

Presentation 1.3: Energy technology, perspectives, scenarios and strategies to 2050

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Energy Policies as a Global Investment Factor

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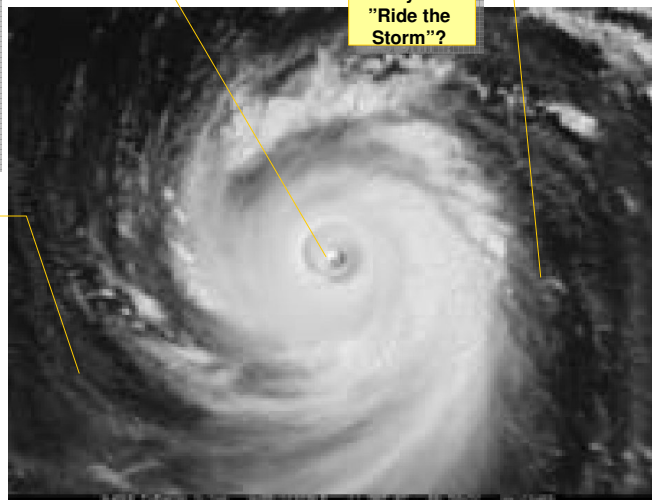
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In the Grips of the Climate and Energy Storm: Three Energy Pathways

Can the forest industry somehow reach a balance in the "Eye of the Storm"?

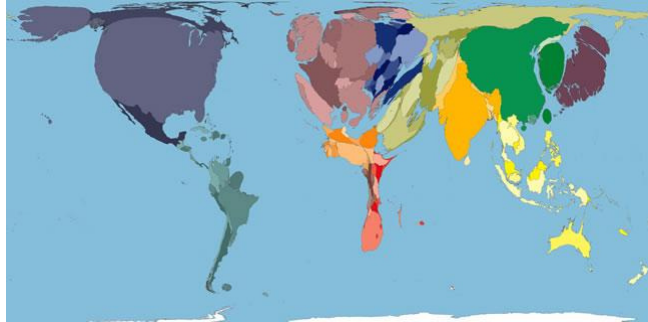
Is there a way to "Ride the Storm"?

Should one be swept along in "Business As Usual"?



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The Geography of Energy
 Annual Fuel Consumption: Size Proportional to Absolute Consumption



On the "fuel globe", the US, EU, China, India and Japan form five almost equal blocks.

Fuel consumption per year (Image: SASI Group, Univ. Sheffield/M Newman, Univ. Michigan)

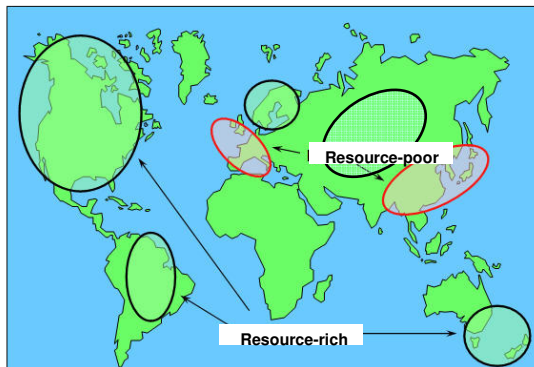
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"To have and have not": Nouveau riche, still poor

- The rich and the poor countries are perhaps not where one assumes them to be. A resource-oriented world has other priorities.

An index based on water, forest, energy and arable land gives a new geography for the rich and poor.



$$\text{Resources} = (\text{water} + \text{forest} + \text{energy} + \text{arable land}) / \text{capita}$$

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Cost Structure

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Eye of the Storm

- In the eye of the storm there is calm.
- We could make an analogy: a position for a forest industry company, where the sensitivity to energy costs and product prices in various scenarios is such, that it in most cases stays on top of the competition, and makes a profit.

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An Example of a Cost Structure

We have taken one example cost structure (which is from an almost real, really anonymous mill), and normalised it to 100.

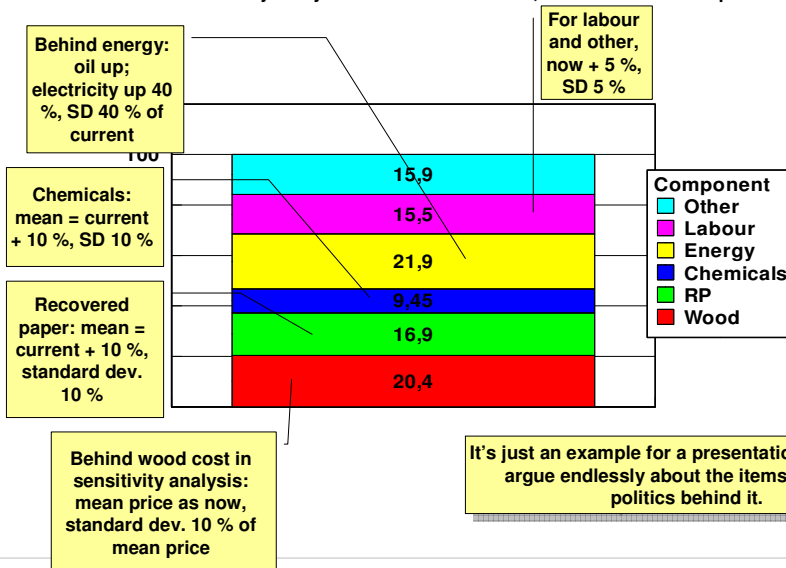


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An Example of a Cost Structure

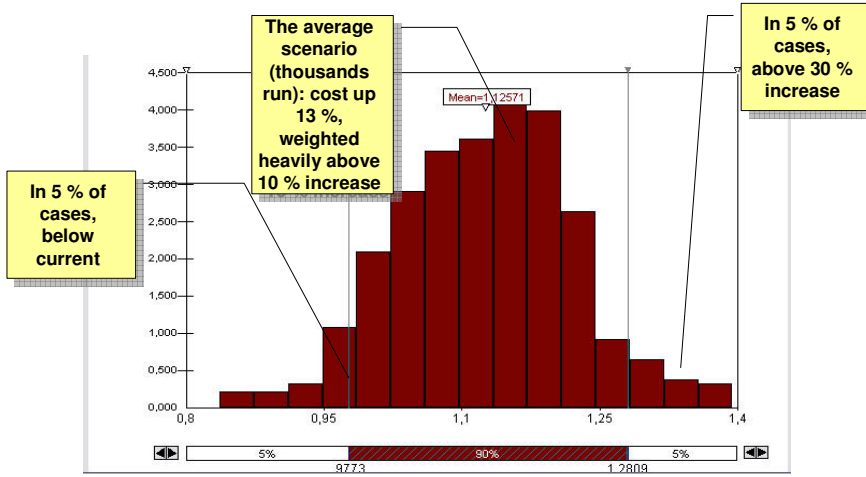
For a sensitivity analysis of the cost structure, we make the assumptions:



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The Outcome

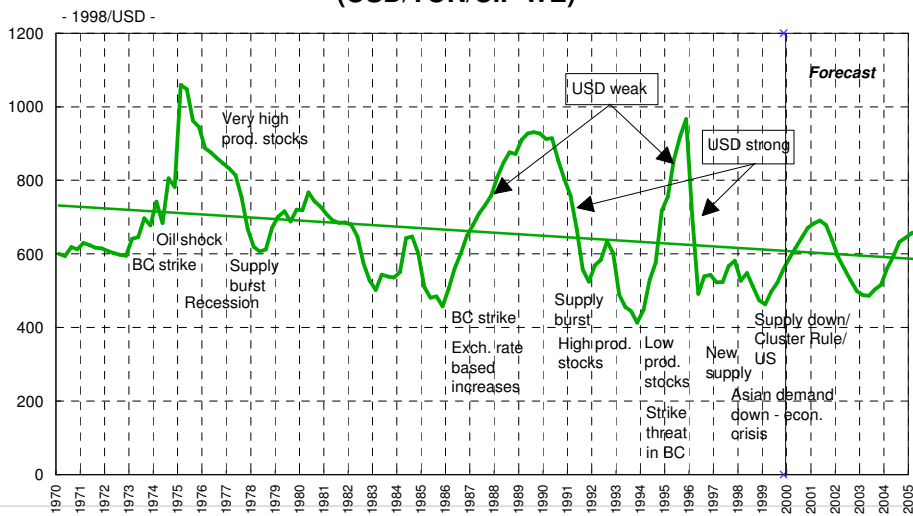


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What about trend prices?

REAL PRICE OF NBSK (USD/TON/CIF WE)



10

F9TT01.XLS



So...

- ... we have, in a sensitivity scenario, a 95 % likelihood of increased costs, and
- apparently sinking trend prices
- with normal mathematics, this would not look good.

- Let's hope that
 - the sensitivity scenario was flawed
 - if it wasn't flawed, we'll hit the lucky 5 % where the costs decreased
 - trend prices are just projections – something will turn the trend
- However, reaching calm in the cost-and-price-change-storm does not look easy.

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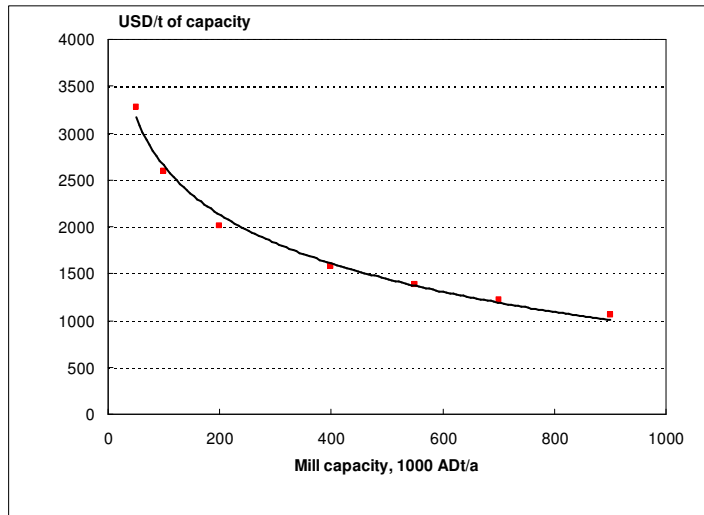


Investment Costs

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Specific Investment Requirements: Kraft Pulp Mills

New bleached hardwood kraft pulp mill projects

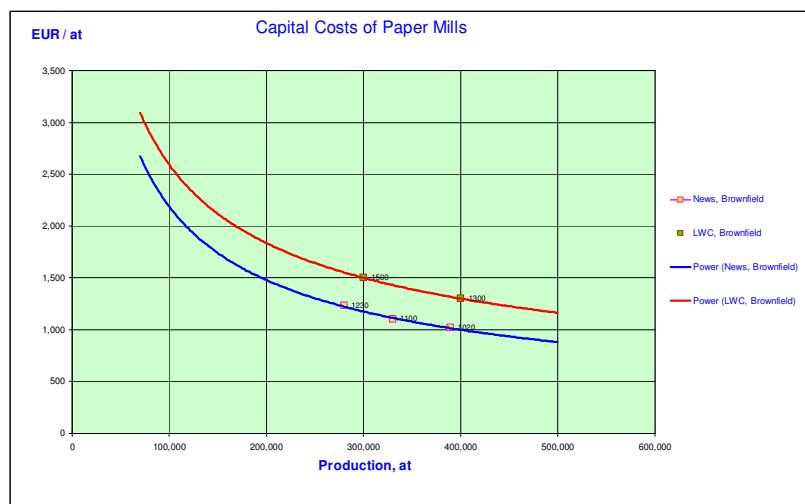


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Specific Investment Requirements: Paper Mills

Some recent paper mill projects



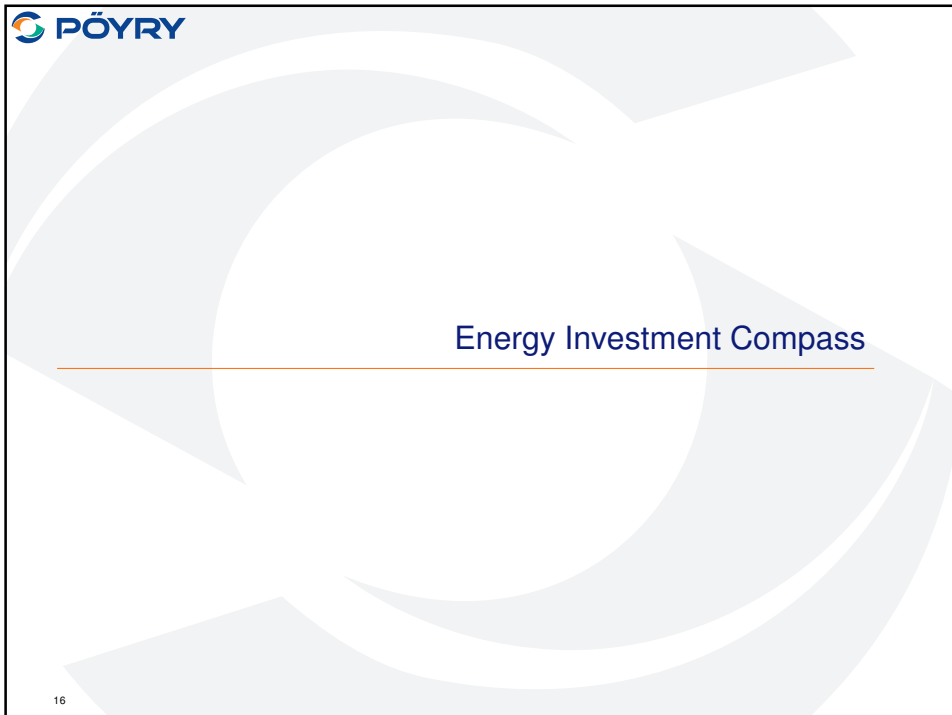
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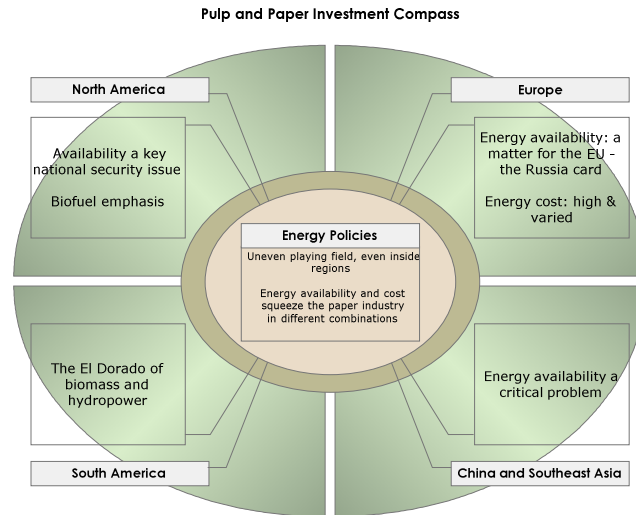
The Paper Industry Is Among the Capital-Intensive Sectors...

- ... and unless a redesign of pulping and papermaking succeeds, will continue to be so
- ***Thus: mill cost structures are highly sensitive to energy, and investment costs are high***

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Compass of Investments



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Energy Policy End Game: Green and Black Chess

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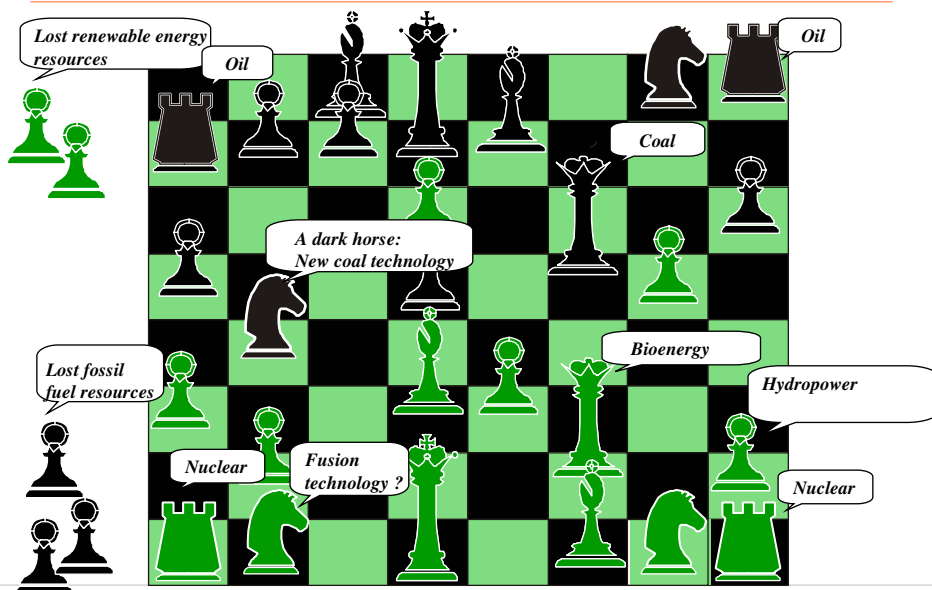
End Game: The Green Queen and the Black Queen

- In assessing the impact of energy policies on global paper industry investments, the fact that we are dealing with a complex issue is not just a disadvantage. We also have an arsenal of complex strategies at our disposal
- **An investment strategy is a high-stakes game of strategic moves.** The game board is complicated and the rules many. **Chess is a suitable analogy** - chess played on a green-and-black board, between the **green energy and the black energy sides, influenced by energy policies.**
- The final diagram is a snapshot from international energy markets and politics - a tough game with many participants. It is important to bear in mind that the naming used in the green-and-black-chess game only takes into account the greenhouse gas emissions during energy generation. It does not consider e.g. the following facts:
 - When uranium is mined carbon dioxide is released during processing.
 - When biomass decays in the dam where hydropower is processed, methane is released.
 - Bioenergy combustion generates large amounts of green carbon dioxide.

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The Great Chess Game: The contest between energy recourses



The Pieces: The Green Side

The king symbolises the green side - the non-fossil greenhouse gas emissions.

The green queen, **bioenergy**, could not be more on the policy agenda – but this presentation is too short to even touch upon all the intricacies of the issue. **Biorefineries** are a particular variation of this theme.

The green rook, **nuclear power**, is an energy form with a large “momentum” - it is difficult to shift it from its path. It is difficult to restructure the nuclear industry, investments are very significant, which is a disadvantage in competing against other resources. The GHG competitive advantage is, however, strong. No emissions coupled with large amounts of energy.

The dark green horse symbolises **fusion technology** and other new unheard-of technologies, which may appear at any moment, or never. Political and governmental support, market forces, public opinion and flashes of genius are all needed. The dark green house symbolises the player who can take unexpected steps in several directions. This ability makes it a dangerous player but also a weak player who can never make a straight decision.

Green pawns symbolise **hydropower** – a true treasure for those who happen to have it. It can produce important amounts of energy with small emissions.

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Pieces: The Black GHG Side

The king, naturally symbolises the black side - the fossil greenhouse gas emissions.

The black queen, **coal**, has the highest greenhouse gas generation potential. The coal industry is politically supported by many different players.

The black rook, **oil**, is in the same category with coal. It has, however, a lower emissions potential, but extremely strong political clout in many sectors, including transport.

The black pawns, **natural gas**, are pieces with the potential to grow stronger. Natural gas pipelines are major construction projects with few “politically safe” routes. The emission amounts are further increased by important methane leakage from the pipelines.

The dark horse symbolising **new fossil fuel technologies** is not a phantom piece: these already exist in laboratories and more will surely be found.

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The Rules of Political Energy Chess

Our green-and-black chess follows the rules of the standard chess game, but energy policies may change the rules. Among possible new rules, we have:

Rule 1: The battle between shutting down or revitalising energy. Shutting down means removing the green rooks

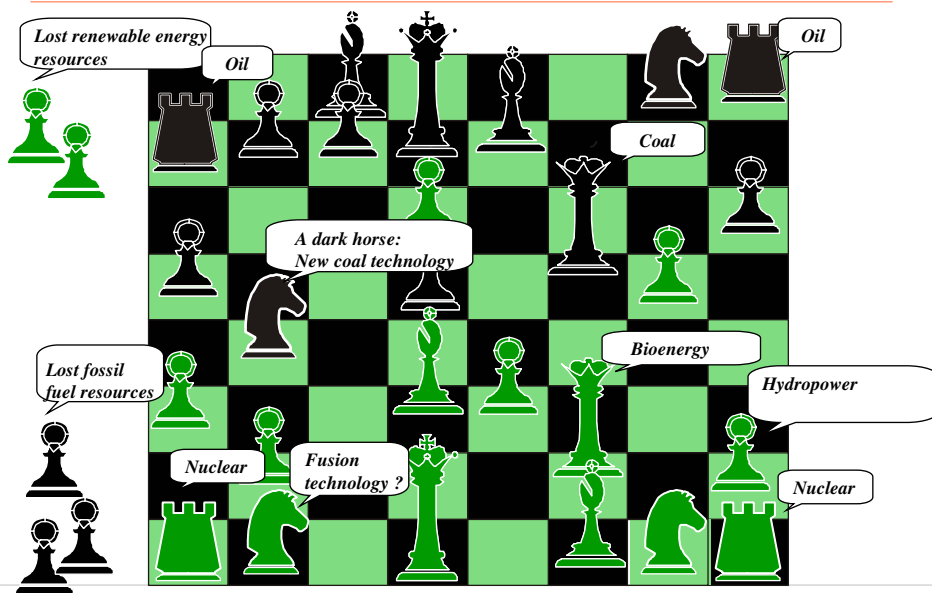
Rule 2: "No new hydropower" is an often-heard demand. In other words, green pawns cannot become green queens.

Rule 3: Indigenous energy security sometimes means utilising present coal resources, which means introducing more black queens into the game at the start.

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The Great Chess Game: The contest between energy recourses



A Green-and-Black Chess Policy Problem: How to Ensure a Victory for the Green Side

- Among all the possible positions and moves in this game, we have chosen the one shown. A possible **energy policy problem is bringing the green side to victory**. The game has only begun. However, many critical questions for the final outcome are about to be answered. Who loses the queen first? That is: which will remain longer on the board, coal or bioenergy? This is left open for the listener. Other questions evoked by the board are:
- Nuclear power (green rook) could be stuck in the corners. This also applies to oil (black rook). The political pressure against these two pieces makes this fairly probable in some regions. However, it is possible for the rook to make forceful attacks, if some space is cleared for it.
- The dark horse in the middle symbolises the unknown future. The horse could take any direction and attack several players: the chosen R&D strategy decides.

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Conclusions

- We have left the play open on purpose, e.g. by not mentioning whose turn it is.
- It is unnecessary for the chess fanatic to analyse the board too deeply: if something is impossible, well, many seemingly impossible things happen on the energy front.
- What the player of the game (e.g. a paper mill, a paper company, the whole sector) needs is political savvy, engineering knowledge, innovations in e.g. energy efficiency and advanced strategic thinking.
- The paper industry has to make a series of moves - that is unavoidable. Otherwise, somebody else makes them for him. In the latter case, the results will not be to the player's liking.

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