

Which future renewable energy scenarios - local self-sufficiency, regional grid-like networks or centralized big plants with mega grid-like networks – are sustainable?
The Goettingen approach of sustainability science.

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Three scenarios

Six sustainability principles at IZNE

Characteristics of sustainability science

The Göttingen approach of sustainability science,

Role of science in societal transformations

Results of the Göttingen group

Comparison of the three scenarios

SCENARIO 1. Local-self sufficiency (Lokal autark):

- primary locally oriented, decentral use of RE installations,
- Maximal utilization of locally available RE sources
- Local accumulators for heat and electricity
- no connections between micronets, no import of electricity

Example Feldheim, 300 Inhabitants

- 100% self sufficiency ren. electricity and heat
- Use of 43 wind generators, photovoltaics, and a biogas plant to produce electricity and heat
- Heat distribution via a heat net connecting all houses
- Electricity distribution via a own electricity network



SCENARIO 2. Interconnected regional grid-like networks (Regionenverbund):

- primary locally oriented use of small to medium RE installations
- All regions rely mainly on their own available RE sources
- micronets interconnecting regions within a country
- Only few imports from neighbour countries

Example: Region Goslar is planning:



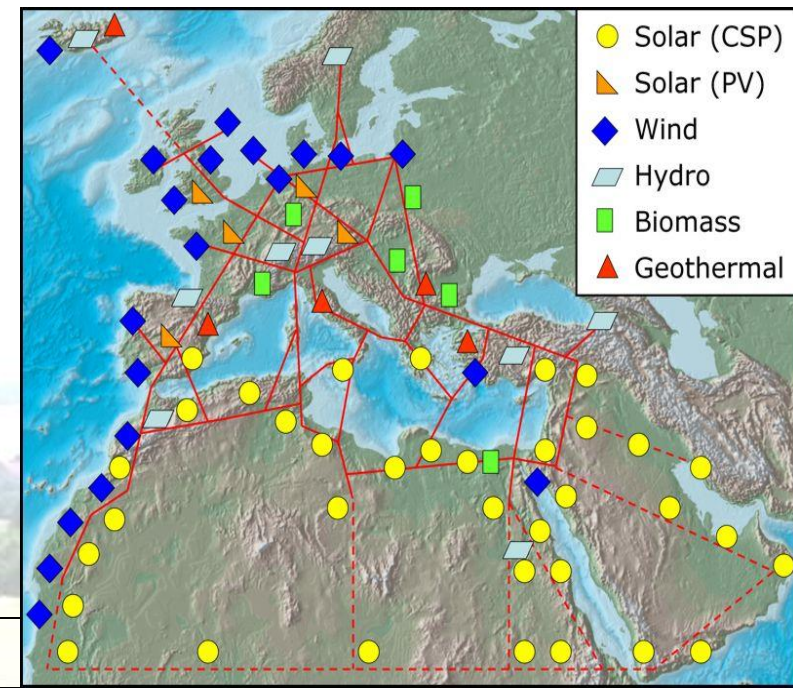
- Communal electricity grids (bought back from centralized energy trusts) in the communities
- RE villages like Immenrode (Wind generators, bioenergy)
- Community biomass heating plants like in Hahnenklee
- Storage of abundant electricity in underground pump storage stations in former mines

SCENARIO 3. Centralized big plants with mega grid-like networks (International-Großtechnik):

- primary big RE installations
- international and intercontinental transport of energy via meganets
- storage of fluctuating RE in huge storages

Examples:

- Desertec
- Seatec
- Huge pump storages for electricity in Norway



Our 6 sustainability principles

Are based on actual scientific analyses of the state of the world (i.e. the IPCC reports)

Which lead us to formulate value preferences which are in line with national and international political documents (UNO: Agenda 21, constitutions of some countries) as well as NGO intentions (i.e. earthcharter)

Are attempts to make the general principles of intra- and intergenerational justice more precise



The “respect principle” (Achtungsprinzip):

assigns all forms of life the same right to live (Albert Schweitzer, 1991, Martin Gorke, 1999).

Respecting dignity and integrity of all living beings

- reflect cultivation of energy plants with regard to principles of nature conservation



The “precautionary principle” (Vorsichtsprinzip):

is aimed at avoiding irreversible human caused changes in our biospheric balance (climate change, species extinction)

Komiyama and Takeuchi 2006, p.5 “The primary objective is ... to achieve, as soon as possible, substantial improvements in ... the interaction between the sciences and decision-making, using the precautionary approach, where appropriate, to change the existing patterns of production and consumption and to gain time for reducing uncertainty with respect to the selection of policy options.”

- no use of genetically manipulated plants
- reflexion of consequences of industrialized monokultur, if the principle is violated search for alternatives

The consistency principle (Konsistenz-/Kreislaufprinzip):

directed at replacing the use of finite resources (as actual main base of our economy) by renewable resources without any waste products, being in line with naturally occurring biospheric cycles.

- in the bioenergy field cascade use of plants, consequently closed loops
- reflect whether imported food or synthetic fertilizer or pesticides violate this principle
- if so search for alternatives



The sufficiency-/ justice principle (Gerechtigkeits-/Suffizienzprinzip):

Just distribution of resources within and between countries

That requires life styles in industry countries which reduce material consumption and rely instead more on nonmaterial potentials for a life fulfilled with sense (creativity, art, social connectedness)

- Ein Bioenergiedorf, bei dem Ressourcen aus dem direkten Umfeld energetisch genutzt werden und in dem Menschen gern und stolz leben und anfangen, gemeinsam ihre Häuser zu dämmen, weil sie den Silageberg am Ortsrand reduzieren wollen, die ihre Erfolge feiern, entspricht diesem Kriterium stärker als eine Ortschaft mit Bioenergie-Großanlage mit längeren Zulieferwegen, Export der Wertschöpfung, hohem Energieverbrauch und einer indifferenten, unbeteiligten lokalen Bevölkerung.

The “efficiency principle” (Effizienzprinzip):

directed at avoiding the wasting of limited resources.

Highest possible degrees of efficiency (because RE sources are also limited!!!)

- Reflect energetic costs of constructing RE installations and of transport of RE
- Long transports of electricity (super grids) may violate this principle



The “principle of participation” (Partizipationsprinzip):

is ensuring the broad public population to take part in searching for, evaluating and implementing sustainable ways of life.

Brings together stakeholders and concerned persons to reflect chances and concerns to find fair and cooperative solutions

Corresponding sites Agenda 21 (UNO 1992):

- chapter 35.6 “The primary objective is ... to achieve, as soon as possible, substantial improvements in ... participation of people in setting priorities and in decision-making relating to sustainable development”
- chapter 36.9 “The objective is to promote broad public awareness as an essential part of a global education effort to strengthen attitudes, values and actions which are compatible with sustainable development. It is important to stress the principle of devolving authority, accountability and resources to the most appropriate level with preference given to local responsibility and control over awareness-building activities”
- chapter 14.22 “Governments at the appropriate level, with the support of the relevant ... regional organizations, should ... launch applied research on participatory methodologies, management strategies and local organizations” ().
- chapter 31.1 “The public should be assisted in communicating their sentiments to the scientific and technological community concerning how science and technology might be better managed to affect their lives in a beneficial way” (UNO 1992,).

Sustainability Science

the advocates of sustainability science see a greater chance for science to contribute substantially to solving the global problems of today, if science

- (1) acts explicitly to support sustainable development,
- (2) takes an interdisciplinary approach,
- (3) is transdisciplinary and works in synthetic and parallel ways combining research and application in action-oriented research, during which scientists initiate sustainability changes in a society and simultaneously perform research.

Sustainability Science

(1) acts explicitly to support sustainable development

UNO 1992, chapter 35: “The sciences should play an increasing role in ... finding new development practices, resources, and alternatives. ... Thus, the sciences are increasingly being understood as an essential component in the search for feasible pathways towards sustainable development.”

Kates, Clark et al. (2001, p. 642) Clark and Dickson (2003, p. 8059)
Komiya and Takeuchi (2006, p.3): similar calls



consensus within the scientific community is growing that science should direct its efforts explicitly to support sustainable development **NEW ROLE FOR SCIENTISTS!**

Sustainability Science

(2) takes an interdisciplinary approach

UNO 1992, chapter 35.9: “The scientific and technological means include ...supporting new scientific research programmes, including their socio-economic and human aspects, at the community, national, subregional, regional and global levels, to complement and encourage synergies between traditional and conventional scientific knowledge and practices and strengthening interdisciplinary research related to environmental degradation and rehabilitation”



Sustainability Science

(3) is transdisciplinary and works in synthetic and parallel ways combining research and application in **action-oriented research**, during which scientists initiate sustainability changes in a society and simultaneously perform research

Kates et al. (2001, p. 641): “In a world put at risk by the unintended consequences of scientific progress, participatory procedures involving scientists, stakeholders, advocates, active citizens, and users of knowledge are critically needed”

UNO 1992, chapter 31: “The cooperative relationship existing between the scientific and technological community and the general public should be extended and deepened into a full partnership”

The Göttingen Approach of Sustainability Science

How we integrated the defining characteristics of sustainable development and sustainability science into our approach?

- It consists from seven elements comprising the specific tasks the scientists have to fulfill during the whole research cycle.
- The approach presupposes a group of scientists willing to cooperate and sharing an intrinsic sustainability motivation.
- The first task is being defined as the traditional scientists' role (traditional research producing scientific knowledge, **role A**).
- The other six tasks are different practical problem solving activities (application of scientific knowledge in inter- and transdisciplinary teams, **role B**) taking place consecutively:



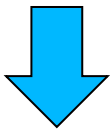
Role A

RESEARCH

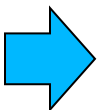
Role B – Contribution to solve global problems

Select a global critical problem

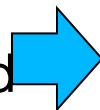
Transfer of the solution toward the global level



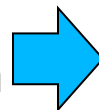
Create an alternative solution



Search for political and financ. support



search for partners in practice



perform a local demonstration model



Seven elements of the Göttingen approach of sustainability science

Results: 2000-2005: Bioenergy Village Jühnde



History of Bioenergy villages in Germany

- | | |
|-------------|--|
| 1998 | A first pilot project was planned by our team |
| 2000-2001 | Motivation of people in the village JÜHNDE |
| 2002 - 2003 | Planning and engineering period |
| 2004 – 2005 | Construction of the fermentation plants, the central heating plant, and the heating grid |
| 2005 | Production of heat & electricity with biomass |
| Since 2006 | Establishment of further 50 bioenergy villages |

Transfer results:

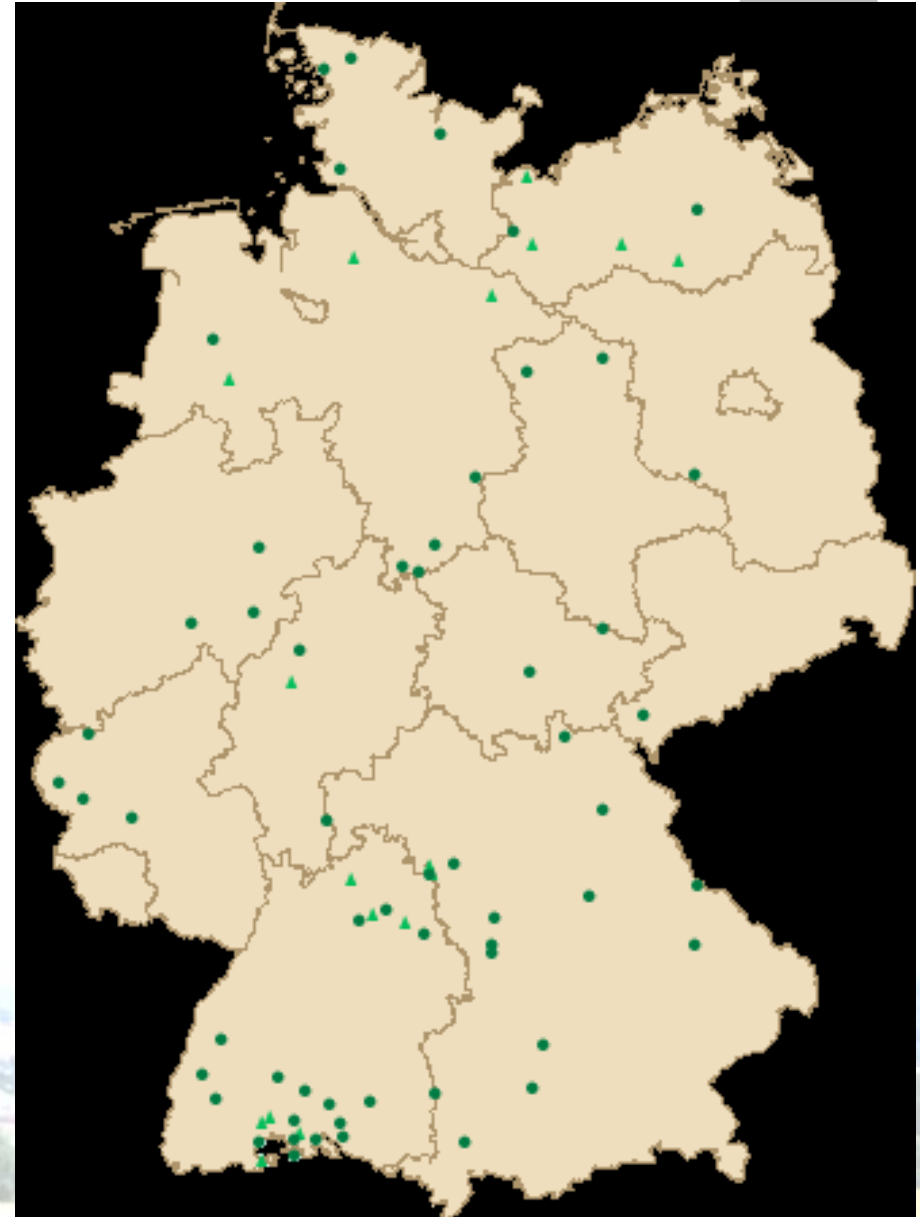
Many villages in Germany are on the way to bioenergy villages

**Examples for
Bioenergy villages
in Germany**

**Appr. 25 in planning
process**

Appr. 50 finished

www.unendlich-viel-energie.de



International Transfer: Invitations from other countries to present the idea



Comparison of the three scenarios

Prinzipien NH

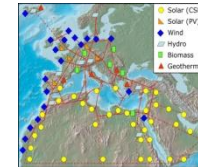
Local self-sufficiency
Feldheim



Interconnected regional networks
Region Goslar



Centralized big plants
Desertec



Respect
Precaution
Consistency
Sufficiency
Efficiency
Participation

++

++

?

- ++ Scenario and principle compatible
- + Scenario and principle partially compatible
- ? Scenario and principle difficult to bring in line
- Scenario and principle not compatible

Are centralized big RE plants requiring high-voltage transmission lines (scenario 3) compatible with the participation principle?

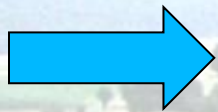
Schweizer-Ries, Zöllner, Rau, 2010:

450 Questionnaires and 12 interviews in Germany

Acceptance of such lines if RE electricity is transported

BUT

Majority of subjects favours such lines only AFTER local RE resources are exhausted



Majority of people seems to prefer decentralized RE solutions

Are centralized big RE plants requiring high-voltage transmission lines (scenario 3) compatible with the participation principle?

Internet search for „citizens’ initiatives against hv transmission lines“ reveals 185 000 findings in the net (spring 2011)

bürgerinitiative freileitung - Google-Suche - Mozilla Firefox

Ungefähr 184.000 Ergebnisse (0,16 Sekunden)

Vorsicht: Freileitung! - Startseite [Suche](#)

Bürgerinitiative im Großraum Northeim für eine verpflichtende Erdverkabelung für ... (die von E.ON geplante Freileitung Wahle-Mecklar)
[www.vorsicht-freileitung.de/](#) - Im Cache - Ähnliche Seiten

BI Keine 380 kV-Freileitung im Werra-Meißner [Suche](#)

Bürgerinitiative - Keine 380kV Freileitung im Werra-Meißner Kreis.
[www.keine-380-kv-freileitung-werra-meissner.de/](#) - Im Cache

Bürgerinitiative (BI) „Keine 380-kV-Freileitung im Werra-Meißner ...“ [Suche](#)

Dateiformat: PDF/Adobe Acrobat - Schnellansicht
 Bürgerinitiative (BI) „Keine 380-kV-Freileitung im Werra-Meißner-Kreis“ e.V. ...
[www.keine-380-kv-freileitung-werra-meissner.de/.../5_89a3ed2874ebc63997e1570f5574871a.html](#)

[+ Weitere Ergebnisse von keine-380-kv-freileitung-werra-meissner.de](#)

Bürgerinitiative: Keine Freileitung Neuenhagen-Letschin - ::Gruppe ... [Suche](#)

März 2011 fand die öffentliche Sitzung der Bürgerinitiative Keine Freileitung Neuenhagen-Letschin statt. Interessierte Bürger und Politiker konnten sich bei ...
[gruppe-weimar.de/Freileitung/](#) - Im Cache - Ähnliche Seiten

Bürgerinitiative will Erdkabel statt Freileitung - Freie Presse [Suche](#)

28. Febr. 2011 ... Theuma/Bergen. Die für Donnerstagabend vom Energieversorger Envia in Theuma anberaumte zweite Informationsveranstaltung zur neuen ...
[www.freiepresse.de/.../Buergerinitiative-will-Erdkabel-statt-Freileitung-artikel7602107.php](#)

Bürgerinitiative gegen 110-kV-Freileitung - Nachrichten aus ... [Suche](#)

25. März 2011 ... Als im März 2010 das Raumordnungsverfahren wegen einer von E.ON eides geplanten Hochspannungsleitung eröffnet wurde, schlossen sich Bürger ...
[www.blickpunkt-brandenburg.de/straussberg/nachrichten/?... - Im Cache](#)

Grundsätze - Bürgerinitiative (BI) „Keine 380-kV-Freileitung“ [Suche](#)

8. Juli 2010 ... Juli 2010 um 14:22 Uhr BI Keine 380kV Freileitung. E-Mail · Drucken · PDF. Die BI begrüßt die regenerative Energiegewinnung; ...
[www.keine-380kv-freileitung-schwalm-eder.de/index.php?...buergerinitiative](#)



Bürger unter Strom
 Eine Aktion der Bürgerinitiative
 Keine Freileitung Neuenhagen-Letschin

Are centralized big RE plants requiring high-voltage transmission lines (scenario 3) compatible with the participation principle?

Scenario 3 projects seem to be not or only with excessive costs to be implemented.

Example: A 75 km high-voltage transmission line between Aragon (FRANCE) and Baixas (SPAIN) caused a 30 year long conflict with the local population, now is is planned to be finished until 2014. Prognosticised costs: 800 Mio Euro, because only underground installation has been a compromise.



Role of scientists:

- To reflect about sustainability assessments of RE scenarios BEFORE strategic decisions (i.e. regarding necessity of hv transmission lines) are finished
- To initiate and support such projects and scenarios which are compatible with sustainability criteria
- Chance für uns als Wissenschaftler: Beim Ausbau der EE bereits heute bei der Weichenstellung für künftige Entwicklungen mitreden, auf Chancen und Gefahren verweisen, positive Modelle schaffen.

Weiterentwicklung von Modellen der direkten Beteiligung der Bürger an Investitionen und Betrieb (Beispiel Bürgerwindparks)

- Finanzielle und personelle Unterstützung regionaler Moderationsprozesse

Thanks for the attention.

More information:

www.umweltdaten.de/publikationen/fpdf-l/3997.pdf

www.izne.uni-goettingen.de

www.wege-zum-bioenergiedorf.de

www.peterschmuck.de

I can send you chapters from:

Schmuck, P. & Schultz, W. (Eds.), (2002). *Psychology of sustainable development*. Boston: Kluwer Academic Publishers.

Schmuck, P. & Sheldon, K. (Eds.) (2001). *Life goals and well-being. Towards a positive psychology of human striving*. Seattle: Hogrefe & Huber.