week)
    - NB: describe achievements, not actions. (e.g., instead of data preparation you write all data in XXX format, well-described, ready for analysis using YYY)

Thesis Design acceptance criteria:

Below you see the weight of each section and the questions used by the supervisor to assess the sections.

1. A title, supervisor(s), abstract **(10)**
    1. Is all clear and neat?
2. A clearly defined research question and corresponding sub-questions **(20)**
    1. Can the research question be answered?
    2. Do answers to the sub-questions indeed help in an understanding of the research problem or even in solving the research problem?
    3. Are the sub-questions detailed enough?
3. Overview of the state of the art of the literature **(20)**
    1. One expects that the research problem is grounded in the literature and that each sub-question or field has a small section of relevant literature.
    2. All parts of the thesis should be grounded in or at least connected to the literature.
4. Methodology **(20)**
    1. Do I get a clear picture of the used resources?
        1. E.g., for data, do I get a clear picture of the data, its state, its availability, how much it is, how dirty, how much work to process, etc, etc.
    2. Are the methods which will be used described in enough detail, so that I can picture what will be done exactly?
    3. Is the evaluation appropriate? That is, do I understand how each sub-question is answered by the evaluation?
5. Risk assessment **(10)**
    1. Is it complete?
    2. Is it realistic?
    3. Is the backup plan executable?
6. Project plan **(20)**
    1. Is it complete? (I.e., every part of the work covered.)
    2. Is it realistic?
    3. Does it give a clear picture of what will be done when?
    4. Is it possible to evaluate whether the student is on schedule at any point in time?

Self-Evaluation Research Question

1. What is your evolving research question?

How the Dutch energy market can be encapsulated in a systems dynamic approach?

2. What is the core research problem to which your research question is related?

The core research problem is the way energy transition is going to be realised in the Netherlands (at a country level). The main goal is to address the topic with a system dynamics approach while trying to assess and implement the way energy transition can happen.

3. What are your sub-questions that are instrumental to answering your research question?

I. Focus on analysis on the available data and data-driven thinking.
    A. What data is there on the issue?
    B. What kind of analysis can be conducted with that data?
II. What would be a simple initial model to describe the energy transition in the Netherlands?
III. How can we calibrate the model? (this part needs exploration in order to answer more specific questions according to our future findings)

4. Does your research consist of different parts, possibly corresponding with the sub-questions? If so, explain how these parts are necessary to be able to answer the research question.

The research question posed consists of different parts in order to be completely answered. While answering the various subquestions (the existing ones and the others that might arise during the process), the overall question is also solved. Those different parts are:

- Review existing literature that might be useful.
- Find the data available. (RQ-I-A)
- Conduct data analysis on the available data. (RQ-I-B)
- Build a simple initial model that describes the energy transition and reflects the behavior and interconnections of the system's elements. (RQ-II)
- Calibrate the model and reflect on its behavior. (RQ-III)

5. How do you plan to answer your research question, i.e. what is your methodological set-up. Why do you choose this set-up? How are you going to evaluate?

The process of answering the research question and subquestions consists of various steps. Those steps can be:

1. Review of relevant literature (Related work section)
2. Exploration of available data (Material & Methods section)

3. Construction of a causal loop diagram (Material & Methods section)
4. Construction of a stock and flow diagram (Material & Methods section)
5. Calibration of the model (Results)

This set-up seems to create a good outline for the research question to be answered. It follows a generic flow that can be found in other relevant works as well.

The evaluation is going to be realised by the exploration of the model's behaviour. The results of the model are going to be compared with the actual data available.

- Models (comments here + models)

General notes:

- Polarities need to be added in some models (need of exploration and understanding from my part)
- Variables with “Australia” will be replaced as soon as we find the way the Netherlands’ variables behave.

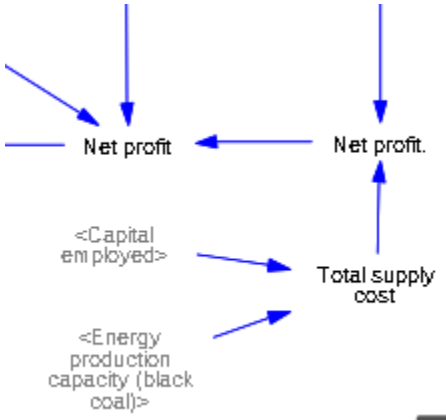
In figure 1-sfd model:

- New non-RE capacity, New RE capacity and Unprofitable capacity variables are not defined. I have defined them in order to produce a working model. However, I would like to check with you if my definitions are acceptable for the first phase of our modelling process.

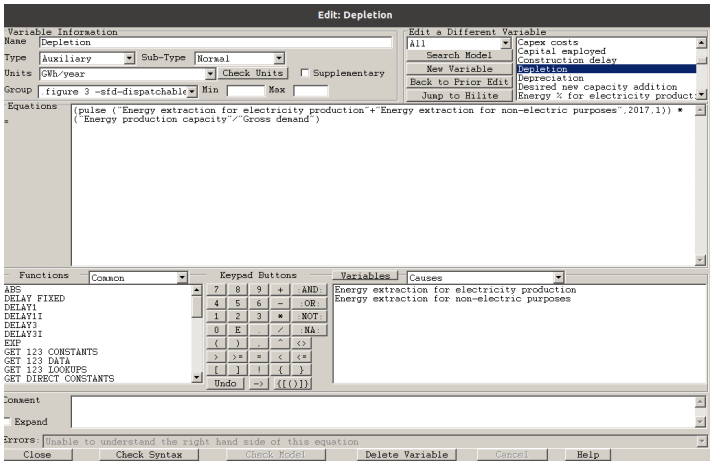
In figure 3-sdf-dispatchable resources model:

Note: started the simulation for black coal

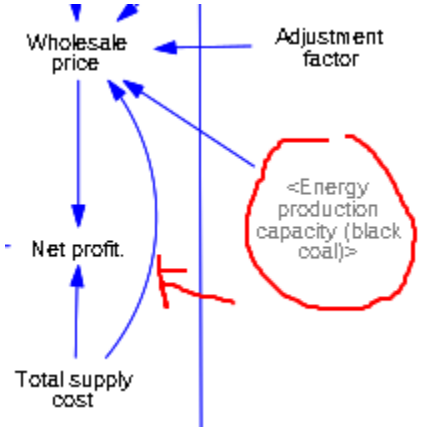
- I added the Capex costs variable (which was mentioned in the Capex equation but did not exist in the model). However, I am not sure how to define it.



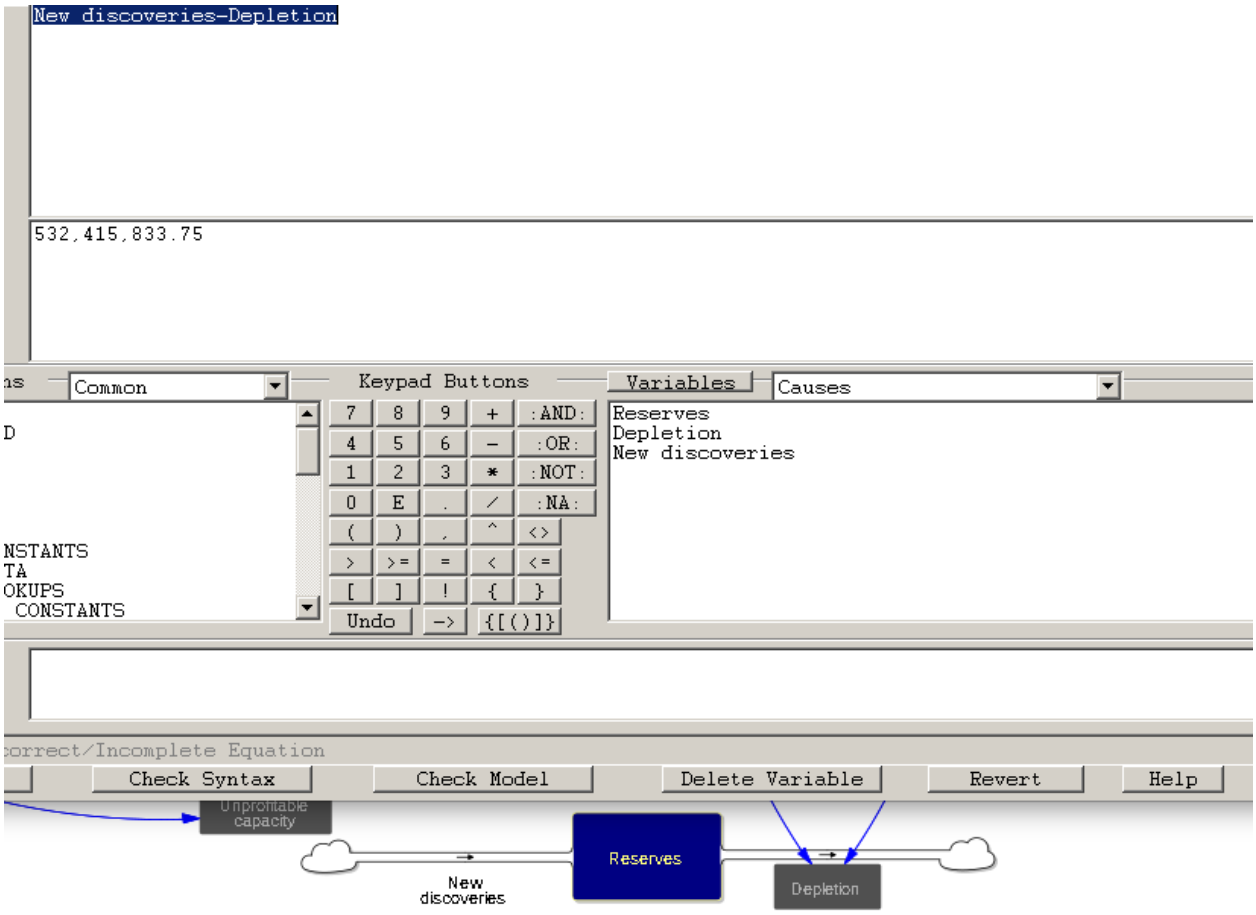
- [redacted] added the shadow variables and the total supply cost one since it was required from the equation.



I think something is wrong with the depletion variable (and its equation)



- additions (for the equation)



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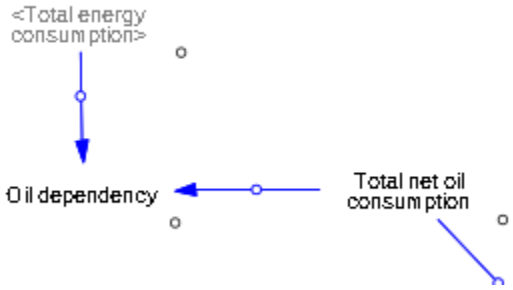
the equation is not correct (for Vensim) unless reserves-stock is included in it.

- Some variables are not defined in the paper (capex costs, energy extraction for electricity production, total supply, unprofitable capacity) How should we handle them?

- In general, I was a bit confused since for some cases there was missing information and I wasn't sure if I should focus more on the model (graphically) or the equations in order to finalize it.

In figure 3-sfd-CO2 emissions model:

- No connection between the top elements - I added it
- 

added in order to fulfil the equation
- Actually, much of the information needed is missing in order to complete this diagram. I think the most useful thing would be to list all the variables/ stocks for which the definition is not complete. They are:
    1. Black coal
    2. Black coal-(CO2-e)
    3. Brown coal
    4. Brown coal-(CO2-e)
    5. Bio power
    6. Black coal - (CO2-e)
    7. Brown coal - (CO2-e)
    8. Domestic consumption of black coal of total production
    9. Domestic consumption of brown coal of total production
    10. Domestic consumption of gas of total production
    11. Gas
    12. Gas-(CO2-e)
    13. Gas - (CO2-e)
    14. Global CO2 emissions
    15. Hydro power
    16. Oil
    17. Oil - (CO2-e)
    18. Oil production
    19. Oil-(CO2-e)
    20. PJ
    21. Renewable electricity
    22. Solar power
    23. Total CO2 emissions of total consumption
    24. Total CO2 emissons of total production
    25. Total electricity generation
    26. Total energy production.
    27. Total net black coal consumption

28. Total net brown coal consumption
29. Total net gas consumption
30. Total net oil consumption
31. Total non-RE
32. Total RE
33. Total RE.
34. Wind power

In figure 3-sdf-non-dispatchable resources model:

In general, the issues in this model do not appear to be major. The elements that are not properly defined are:

1. Capex costs
2. ROIC
3. Total supply cost
4. Unprofitable capacity
5. Backup power cost
6. Supply cost
7. Total supply