

WATCH OUT, DEAR SWITZERLAND! *Too small to act or too exposed to wait?*

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I am proposing a plan of action. It responds to the emerging risks of climate change and resource constraints.

Yes, Switzerland has been economically successful. And if it chooses wisely, Switzerland can stay successful. But will it?

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Today's resource paradox

Despite its limited natural resources, Switzerland shines as one of the world's most competitive and innovative economies, with low unemployment, a highly skilled labour force, and a per capita GDP among the highest in the world.¹ But can this success last, given growing ecological constraints around the globe and the multifaceted impacts of climate change? Is it necessary to stay within 2°C warming as the 2015 Paris Climate Agreement stipulates?² If humanity does not curb its emissions, will climate change increase the resource pressure and its unpredictability?

Switzerland is already heavily resource dependent. For instance, the country eats twice as much as it can grow. As a whole, it consumes four times as much as Swiss ecosystems can regenerate.³ It does this even though Article 73 of the Swiss constitution urges that the *“Confederation and the Cantons shall endeavour to achieve a balanced and sustainable relationship between nature and its capacity to renew itself and the demands placed on it by the population.”*

Given the new era of climate change and resource constraints, what does Switzerland need to do to remain successful?

Opinions vary widely, yet the stakes are high. Does resource dependence pose a significant risk to Switzerland? Or is it largely irrelevant, as current policies and investment patterns imply? These essential questions highlight the inescapable fact that Switzerland is at a crossroads. What are our options?

We propose a new path. But before outlining our suggested response to the dilemma, we discuss why business-as-usual is less and less viable. Then we outline five steps which we believe are necessary for Switzerland to build a robust and successful future (page 7: Switzerland can succeed).

Getting Switzerland's resource capacity right is critical for food, energy, transportation, urban planning, economic stability, international relations, and any other activity enabling Switzerland's success. In an overused and overstretched world, **resource sovereignty**⁴ becomes an ever more significant driver of a successful economy.

What we already know about our resource situation

Despite the many uncertainties, some aspects are already clear.

i. **Assume that increasingly tight global resource trends are largely a given.**

These persistent trends only shift slowly. It is possible that they can be redirected, but given the current level of weak international cooperation and focus on deregulation in countries like the US, it is improbable. Ecological constraints emerge as slowly as they can be overcome. These constraints refer to the planet's weakening "supply" whether it is climate change, receding ground water, land erosion; or whether it is the "demand side": population growth and the intensification of resource-dependent infrastructure. Some nations are taking steps toward strengthening their resource sovereignty, especially on the energy front. Despite those efforts, changes are slow to manifest because of the inherent inertia of built infrastructure and the long time-delays governing population size. Turning the trends in the long run is possible, but the shift cannot occur from one day to the next.

ii. **Despite the proclaimed intents of the Paris Agreement, efforts to decarbonize are not yet spreading** at the required speed and scale to achieve the necessary results.⁵ For instance, we still lack a clear plan and concerted efforts to exit the fossil-fuel economy.

Yet nothing less is required to reach sustainability — in parallel to lowering the current demand for biological resources.⁶ Humanity's demand – its Ecological Footprint⁷ – is currently 60% higher than what the Earth can renew — without even taking into account the fact that the 10-100 million wild species with whom we share the Earth also need space and resources. At the current level of demands on nature, humanity no longer operates in a safe resource space.⁸ Yes, renewable energy technology is becoming more cost competitive. But it is not yet

What does Paris tell us?

The 2015 Paris Agreement, which entered into force on November 4, 2016, stipulated: Global warming should remain well below 2°C, possibly even 1.5°C above pre-industrial levels.

Avoiding an increase over 2°C requires, according to IPCC reviewed climate models, less than 450ppm CO_{2e}. atmospheric concentration. Further, 450ppm may be on the high side, particularly for Paris' postulated 2°C upper long-term limit.

In 2016, the atmosphere contained 403 ppm CO₂. Currently, humanity's emissions increase the CO₂ concentration by 2 - 3 ppm per year.

If we include non-CO₂ greenhouse gases, the current concentration may be at 470 ppm CO_{2e} already.

In other words, humanity has between minus 10 to plus 20 years of current emissions left to comply with Paris. Minus ten means humanity should have stopped emitting ten years ago.

In Paris, Switzerland proposed to reduce its aggregate CO₂ emission 50% by 2030 compared to 1990 levels. In 2012, they were 97% of 1990 emissions.

compensating for the lack of political will to implement such technologies at scale.

- iii. **Climate change and tightening resources are turning the global economy into a negative sum game.** Ecological overshoot is inevitably leading to the liquidation of natural capital. In addition, less natural capital amplifies the potential for overshoot. With weakened natural capital, it becomes more difficult to adequately power and feed the global economy. Paradoxically, expanding a resource hungry economy, undermines the economy's ability to operate. The global economy turns into a negative-sum game.
- iv. **In the current situation, the “Tragedy of the Commons” is tragic but not that common.** Or at least it is not as dominant a force as often mistakenly claimed. No doubt, this negative sum game driven by resource liquidation has “Tragedy of the Commons”⁹ elements. Examples thereof are CO₂ emissions from fossil fuel in the atmosphere or fishing in international waters.

But there are also significant elements in the global resource dynamics that are NOT driven by a “Tragedy of the Commons”: overusing ecological assets within the country or building resource-intensive infrastructure or infrastructure promoting more resource use.¹⁰¹¹ Such infrastructure will likely turn into future stranded assets.

While the time of occurrence of such feedback may be hard to predict, the types of impacts are foreseeable. Still, acting against this negative sum game can be difficult, particularly if corrective actions are costly now while the gains are only harvested later.

Quick, automatic adjustments of Switzerland's resource consumption are unlikely, since much demand is determined by drivers with large inertia such as urban form, energy efficiency of the housing stock, transportation infrastructure and population size.

- v. **Exceeding many others' environmental performance alone does not make Switzerland safe.** Contrary to what is often assumed, Switzerland is not always environmentally best-in-class. See for instance comparison to 13 OECD benchmarking countries quoted in a report prepared by BakBasel and Global Footprint Network for the Swiss government.¹² Even if it were better than all the

Biocapacity: the ultimate resource

The **Ecological Footprint** is the biologically productive area needed to provide for everything people use: fruits and vegetables, fish, wood, fibers, and absorption of carbon dioxide, space for buildings and roads.

Biocapacity is the productive area that can regenerate what people demand from nature. As we phase out fossil fuel -- as anticipated in most imaginable scenarios -- biocapacity will not only have to feed us. It also will have to help us replace fossil fuel. Therefore, mapping an economy's material dependence on biocapacity provides an overarching view on an economy's material dependence.

www.footprintnetwork.org

reference countries,¹³ this would not automatically make Switzerland immune against resource risks. For instance, all those countries have resource demands that are far from being globally replicable.

- vi. **What really matters in the race for global biocapacity is relative GDP.** Assuming that resource security is pursued through market exchanges rather than military means, winning in this current competition for the world's limited biocapacity depends on maintaining or, better, increasing one's relative income. What matters is not what I earn in absolute, but compared to what everybody else can spend on the resources for which all compete. Even if the "globalized economy game" remains stable and the WTO acts as the benevolent steward of international trade,¹⁴ the global auction for the world's limited resources will get harder and harder.

Maintaining success in accessing the dwindling natural capital from abroad will become harder for economies whose relative income recedes compared to the rest of the world. This is already happening for most high-income countries vis-à-vis the emerging economies. The Swiss resident is now taking home a 30% smaller share of the global income than 25 years ago, and a 45% smaller share than 35 years ago. Therefore, Switzerland is caught in a bind: less and less relative income for Swiss economic agents as they are competing in the purchase of ever scarcer resources.

- vii. **Planning to win the relative income game forever is a fragile strategy.** Switzerland still may be able to outcompete all the other countries economically for many decades to come. But the odds of winning this bet are getting smaller, and the continuous ability to outperform all others is definitely not guaranteed over longer time periods.
- viii. **Exiting the current game, too, has significant risks and costs.** To not be exposed to this competition would mean to leave the global economy. But withdrawing from the global economy does not generate the necessary resources for the Swiss economy to operate, nor does it produce goodwill in the world — which Switzerland's trade relationships depend on. In other words, how can Switzerland keep engaging with the world while depending less on it?
- ix. **Nor can Switzerland rely on self-corrective mechanisms.** More specifically, market forces do not necessarily provide sufficient feedback to ensure robust economic outcomes. Four significant self-regulating market mechanisms are often invoked in the context of resource constraints: **price, technology, high income, and trade**. All four are substitution mechanisms. Higher prices will reduce and/or shift demands or spur innovation. Trade allows us to overcome local constraints. And indeed, some resource substitution is possible. For example, houses can be built with bricks, rocks or wood. Rather than eating fish, we can eat chicken or tofu. However, these mechanisms may not be strong and fast enough to self-regulate in view of the rapidly expanding global resources overshoot. Prices do not necessarily react adequately as shown in the carbon

dynamics. Amazing new technologies like photovoltaics are possible, but take time to scale. So all these self-correcting mechanisms may not act swiftly and forcefully enough. The possibility of significant market failures is important to consider, since the consequences of such an occurrence may be costly or risky. It would be a blind spot for Switzerland to see itself as immune to resource shocks. Switzerland may well be a special case – but is it truly too small, too rich, too singular and internationally too appreciated to ever fail?

Given the reality that Switzerland, like any economy, cannot easily escape its resource dependence, preparing oneself for the predictable future is a good investment. In view of the immovable resource trends, it is dangerous to rely solely on international trade as the endless resources provider. If trade relationships were to become less reliable, how would Switzerland be able to bridge the gap between its residents' resource consumption and its domestic resource availability?

Recognizing this dilemma **suggests that over the medium to long term domestic resource endowment become a significant driver of economic vitality and resilience.** This recognition encourages each city or country to employ strategies that can address risks emerging from resource deficits.

How can Switzerland succeed? How can it escape the resource trap? How can it avoid becoming hostage to its resource dependence?

What follows is our answer.

Switzerland can succeed, but it needs to choose success

We live in a new world in which human activities have become large compared to what Earth can renew. To succeed, our strategies need to adjust to these circumstances.

Five sequential steps explain how. They are true for Switzerland or any community that intends to succeed.

1) Commit to your success.

Succeeding starts with committing to your success. Such commitment requires the premise that escaping the current path is possible. Just performing less poorly than others in a world that is eroding its resource base is nothing short of playing "losing last". In contrast, we suggest playing for success.

Planning for success requires exploring: What do we have to do to enable a world that works? In an increasingly global world, this may well mean that a world that works is a world that works **for all**. The reason is obvious: If our solutions bake inevitable conflicts

into our world – for instance through overuse of some that excludes possibilities for others to thrive – such solutions are likely to backfire.

If indeed we commit to a world that works for all, and recognize that we are currently systematically eroding the resource base on which the human enterprise depends, then the lens for decision-making becomes: What do we need to support, invest in, or do so that a flourishing existence is available for all, within the physical means of our planet?

2) Focus on society's wealth, not its income.

Rather than focusing on income maximization, as measured by GDP, we need to pay attention to what allows us to generate income in the future. This latter ability is what economists call “wealth.” Society's wealth is the engine that allows us to be productive in the future. Therefore, building a world that works rather than liquidates its underlying assets requires a shift from maximizing income to maximizing society's wealth.

Since every economic activity builds on natural capital, there needs to be a particular focus on maintaining nature's wealth. This asset is necessary and complementary to any human-generated wealth. If we want higher income, we also need to make sure we have more nature in order to support these expanded activities. Currently we do the opposite. We liquidate and overuse nature in order to generate quick returns and higher current income. For example, paving over productive land, overharvesting fisheries, emitting CO₂ when burning fossil fuel, all generate short-term income while also reducing future income opportunities.

3) Measure what you treasure.

In a world of growing resource constraints and climate change, resource sovereignty is becoming an increasingly significant parameter of economic resilience. To manage our resource situation, we need to accurately track how resource secure we are. In other words, we need to measure to what extent we live within the means of what nature provides.

The Ecological Footprint¹⁵ is one biophysical accounting tool that is designed to provide that answer. Data makes it possible to set meaningful targets such as the optimal resource deficit for Switzerland.

4) Assess whether your policies and investments serve your goal.

This means that for every opportunity to spend public money (or invest private Swiss Francs), we need to assess whether it both increases our resource security while also generating financial benefit. Given limited budgets and the gap between where our Footprint is today and where we want it to be, it becomes possible to calculate how much progress we need to achieve with each Swiss Franc we spend. For every portion of our budgets that is already locked in and is not contributing to improving resource security, the pressure on the remaining part of the budget to boost resource security

becomes that much higher. (The box below shows how such assessments can be performed).

TOOLS FOR CHOOSING SUCCESS

Decision tools are needed to support government agencies and private investors in choosing the most effective policy and investment options. These are options that both increase our resource security while also generating financial benefits. These tools inform decision-makers on those two dimensions:

- 1) On the one hand, resource accounting such as Ecological Footprint or carbon accounting, is needed to assess to what extent policies, projects or programs reduce the resource dependence of an economy.
- 2) On the other hand, comprehensive cost-benefit assessments help evaluate the financial net benefits of those initiatives. More comprehensive financial accounting needs to incorporate two improvements. First, it needs to help make explicit the client's assumed future, since this is the context within which the investment will have to operate. Second, it needs to make sure all relevant costs and benefits are accounted for, including pollution clean-up (costs) or skill formation (benefit). We call such comprehensive cost-benefit assessments NPV PLUS.¹⁶

Sustainable investments need to meet both the resource and the fiscal criteria. In other words, building a successful future is not a choice between austerity or stimulus. Rather it is about making sure that each investment can yield a double benefit: Footprint reduction AND financial viability.

5) Think ahead: Speed and scale.

Acting for a resilient future cannot not merely be a “lifestyle choice.” Rather it is the essential driver in a strategy committed to success. Such a strategy requires a new mind-set: one with a systems-perspective. For instance, those aspects of our economic system that can only be modified slowly (such as infrastructure or demographic trends), and with time delay (think of the aging of key infrastructure such as power plants and dams), need the most attention early. The reason is that those aspects cannot be rectified at the last moment. Like super tankers, they need to be set on the right course earlier than agile small boats.

Four key factors drive a country's resource situation and therefore offer high-leverage intervention opportunities:

- **How we build and operate our cities.** The compactness and integrative zoning determines travel distances, energy efficiency of the housing stock defines

energy requirements, the way we build and equip our houses its materials demand. Good urban form can generate high quality of life on much less resource demand.

- **How we provide energy.** Is energy based on fossil fuel use, or solar power? Are we using the energy efficiently in our production and consumption processes? Cost-effective technology already exists today to decarbonize our energy system.
- **How we feed ourselves.** Food occupies a huge part of the productive areas of the planet. We can eat lower on the food chain and avoid food waste.
- **How many we are.** As we are more people on the planet there is less planet per person. Women empowerment through equal opportunity access as well as safe and affordable access to family planning lead to smaller and more prosperous families.

EXAMPLE: Energy: A bright future is possible

Today Switzerland can only produce a fraction of its energy through its own resources. Hydropower, currently Switzerland's largest renewable source, now provides 40% of Switzerland's electricity demand, or 9% of its total energy consumption. The rest, including all fuels with the exception of a few wood chips, comes from abroad. In addition, the Paris Climate Accord has made clear the need to fully exit fossil fuels by mid-century, if not earlier. Given that the future of transportation will most likely be electric, demand for power is bound to increase dramatically. Current energy policy is utterly unprepared to meet this challenge. What are the options? What should Switzerland do? At what speed and scale?

In his book "*Zwischen Ressourcenverknappung und Versorgungssicherheit: Zur Zukunft der schweizerischen Energieversorgung*" (2015), Prof. François Cellier documents the significant gap that exists between what a sustainable Switzerland needs and where our current energy plans fall. Prof. Gunzinger complements the book by showing that a renewable energy strategy for Switzerland is not only technically possible but offers Switzerland as a whole a clear net economic benefit. None of these approaches build on nuclear power, considered by both to be too expensive of an option.

Rechsteiner and Swiss Cleantech confirm the perspective. *2000 Watt Society* in Switzerland has been a practical pioneer building the foundation of such a transformation.¹⁷

Will Switzerland embrace this possibility? What is the benefit of clinging to business as usual?

EXAMPLE: Food for thought

Context:

1. By 2050, the world population is projected to reach 9 to 10 billion¹⁸.
 2. Switzerland already procures half of its food outside of its borders.
 3. The Paris Agreement requires a shift in agricultural practice, not only to reduce non-carbon greenhouse gas emissions, but also to wean agriculture off fossil-fuel inputs. At the same time, higher temperatures may challenge agricultural yields.
- If we subscribe to this context, how do we suppose Switzerland will be able to feed itself (and be carbon neutral)? What does this mean for us right now?
 - How do we need to rethink our food system?
 - What should be our goals, also considering that, as concluded by many forecasts, 10 million people will be living in Switzerland by 2050?
 - Does Switzerland have to think more proactively about its food security, or will its financial resources always allow it to procure its food elsewhere?
 - Would that mean that Switzerland just buys food away from others, or will this money help stimulate additional production, becoming a win-win for everybody?
 - Do our strategies hold when tested against the need to produce, harvest, store, and distribute agricultural products without the use of fossil fuel?

Why it is risky to stick with old options

We live in a new world that requires fresh perspectives. Still, we can learn from and pick the best elements from past proposals designed to position Switzerland for continued success. Six archetypical responses reflect the essence of how different ideologies and perspectives have proposed to respond to the resource challenge and to make Switzerland resource secure.

Conventional Strategy	Limitations
<p>“Retreat from the world,” and reduce global integration as much as possible (even if it reduces standards of living) to avoid the negative impact of cutthroat competition over resources. Increasing numbers of political platforms around the world, from left to right, advocate for increasing trade barriers to reducing their country’s global integration.</p>	<p>Isolation could be limiting and risky. Also it is difficult to escape global markets easily or support a vibrant economy without some trade. Trade enables production specialization and input diversification. Also, Switzerland is currently highly dependent on resources from abroad (its demand is fourfold of what its own ecosystems can produce). Further, such withdrawal might not stop the global resource dynamic or climate change, nor protect Switzerland against forthcoming negative impact. Withdrawing could be very costly and weaken Switzerland in the process.</p>
<p>“Forge privileged resource relationships.” One way of securing Switzerland’s supply may be to develop long-term bilateral resource contracts with biocapacity-rich nations. Enabling this would require significant additional intervention by the government (since hitherto most resources are traded privately and not via government-sponsored channels).</p>	<p>This strategy could be seen as a danger from the neutrality tenet. This strategy will only work if: a) potential partner countries respond to Switzerland’s special interest, contracts can be maintained without political vassalage and inconsistency with other international obligations, and only if transport lines are secure, and if b) the ensuing special relationship with the supplier country is found acceptable by the Swiss people. Negotiating such long-term contracts may be politically challenging, including on the domestic front, and would require significant government intervention and investments. Is Switzerland ready for it?</p>
<p>“Embrace hyper-growth,” and accelerate your economic output in order to keep up with, or even outdo, emerging economies. To succeed in the resource competition requires increasing the relative income of the Swiss for as long as possible.</p>	<p>Accelerating Switzerland’s economic expansion for and keeping up with emerging countries over the long-haul, may prove difficult. Already today Switzerland maintains a strong competitive advantage through unique strategies that may not be easily replicated elsewhere. Still current growth rates are far lower than those in emerging markets. It may not be realistic to expect new strategies that can boost Switzerland’s GDP faster than that of emerging economies. Also, if these strategies required more resources in order to succeed, the gains in economic advantages would have to increase even faster.</p>
<p>“Hedge your bets,” keep maximizing the global integration benefits through a strong Swiss brand¹⁹ as long as it lasts, and set up a sovereign fund as an insurance. A sovereign fund (capitalizing on the current economic advantages) needs to be large enough to allow Switzerland to reengineer its economy when it</p>	<p>There is still uncertainties and risk involved with this approach since adjusting later may be cheaper (due to improved technology) or costlier (reengineering infrastructure takes time and reacts inadequately to politically volatile resource contexts). Even more importantly, is there enough political will to divert</p>

<p>becomes necessary. It gives Switzerland the means to react once required.</p>	<p>significant income streams of today into a sovereign fund to be spent collectively and later?</p>
<p>“Accelerate adoption of extreme resource-efficiency right now.” In other words, employ the most efficient technologies available in order to reduce Switzerland’s dependence on foreign resources. It may also ensure a soft landing out of today’s globalized economy, should it no longer be able to provide. It is a move from “more butter, less guns,” using the economic text-book metaphor of economist Paul Samuelson,²⁰ to “less butter, more post-oil infrastructure.” It includes proposals like the “sustainable intensification” of agriculture that aims at increasing production while reducing the burden of farming on the environment.</p>	<p>Intensification comes at a price, and more careful use of resources will typically take more effort as well. The underlying dilemma is that the increase in resource efficiency could require more labour, thereby reducing labour productivity (and wages). No good answers to this conundrum have been worked out yet: much of the labour productivity increase has historically been gained through cheap resources and energy. Without such pre-condition could high wages be sustained? A variance of this strategy may be to also invest heavily in the resource efficiency of value chains leading to Switzerland. But this could increase the competitiveness of other countries vis-à-vis Switzerland.</p>
<p>“Encourage consumers to embrace and adopt sufficiency”. Wellbeing can be achieved using fewer resources. In fact, much happiness research shows that the most lasting factors for happiness, once basic needs are met, can be achieved with little resource input. Certainly, Switzerland has the opportunity to reduce some of its resource demand while maintaining its population’s sense of wellbeing.</p>	<p>Measurably reduce consumption through re-education is possible. But results may not last, and may not be of the magnitude required. Some behaviour change is possible: For example, Californians recently reduced their domestic water consumption by 24% compared to the prior year. The reduction was achieved in response to a four-year drought, one of the worst in the state’s history. Substantive, lasting overall Footprint reductions through mere behaviour change are rare. They need fresh contexts to last: for instance, when people move to new urban settings they can learn new habits that offer great lives while also encouraging sustainable consumption options, if new habits are set during their first three weeks.</p>

Each of the options described above has potential, but none of them is a magical solution for the conundrum. This is the gap this proposal attempts to bridge: by directing every new investment or policy decisions towards both Ecological Footprint reduction and value generation.

Closing Note

Keeping Switzerland successful in a world of resource constraints and climate change requires fresh approaches. It is not a request for higher investments or new money. Rather, we argue that even without extra spending, this transformation is as financially feasible as it is necessary. But it does require current budgets to be allocated differently. In order to gain momentum towards this new approach, it will be necessary to prioritize opportunities and generate early wins that demonstrate their performance on both accounts: resource security and financial return. Success is possible. Let’s abandon “losing last”. Let’s play “thriving lives for all, within the budget of nature.”

Now the ball is in your court: **Given your love for Switzerland, how complete should Switzerland's resource sovereignty be? How do you want to get there?**

ENDNOTES

¹ Over the last century, the Swiss economy has been a strong performer. Despite the country's natural resource limitations (water, hydropower and some agriculture notwithstanding) Switzerland has built a powerful and robust economic engine that is tightly integrated into the global economy. Through these trade relationships, Swiss businesses have been able to secure all the resources they needed. They could afford it thanks to their competitive advantage built on specialization, brand-management, a highly skilled labour force and innovation.

² For more information on climate, visit <http://www.ipcc.ch/report/ar5>. In essence, this synthesis report points out that if CO₂ equivalent concentrations were stabilized at 450, 550, and 650 ppm, mean projected warming over pre-industrial levels would be 2.0, 2.9, and 3.6°C, respectively, once the climate system reaches equilibrium. Reaching an equilibrium takes several decades due to gradual heat diffusion in the oceans.

³ For more information on natural resource demand from a Footprint perspective, visit www.footprintnetwork.org. Other resource data sets are available from the World Resources Institute at www.wri.org/resources/data.

⁴ When alluding to resource constraints, or the need for resource security, Global Footprint Network takes the perspective that ultimately the most limiting material factor for life, including human life is nature's ability to renew. In Global Footprint Network terminology, this ultimate resource is called biocapacity. For instance, even the amount of fossil fuel on this planet is not most limiting, because what we lack is enough capacity to absorb the CO₂ emissions, not the amount underground. Resource sovereignty therefore is a state in which an economy has sufficient access and control over the biocapacity it requires to operate.

⁵ Switzerland's commitment is available at <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Switzerland/1/15%2002%2027%20INDC%20Contribution%20of%20Switzerland.pdf>. Data on Switzerland's emissions, reported by UNFCCC are available here: https://unfccc.int/files/ghg_emissions_data/application/pdf/che_ghg_profile.pdf. The independent assessment by Climate Action Tracker rates the Swiss performance as "medium" – stating that "With currently implemented policies and measures, Switzerland will neither be able to meet its pledge nor its INDC." <http://climateactiontracker.org/countries/developed/switzerland.html>.

⁶ As fossil fuel is becoming less of an option, the economy will have to rely increasingly on renewable resources. Minerals and metals will be less of an immediate concern as deeper mines will give access to those resources, but this comes at the cost of using more energy, which without fossil fuel is mainly limited by renewable potential. Renewable resources are direct sunlight, as well as indirect sunlight, i.e., biological resources (or biocapacity) and wind/water energy.

⁷ Mathis Wackernagel und Bert Beyers 2016. „Footprint: Die Welt neu vermessen.“ (in German): <http://www3.europaeische-verlagsanstalt.de/content/footprint-die-welt-neu-vermessen-neuausgabe-2016-mit-aktuellen-zahlen-und-kommentaren/mathis> or visit www.footprintnetwork.org

⁸ See Rockström, J., Steffen, W., Noone, K., Reresson, A., Chappin, F. S. I., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., De Wit, C. A., Hughes, T., Van Der Leeuw, S., Rodhe, H., Sornlin, S., Snyder, P., Constanza, R., Svedin, U., Falkenmark, M., Karberg, L., Corell, R. W., Fabry, V. J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P. & Foley, J. 2009. Planetary boundaries: exploring the

safe operating space for humanity. *Ecology and Society*, 14; An updated version is available at Steffen, W.; Richardson, K.; Rockstrom, J.; Cornell, S. E.; Fetzer, I.; Bennett, E. M.; Biggs, R.; Carpenter, S. R.; de Vries, W.; de Wit, C. A.; Folke, C.; Gerten, D.; Heinke, J.; Mace, G. M.; Persson, L. M.; Ramanathan, V.; Reyers, B.; Sorlin, S. (2015). "Planetary boundaries: Guiding human development on a changing planet". *Science* 347 (6223). doi:10.1126/science.1259855

⁹ A tragedy of the commons is a situation in which benefits are concentrated and costs are diffused. For example, fishing in a public pond, the more I fish, the more fish I get. But there is less for the others, and it may eventually erode the entire fish stock to the detriment of all. Similarly, CO₂ emissions are a tragedy of the commons because, as the emitter gets the benefit of fossil fuel use. But the costs of climate change are put on all of humanity.

¹⁰ For example: coal plants.

¹¹ For example: motorway infrastructure such as additional alpine tunnels for cars.

¹² For more information see:

<http://www.aren.admin.ch/dienstleistungen/04135/05243/index.html?lang=de> (It includes a longer report, in English, French and German, Global Footprint Network and BakBasel produced for the Swiss ministries).

¹³ Austria, Belgium, Chile, Czech Republic, Denmark, Germany, Ireland, Italy, Netherland, Norway, Sweden, UK, USA.

¹⁴ In view of the immovable resource trends, it could become more problematic to rely solely on international trade as the "endless" resources provider. If competition for resource access stiffens or trade relationships become less reliable, how will Switzerland be able to bridge the gap between the residents' resource consumption and the domestic resource availability? Would recognizing this dilemma require us to recognize domestic resource endowment as a driver of economic vitality and resilience? Does it encourage each investor, whether private or public, to employ strategies that can address risks emerging from biocapacity deficits?

¹⁵ The Ecological Footprint (or Footprint) adds up all human demands on nature that compete for biologically productive space: providing biological resources, accommodating urban infrastructure or absorbing excess carbon from fossil fuel burning. The Footprint is compared with all the available biologically productive space (biocapacity). Both can be calculated at the global, national, local and personal levels. To make them comparable, they are expressed in a standardized unit: global hectares – biologically productive hectares with world average productivity in a given year.

¹⁶ See www.footprintnetwork.org/npvPLUS for more details.

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- 1) Anton Gunzinger „Kraftwerk Schweiz“ 2015.
[http://www.zyztglogge.ch/index.php?id=45&tx_gishop_pi1\[puid\]=931](http://www.zyztglogge.ch/index.php?id=45&tx_gishop_pi1[puid]=931). And www.kraftwerkschweiz.ch
 - 2) Rudolf Rechsteiner „100 Prozent erneuerbar“ oder „Grün gewinnt“(also):
<http://www.rechsteiner-basel.ch/>
 - 3) François Cellier 2015 “Zwischen Ressourcenverknappung und Versorgungssicherheit: Zur Zukunft der schweizerischen Energieversorgung”
<http://www.oekom.de/nc/buecher/gesamtprogramm/buch/zwischen-ressourcenverknappung-und-versorgungssicherheit.html>.
 - 4) Swiss Cleantech’s Energiestrategie
<http://www.swisscleantech.ch/fileadmin/content/PDF/Publikationen/swisscleantech-Cleantech-Energiestrategie-4.0.pdf>

¹⁸ <http://www.un.org/en/development/desa/news/population/2015-report.html>

¹⁹ Currently, a large portion of the value-added of a supply chain goes to the brand-holder of the final product. This underlines the significance of maintaining a strong brand. But it is not clear whether brand-advantages can be maintained over the long-run.

²⁰ “At least since Paul Samuelson first published his famous, standard-setting textbook in 1948, it has been popular to label the two goods in question “Guns” and “Butter.” This dichotomy, which probably has its origins in political discussions about the costs of military build-ups prior to the First World War, captures the very real trade-off societies typically face in the allocation of resources between national defense and private consumption goods. This same basic trade-off applies to all goods and services produced by the government.” Al Broaddus, President, Federal Reserve Bank of Richmond, https://www.richmondfed.org/~media/richmondfedorg/publications/research/region_focus/2003/su_mmer/pdf/noteworthy.pdf