

Thought
experiments to
eliminate fossil
fuels in
Switzerland by
2030

An economic
story



Context and thought experiment

Fossil fuels 525 PJ -> 5 PJ

-10% in 2021, -20% in 2020, ... , -90% in 2029, -99% in 2030+

CH 2019 total final energy 834 PJ

= 9.475 Mt oil (49%) + 32 TWh gas (14%) + 0.156 Mt coal (0.5%)

-> Energy use: Mobility: 314 PJ, Heating: 227 PJ

New PV: +7 GWp in 2030, annually +6.7 TWh in 2030 (24 PJ)

Total energy in 2030: 340 PJ (-59% relative to 2020)

Approach, methodology, challenges

a. **Methodology**

- Identify 2019 energy use: sources and uses
- Estimate likely new energy sources
- Calculate critical uses and changes in prices and use
- Build system dynamics model
- Develop needed complementary policies
- Estimate major consequential transition risks

b. **Challenges**

- No literature (ex. EPMA 2019)
- LT Price elasticities do not apply to large changes (-99%)
- Timing

Simple final energy flow adaptation timeline

2021-22: oil price +, mobility (cars, flights) -

2023-25: oil price ++ (x7), mobility (cheap flights end, careful car use) —
heating - (renovation)

- Elasticity calculation: (CH: LT -0.056) $PED = dQ / dP$
 $\approx \Delta Q / \Delta P \times (P1+P2)/(Q1+Q2)$
- End 2025: Q1=100, Q2=50; P1=100, P2=993

2026-29: oil price > x10, spatial optimization (move, remote work), less heating,
agriculture crowded out

2030: basic logistics break down, shortage of essentials,
government falls, policy reversed

Simple qualitative system dynamics model

Mindset / Worldview

Feedback loops

- Unity of life, Collective wellbeing, Public luxury private sobriety, ... -
- Individualism, Competition, Profit and accumulation of capital, ... +
- Moral receptors: Care, Liberty, Fairness, Loyalty, Authority, Sanctity ... +/-

Beliefs about Mobility, “Comfort”, Governance, Information

Energy and material flow

+

Entropy: CO₂, N, P, pollution (chemical, plastic, heavy metals)

+

Ecosystem services

-

Secondary elements

- Consumerism, novelty, planned obsolescence, advertising +
- Density, spatial organization of society, compact urbanism -

Complementary policies

- a. Ensure oil for essential services, start electrification
- b. Build electric logistics network for essential goods (50% by mass)
- c. Build electric PT network for ca. 20 km/person/day
- d. Spatial planning, abandon worst buildings (remote / hard to renovate)
- e. Accelerate renovation and densification of remaining buildings
- f. Help people move, ensure all companies support measure
- g. Build UBS: electricity, health care
- h. Award a small number of flights based on worthy life projects
- i. Mobilize society to choose values and common goals

Qualitative estimate of impacts

- a. Energy use: 835 -> 340 PJ by 2030, almost linear -50 PJ p.a.
- b. Stranded assets: ca. 50% of road vehicles, farm and construction machinery, oil heaters
- c. Size of economy / GDP calculation (BAU +1.36% p.a., +13% 2020-30)
 - Domestic: 3% p.a. decoupling, size ca. -45%, based on -59% energy
 - Int'l: 2011 est. 584 PJ; est. 2020: 1/2 of total final energy
 - Domestic + Int'l: $(55+113)/2=84\%$; total GDP impact -16%
- d. Wellbeing: depending on additional policies, from ++ to - - -
- e. Inequality: depending on additional policies, from ++ to - - -
- f. CO2: domestic -99%, total -40%, excellent starting point to improve
- g. Biodiversity impact: significant domestic positive impact, mainly due to land-use and industrial agriculture

Wellbeing dependency on additional policies - draft

	2020	2030, base	+compact urbanism	+building retrofit	+Univ. Basic Services	+ Societal Goals
Subsistence	++	--	+	+	++	++
Protection	++	-	+	++	+++	+++
Participation	+/-	-	+	+	++	+++
Affection	+/-	+/-	+/-	+/-	+	+
Understanding	+	+	+	+	+	++
Creation	+	+	+	+	++	++
Leisure	++	+	++	++	+++	+++
Identity	+	+	+	+	+	++
Freedom	+	+/-	+	+	++	++

Brief discussion of major consequential transition risks

- a. Societal breakdown, polarization, populism, extremism
- b. Difficult int'l coordination
- c. Malnutrition if poorly managed
- d. Collapse of financial markets if poorly managed
- e. Need to re-write laws and adapt institutions

Conclusion and implications

Eliminating fossil fuels by 2030 can change Swiss society for the better

- Generally improve quality of life, health, wellbeing, and reduce pollution
- Give meaning to and mobilize society, prepare other transitions to sustainability
- Give Switzerland a moral standing to lead the world by example
- Refocus the economy on human needs and eliminate much waste and cost

Perfectly feasible, but requires big changes to all major institutions

- Goal and size of economy
- Non-market governance of energy, health, land transport, and food
- Mixed governance of housing, air travel, UBS, land use

Major consequential transition risks need careful management

—> Worthy of developing properly and publishing