PBL Netherlands Environmental Assessment Agency

TIAS Report Series

Building Bridges from the Present to Desired Futures

Evaluating Approaches for Visioning and Backcasting

Based on a workshop held at

Central European University, Budapest, Hungary

21-22 March, 2011

No 1

Edited by: Caroline van Bers, Jan Bakkes and Leen Hordijk

December 2016

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Introduction

This report is the outcome of the workshop, Building Bridges from the Present to Desired Futures: Evaluating Approaches for Visioning and Backcasting which was a part of a study coordinated by The Integrated Assessment Society (TIAS) in 2011. The study compared scenario exercises that have or are using backcasting and the workshop formed an important cornerstone in validating the results of the research conducted, and to learn more from those experts who have used backcasting extensively in their projects to foster sustainable development. Specifically, the focus was on the effectiveness of various approaches – what works and what does not – with regard to specific sectors such as energy systems, land use change and food security.

The point of departure for the workshop was a short review of backcasting efforts in various domains. Participants of the workshop were asked to critically reflect upon the term backcasting, to identify the various dimensions that backcasting studies aim to cover. These critical reflections are conducive to developing a coherent understanding of the various theoretical foundations and methodological purposiveness of backcasting approaches that have been applied. In addition to examining backcasting efforts with regard to methods applied, an adequate comparison also entails a qualitative assessment of the process itself. Moreover, it is important to evaluate stakeholder participation throughout the lifespan of a backcasting study because this determines the extent to which learning processes take place in the various contexts. This paper presents the experiences with and perceptions of backcasting of those experts who participated in the workshop.

The participants were provided with a set of guiding questions which provide the structure for their contributions in this report:

- What is/was the focus and theme of your backcasting study/project(s)?
- Who are the target groups of the study/project?
- What has worked particularly well in this backcasting process and what were the enabling conditions?
- What significant challenge have you faced in the process?

Despite a growing interest in backcasting and the contexts in which it has been applied, a universal backcasting framework is still lacking. One of the main goals of the workshop was therefore to commonly build a conceptual framework for backcasting and its usage contributing to a strong basis for further research.

The discussions that took place in working groups and in the plenary of the workshop were documented by the graduate students who participated in the workshop, and have been used to further the work of TIAS and PBL Netherlands Environmental Assessment Agency in this area. The themes covered were disparate and a synthesized summary in the form of outcomes proved challenging and was therefore not attempted.

Defining the Terms

Although visioning and backcasting have been the focus of the study and the workshop, various other important concepts and processes are common to, or provide the context for this domain. Definitions for these terms have been formulated by the experts at the workshop. A range of concepts and approaches of backcasting and are used by the contributors to this paper. The authors are aware that there may be other perspectives on these terms depending on the purpose and context of their use.

Visioning: A vision is an attractive and idealised description of a desired future state that is historically or contextually better. Visions are value-based that emerge from creative thinking and

social learning processes in order to transcend historical or existing contingencies. On the one hand, visions should articulate the ambition to transcend these contingencies by contrasting the past and present with the future. This allows visions to mobilise the resources and the stakeholders required to realise the envisioned change. On the other hand, visions derive their strength from those parts that can be made explicit, be communicated to and shared with other stakeholders. This would support reaching consensus on a future what could labelled as desirable, which makes it an important element of backcasting exercises. As it will be presented in the next chapter, backcasting is a useful approach to envision plausible and desirable pathways that may lead to the envisioned future.

Planning: Planning occurs over shorter time frames and depicts a more specific and clearer future state. In contrast to visioning, planning sets out a series of actions necessary for implementation. Thus, while backcasting and planning are related in that both deal with the future, they 'feel' quite different. Planning connects the dots (all of them) while backcasting is about vision, ambition and a few strategic junctions. Backcasting would certainly not provide a basis for budgeting resources or allocating responsibilities, as planning would.

Backcasting: The essence of backcasting is to build bridges from the present to a desirable future in a retrospective manner, while identifying the intermediate steps that lead to that future. Backcasting emphasizes both the articulation of a societal and environmental vision, and the identification and analyses of pathways to this vision. It aims to connect a vision for the future to present-day decision making, putting the finger on key choices that have to be made now and in the near future. In addition, backcasting can be a powerful tool in the interaction with stakeholders as well – again, to connect vision with concrete near-term priorities for action and responsibilities. The problems that backcasting has to address are characterised by complex, interrelated environmental, economic and social challenges, that call for a holistic vision involving a whole-systems change.

Forecasting: Forecasts present most likely futures, based on assumed drivers for change. They feature a limited range of variation and are based on a given set of drivers. Because of their projective nature, forecasts rely on historical data in combination with conjectures of future development. An advantage of forecasting methods and at the same time their drawback is that they tend to treat the future as a form of continuation of the past. This can be an advantage to a study, for example in identifying long-lived impact of present decisions; or comparing early-action and late-action strategies; or exposing overly optimistic expectations of technology development. Conversely, taking the past as a guide to the future means a drawback as it hides the inherent uncertainty of the future, especially with regard to disruptive changes.

Scenarios: In the literature, two main types of scenarios can be found: normative or exploratory. The common denominator is that they serve the aim of making assumptions about future developments. They stand for the exploration of possible development paths and their future consequences. Scenarios aim to inform policy makers about possible future developments and about the particular actions that may influence these developments in a desired direction.

Participatory approaches: Participatory approaches are based on the involvement of a variety of stakeholders other than the scientific community with the aim of a collective development of desirable future scenarios and their implementation.

Business as usual: Many traditional future studies include a reference scenario or related projections, for example trend extrapolation, baseline, conventional development, no-new policies variant or business as usual. These projections are meant to serve, as the name says, as a reference. They are useful to unveil critical points and failures in the system, illustrating the necessity to generate a change; or, to estimate the comparative contribution of specific policy strategies. A surprising drawback, encountered by participants to the workshop, is that business-as-usual seems too appealing. For stakeholders and decision makers who prioritize complexity reduction, or simplicity, business as usual might look like an attractive option and therefore stimulate the perpetuation of a range of ill-considered decisions.

Scenarios, forecasting and backcasting are useful and complementary in varying contexts and ways. Scenarios for instance are well-suited to study likely projections of future developments under different contextual conditions. Forecasting projects the most likely futures based on available data and knowledge, while through backcasting the path towards the most desirable future can be explored (see Figure 1).

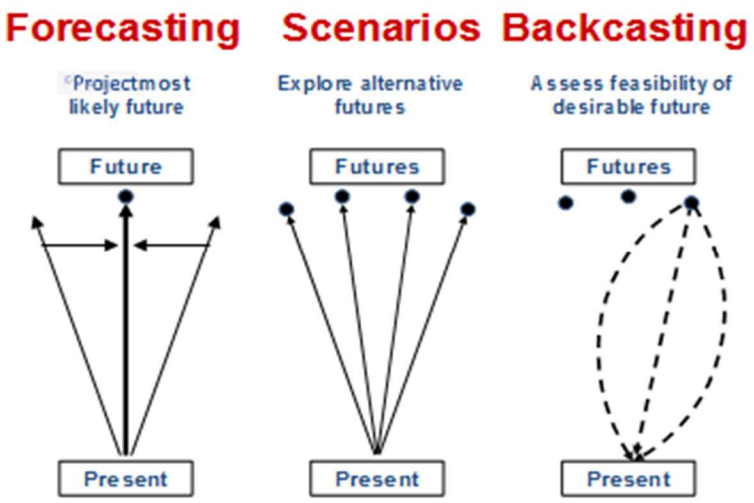

Figure 1: Main distinctive characteristics of forecasting, scenarios and backcasting (Robinson, 2011)

1. Backcasting from Sustainability Principles: Richard Blume, The Natural Step

Project Theme

The Natural Step's mission is to equip decision makers across the globe with a unifying Framework for Strategic Sustainable Development to simplify and speed up decision-making for sustainability. The Framework has been developed over a 23-year-long period of testing and application with scientists, business and community leaders. The unique and underlying element of this Framework is 'backcasting from sustainability principles'.

Target Groups

Having sufficiently tested this approach we are now launching a new initiative to scale up dissemination and application of the Framework to support backcasting from a sustainable society. Target audiences include:

- **Decision-makers world-wide** – so that anyone who requires it is able to evaluate key sustainability decisions using backcasting based on sustainability principles.
- **Scientists and educators** – through the Real Change programme, an international applied research initiative we wish to continue scientifically developing and applying the Framework within thematic areas (examples include sustainable product innovation, metal flows, rainforest management, conflict resolution, integrated water management, energy systems, traffic systems).
- **Practitioners** – through scaled-up training and integration within university curricula, we are aiming to increase the number of practitioners capable of applying backcasting from sustainability principles, in order to crowd-source an ever-expanding fact base of sustainability data, expertise and inspiring case studies.
- **Business and community role models** – coaching and supporting businesses, sectors, communities and regions to become role models for sustainability.

Enabling conditions

Robust theory and development of the Framework

- A key breakthrough is the derivation of first-order science-based sustainability exclusion criteria principles. These principles define the conditions for sustainability and allow for backcasting while avoiding some of the challenges with scenario planning. With regard to sustainability, these principles are:
- Necessary - to avoid imposing unnecessary requirements and to avoid confusion over elements that may be debatable;
- Sufficient - to avoid gaps in the thinking;
- General - applicable in any arena, at any scale, by any member in a team, regardless of field of expertise;
- Concrete - to inform knowledge brought to the table by each expert and to help the team's planning agenda; and
- Non-overlapping - to allow easy understanding and to ensure indicators can be developed to monitor progress.

Furthermore:

- Testing and refinement of the Framework is done in dialogue between scientists and decision-makers.
- How the various tools and concepts relate to each other and the goal of sustainability is demonstrated in such a way that strengths and gaps can be identified, and synergies are created between their use.

Applying backcasting from sustainability principles

When applying backcasting from sustainability principles, the following guidelines are proposed:

- Create a common language using the Framework and sustainability principles to achieve consensus on the goal of sustainability, and how to align ones' activities with this goal.
- Use sustainability principles to allow for: 1) the generation of creativity within system constraints;
  2) calculation of resource potentials; 3) strategic management of trade-off situations; 4) appropriate setting of the scope; 5) interdisciplinary cross-sectoral cooperation; and, 6) avoiding unknown problems.
- Use a participatory, step-by-step process to apply the Framework, from awareness and visioning to brainstorming and action planning, including prioritization questions that integrate the business case.
- Gain commitment from the top of the organisation and / or key champions to drive the process.
- Use strong facilitation and coaching methods – games, creativity exercises, metaphors, application tools, and so forth.
- Use illustrative case stories and prior successes as inspiration and proof of viability. Well-cited examples include community planning in Whistler Canada, Electrolux's phase out of CFC's and substitution of metals, IKEA's introduction of CFL lighting solutions and the sustainability programme and model for a 'prototypical company of the 21st century' produced by Interface Inc.

Significant Challenges

The project has been challenged by a number of limitations common to many sustainability-oriented initiatives, including:

- insufficient knowledge in the business community;
- entrenched mind-sets, short-term thinking;
- a lack of leadership;
- a lack of commitment to what transformation science tells us is needed;
- maintaining the creative tension between current reality and desired future;
- lead time needed to build up competence in scaling up the use and dissemination of the Framework; and,
- an abstract message (as opposed to a clear message like saving threatened species or addressing poverty directly) that hinders quicker dissemination.

Update from The Natural Step (R. Blume, Dec. 2015)

- The Natural Step has compiled a reference list covering the 25+ year history of publications and case studies connected to its activities, the Framework for Strategic Sustainable Development and the underlying methodology of backcasting from sustainability principles - http://www.thenaturalstep.org/sustainability/fssd-references
- The Alliance for Strategic Sustainable Development (formerly the Real Change initiative): Since 2011 The Natural Step has contributed to further development of a research network where there are specific research projects and partners who apply the Framework for Strategic Sustainable Development in an ongoing manner - http://www.alliance-ssd.org/journal-special-volume/
- Planetary Boundaries and FSSD synthesis: Work is underway to explore how we can backcast from "a safe operating space for humanity", combining with the planetary boundaries promoted by the Stockholm Resilience Centre. A first publication on linkages is downloadable from: http://www.ecologyandsociety.org/vol18/iss2/art5/
- There has been a significant update to the way we approach backcasting from social sustainability principles. A PhD dissertation on the topic is downloadable from: http://bth.diva-portal.org/smash/get/diva2:852857/FULLTEXT02.pdf
- Organisational visioning model applying backcasting from principles: The Natural Step has applied an integrated model for creating organisational visions framed by sustainability principles in a number of organisations wanting to be pioneers in sustainable business.
- The Future-Fit Business Benchmark: The Natural Step is a co-initiator in the process of developing an international benchmark to define a universal set of goals for a sustainable business to backcast from. It is currently open for public consultation but already getting significant interest from major corporations: http://futurefitbusiness.org/
- The Blekinge Institute of Technology, with which The Natural Step collaborates closely, is coordinating a Special issue in the Journal of Cleaner Production where backcasting will feature heavily.
- Ashoka, the largest network of social entrepreneurs, has nominated The Natural Step Founder, Professor Karl-Henrik Robèrt, as an Ashoka Globalizer and identified the body of work promoted by The Natural Step as a social innovation 'ready to scale.' The latter is in development and TNS is open to all ideas! https://www.ashoka.org/fellow/karl-henrik-robert

2. UNEP GEO–3 and GEO–4: Marion Cheatle, Former UNEP staff member and International Co-Chair for CCICED (special project on outlooks), and Visiting Professor, Tongji University, Shanghai

Whilst I have considerable experience of developing and applying forward-looking scenarios within the UNEP Global Environment Outlook (GEO) process, particularly in relation to GEO-3 and GEO-4, I do not have first-hand experience with backcasting scenarios. However, within the framework of the China Council for International Cooperation on Environment and Development (CCICED), I was actively engaged in a process to analyse the feasibility of, and appropriate approaches and methods for, carrying out a China Environment and Development Outlook (CEDO). Backcasting was proposed as a possible approach for, or a component of, developing the 'Outlook' of the CEDO. Participation in the TIAS Visioning and Backcasting Workshop enabled me to come up to speed on backcasting, understand its methods, advantages and limitations, learn from other's experiences in its practical applications and, with this information, to be in a position to better assess its potential value and appropriateness for CEDO.

For GEO-3 (published in 2002), four plausible futures were developed for the period 2002 to 2032 based on a similar 4-scenario process pioneered by the Global Scenarios Group. The GEO scenarios (Markets First, Policy First, Security First and Sustainability First) were developed at a global level and subsequently, through an iterative process, for all major regions: Africa, Asia-Pacific, Europe, Latin America and the Caribbean, North America and West Asia). The qualitative scenario development process was supported by selected, relevant, available quantitative modelling. A range of socio-economic drivers, environmental themes and policies were pursued through the scenarios to arrive at policy implications which were then included in the policy-relevant findings and conclusions of the report. GEO-4 (published in 2007) brought the same four scenarios up to date, extended their future pathways to 2050 and carried out more explicit regional differentiation.

4. UNEP´s 5th Global Environment Outlook (GEO-5): László Pintér, Department of Environmental Sciences and Policy, Central European University and International Institute for Sustainable Development

Project Theme

I was a coordinating lead author of Chapter 9, "Scenarios and Transformative Change" of UNEP's 5th Global Environment Outlook (GEO). We used backcasting to map policy options to close the gap between an outcome consistent with long-term (2050) goals and targets agreed upon in Multilateral Environmental Agreements or identified by science and a business-as-usual projection. Both the business-as-usual projection and the backcast in the challenge scenario will be based, to the extent possible, on existing scenarios, complemented by new model runs in a few thematic areas if required and possible

I am also working as an international member of the China Environment and Development Outlook Feasibility Study (CEDO-F) Task Force, an initiative of the China Council on International Cooperation on Environment and Development (CCICED), currently as a member of the working group in charge of developing detailed recommendations for CEDO's methodologies.

Between 2004 and 2008, I led the International Institute for Sustainable Development's work on the Integrated Vulnerability Assessment and Adaptation Strategies for Hungary's Lake Balaton Region project for UNDP-GEF that involved the development of qualitative scenarios based on a vision of a region that successfully adapts to the impacts of climate change, combined with the impacts of other forces of global and local change.

Target Groups

The main target group of GEO is UNEP's Governing Council and the Global Ministerial Environment Forum (GMEF).

Enabling Conditions

The work is under way, so it would be premature to speculate what worked well. What can be said though is that GEO's key audiences represented at an Intergovernmental and Multi-stakeholder Consultation favoured a stronger focus on solutions formulated around a backcast than a 'classical' scenario approach involving the development of, typically, four alternative projections.

Significant Challenges

Identifying the elements of a 2050 challenge scenario outcome and ensuring cross-scale and cross-thematic consistency, particularly taking trade-offs and synergies into account, will be a challenge. We will likely find major gaps in quantitative 2050 goals and targets in Multilateral Environment Agreements (MEAs) or inconsistency between MEA goals and targets and safe limits identified by science. I also expect reconciling different disciplinary and regional perspectives through the backcasting process difficult.

At the end, GEO-5 will have to be signed off by governments at an intergovernmental consultation. Based on past experience, striking a balance between what is politically acceptable and what is scientifically necessary will not be simple.

3. The DuWoBo project and the Space for Water Project in Flanders:

Peter de Smedt, Joint Research Centre, European Commission, formerly with the Research Centre of the Flemish Government

The DuWoBo project (2004-2007)

The objective of the DuWoBo project was to initiate in Flanders a transition management process for sustainable housing and building. From the transition perspective, current socio-technical systems are made up of a range of technologies, infrastructures, patterns of behaviour, cultural values and policies. A transition implies a transformation process in which existing structures, institutions, culture and practices are broken down and new ones are established (Loorbach, 2007). It is a distinctive approach because of its explicit normative focus on sustainable development and its specific use of selective participation emphasizing innovation and experimental niches. In practice, a set of four normative (desired) images of the future (2030) were developed with an initial group of stakeholders (transition arena group). This lead to four working groups that enlarged the participation. Via a backcasting approach various paths that should support the desired transition were developed and discussed.

The outcome was presented back to the sponsor, the government of Flanders. Several initiatives are now put in motion. Annual meetings of the arena keep the process ongoing. Still, it remains difficult to link consensus on the long term transition (sustainable vision) with the short-term (niche) initiatives. In addition, the selection of frontrunners (pioneers, niche players) for a transition process is of crucial importance. More information: http://www.duwobo.be/

Ruimte voor water – Space for Water Project (2001-2006)

The objective of the Space for Water project was two-fold: (i) the development of a strategic vision on a regional level (i.e. direct management of 1100 km rivers and supervision of local water bodies); and (ii) the development of water management plans for 11 sub-catchments. The strategic envisioning process included a scientific/technical advisory board and the outcome was presented to the regional council. For each of the 11 sub-catchments, a stakeholder group was formed linking a chain of actions to achieve the main principles of the strategic vision. This was supported by a back-casting approach. Several working meetings were organised and 11 official integrated water management plans were development and agreed upon.

The formal participatory processes ensured a broad involvement and was able to include a variety of regional and local perspectives. The principles of the strategic vision (i.e. optimal resilience, integrated sediment management, enhanced fish migration and tailor-made measures) were general enough to be useful for the 11 sub-catchments. Each water management body agreed to add a (relative) small budget for common projects. However, the attractiveness of the principles was less effective in generating investments. Flooding issues were still the most dominant attractor for large scale infrastructure projects at all levels. Additional EU funding (Interreg, Life) helped to ensure ecological measures for specific areas.

More information on the 11 sub-catchment plans and related projects (in Flemish):

http://www.provant.be/bestuur/departementen/leefmilieu/dienst_waterbeleid/waterschappen/waterschappen_en_dee/
http://www.provant.be/leefomgeving/waterlopen/gebiedsgerichte_proj/

5. The Latin American World Model[1]: Gilberto Gallopín, Independent Scholar

Project themes

The focus of the Latin American World Model was to analyse the material feasibility of fulfilling the basic human needs globally in a 60 to 100-year time horizon. The study was both a response and a new proposal to the controversy initiated by "The Limits to Growth" (Meadows et al. 1972), and to date the only global model coming from the developing world. The model was disaggregated into four regions (Industrial Countries, Latin America, Asia and Africa). The results showed that in the time horizon considered, the constraints on providing a decent quality of life to the world population were not physical (i.e. availability of agricultural land, natural resources, energy, pollution) or economic, but primarily socio-political (i.e. power structure, poverty, inequity). The study included a mathematical simulation model including the quantifiable variables plus a narrative defining the essential traits of the desirable society and the most important non-quantifiable factors.

Target Groups

International organizations and policy-makers, and the general public of the planet Earth were the primary audience. The results of the project were directly utilized by UNESCO, ILO, and the government of Egypt. The concept of human basic needs pioneered, in the development arena, by the project was later widely utilized by ILO, ECLAC and other international organizations.

Enabling Conditions

The strong joint motivation of the members of the team, their high level of expertise, and the innovative use of a nonlinear optimization procedure to build the "best trajectory" subject to a series of constraints were essential factors for success. The use as the objective function of Life Expectancy at Birth (as a surrogate for well-being, rather than using GNP), was very well received. The most important enabling condition (besides financing) was the project being hosted by an Argentinian centre of excellence providing total academic freedom and good computational facilities.

Significant Challenges

The major challenge was to operate as an integrated team with members located in different cities and even different countries (long before the Internet). Ex post, and after a military coup d'état, the director and other members of the project had to go into exile and the institution was almost destroyed, partly on the basis of the outlook and diffusion of the project.

[1] Herrera AO et al. 1976. Catastrophe or New Society? A Latin American World Model. Canada: IDRC; Gallopín, G.C. 2001. "The Latin American World Model (a.k.a. the Bariloche Model): Three decades ago." Futures 33(1): 77-89.

6. Backcasting Projects in Australia: Damien Giurco, Institute for Sustainable Futures

Project Themes

My research in this area has focussed on:

a) Iterative backcasting for energy using industrial ecology (near Melbourne)

Developing new scenarios (and how to get there) to reveal the possibilities and differences in benefits and impacts as input to a broader community discussion about a preferred vision (political circumstances changed and the vision was less developed than originally planned) http://dx.doi.org/10.1016/j.techfore.2010.09.004

b) Backcasting the future of mining in Australia using Causal Layered Analysis (Vision 2040)

Still with an iterative theme, this used pre-developed scenarios by the World Economic Forum for mining and metals to give a sense of pros and cons of alternate futures (World Scenario Series. Mining & Metals: Scenarios to 2030 – no longer available online) which were then used as a basis for developing a draft vision using (i) an art exercise to more deeply explore these world scenarios for Australia; (ii) causal layered analysis to develop a vision not based on an existing paradigm. Given the limited involvement of industry, further consultation on the draft vision will be undertaken one-to-one basis with validation partners.

c) Adaptive responses to urban water (Sydney)

Although not formally framed as a backcasting exercise, this initiative detailed how to implement a vision developed in part by our team and in part pre-determined by government.

Target Groups

The main target groups were government, as well as industry and community, but it has been more difficult to engage and create change within the latter groups.

Enabling Conditions

The use of imagery – both graphical "flow-chart" type images (a) to inform stakeholders; and artist impressions and effective facilitation (b) to reproduce conceived views among participants and open them up to further possibilities.

Significant Challenges

The challenges from the governmental side have been departmental re-structuring that has changed focus areas and affected momentum. For the mining futures project, the participation of industry was difficult to secure as they seek to keep their strategy planning in house.

7. Sustainable Energy Use in Sweden: Mattias Höjer, KTH Royal Institute of Technology

Project Theme

I have worked with backcasting mainly with sustainable energy as a focus. I have been involved in studies with this starting point on the Swedish transport system with a global context, sustainable energy use among inhabitants of Stockholm, and the use of energy in buildings. Moreover, I have worked with backcasting, or rather preliminary methodological development of backcasting of feminist futures and of national environmental targets.

Target Groups

Target groups are typically the research community, decision makers and the public. Industry has been less of a target.

Enabling Conditions

Often, I have found a broad interest for the studies' results. I have found our methodology useful in putting forward a message that current trends are not sustainable, and that there may be futures that are sustainable, despite the fact that they might be difficult to realise.

Significant Challenges

It is often difficult to keep the requirement of target-fulfilment in mind when communicating the results. This is a challenge I have worked on and found some ways of handling. Among others, a stronger emphasis on showing the difference between different kinds of futures studies and a more concrete way of presenting results have been good tools.

8. Backcasting – Three examples from national to global levels: Jill Jäger, Consultant

Policy Exercise, Bad Bleiburg, Austria, 1989

The focus of the policy visioning exercise in Austria was on climate change and sustainable development. The participants were divided into four groups. Two groups were given a vision of the world in 2050 with dramatic climate change, two with moderate climate change. Over two days, they worked out a pathway from 1990 to 2050. The surprise came when we found that all groups needed a catastrophe (war, famine etc.) to get to the endpoint. The groups were remixed, the endpoints slightly adjusted and in a second round, some truly innovative thinking took place and the endpoints could be reached without intervening disasters. The narratives from the second round were very creative.

Target group: Run by the Stockholm Environment Institute, participants included experts and stakeholders (industry, government, and NGOs, North and South). It formed part of the process in the run-up to the Second World Climate Conference.

What worked well*:* Two rounds characterised by learning.

Enabling conditions*:* Beautiful location, very detailed preparation, 5-day meeting, excellent facilitation.

Significant Challenge: People who find it impossible to "divorce themselves" from present day constraints.

Scenarios for Asia-Pacific, GEO-4, Bangkok, 2005

The project extended the GEO-3 scenarios from 2030 to 2050. It involved deciding what each scenario looked like in the region in 2050 and then telling a story of how this endpoint was reached.

Target group: GEO-4 Audience

What worked well: Structured process looking at driving factors and developing a timeline.

Enabling conditions: Good preparation in facilitation techniques, debriefing sessions each day, a 5-day meeting.

Significant Challenges: It is important to ensure that all participants "have a voice" and the process is not dominated by "big players".

Planet in 2050, Lund Discourse, October 2008

The project developed **a vision** for the world in 2050. It was supported by a wide range of sponsors, initially by IGBP as a follow up to the film "The Planet" which presented an alarming view of the state of our earth ([(http://www.routledge.com/books/details/9780415590006/)](http://www.routledge.com/books/details/9780415590006/))

What worked well: The development of a normative, interdisciplinary vision.

Enabling conditions: 50 committed people from a wide range of disciplines and backgrounds, five-day meeting with one day "off" in the middle to visit local SD projects. Location.

Significant Challenge: Participants with their own agendas.

9. Use of Participatory Backcasting in PBL's Sustainable City Project:

Eva Kunseler, PBL Netherlands Environmental Assessment Agency

Project Theme

The aim of the Sustainable City project (2008-2010) run by PBL Netherlands Environmental Assessment Agency was to generate integrated options for long-term urban development policies in the Netherlands. Interviews with 30 scientists and practitioners active in the field of urban design and development led to the conclusion that for our study, sustainability at urban context can be operationalised in three main themes: 'health', 'liveability' and 'energy'. Besides cognitive uncertainties, normative uncertainties were expected to play an important role in the discussion and policymaking process of how urban environments can contribute to sustainable development. The involvement of scientific disciplines and the integration of various kinds of knowledge was regarded a prerequisite for meeting the study objectives. Participatory backcasting was found to be an appropriate method for enabling discussion on these uncertainties and stimulating knowledge integration in a future study setting.

Target Groups

Policymakers at the Dutch Ministry of Spatial Planning and Environment were the primary target group of our study. For some time, the project was connected to a policy programme directorate on urbanisation who were developing an urban sustainability policy approach. However, they were not defined as a formal client. At the final workshop, policymakers from different governmental departments were invited to deliberate on the project findings and inform the public on their policy ideas and approaches for sustainable urban development. The 100 stakeholders who actively participated in the study can also be considered as target group. Their active deliberation in three workshop rounds may have had an impact on their daily work.

Enabling Conditions

In essence, participatory backcasting consists of creating desired images of the future in a stakeholder dialogue, then producing and analysing the road-map that could lead to such a desired future. Participatory backcasting requires iteration to integrate new knowledge into the next step. Three rounds of workshops were organized to stimulate iterative deliberation among stakeholders and allow room for analysis in between. The workshop programs were designed to enable an open, creative and stimulating atmosphere, creating a constructive deliberation setting. Structuring the study as an analytic-deliberative process worked very well for the 'energy' theme. Stakeholder knowledge served as input to model-based narratives. Since the energy 'system' is well understood, our quantitative analysis on mechanisms and option potential was well received and further developed in the next workshop round.

Significant Challenges

There was a tension between the utopian, far-fetched images and the need for down-to-earth plausible and feasible strategies. This tension is grounded in the struggle of reconciling model-driven knowledge with stakeholder knowledge, in particular on the themes of 'health' and 'liveability', which are characterized by high cognitive and normative uncertainties. The stakeholders created desired images of the future and designed the roadmaps qualitatively. Their

ideas formed the basis for model-based narratives. For the purpose of subsequent scenario design and analysis, these model-based narratives were reduced to fit in a two dimensional dichotomous scenario axis and in quantitative scenarios. The challenge would have been to develop the scenarios from the storylines, allowing for a more explicit interpretation and discussion of the normative and cognitive uncertainties underlying the model-based narratives. A more conscientious consideration of integration across qualitative storylines and quantitative model runs in scenario construction could have led to a more interactive involvement of policymakers and other stakeholders, allowing policymakers to connect elements of our model-based narratives to political viewpoints and arguments. It is probable that during such interaction, a favourable shift occurs from a focus on the potential to a focus on the feasible policy options.

See article: Dassen, T., Kunseler, E. and Kessenich, L.M., 2013. The sustainable City: an analytical–deliberative approach to assess policy in the context of sustainable urban development. *Sustainable Development*, *21*(3), pp.193-205

10. Restoration Strategy for the Ural River Sturgeon Population:

Viktor Lagutov, Environmental Systems Laboratory, Central European University

Project Theme

A number of practical modelling projects have been carried out by the Environmental Systems Laboratory of the Central European University (Budapest, Hungary) focusing on management and assessment of various environmental systems, including climate change, biodiversity conservation, aquatic ecosystems, and integrated socio-economic water resources management. Though most of the projects utilize traditional "classic" scenario approach, some require methods of backcasting studies. One of such projects is development of the restoration strategy for the Ural River sturgeon population.

Sturgeon is a species of high economic, ecological and social values. There are two primary reasons for the extinction of this species: rivers impoundment and overfishing. The Ural River is the last large European free-flowing watercourse with unique undisturbed ecosystem and preserved sturgeon habitats. The Ural spawning grounds is the only remaining habitat to offer natural sturgeon restoration given the failure of hatchery-based restocking programs. However, overfishing through commercial harvest and poaching is a significant threat to the population. An appropriate fishing strategy for the next 30 years, including maximum allowable catch has to be formulated for the next 30 years.

Target Groups

The study was carried out within the framework of the Ural Basin Project (http://uralbas.ru). The primary target group was Russian and Kazakhstan Fishery and Water agencies. The regional environmental authorities from both basin countries have participated in process of scenarios formulation and discussion.

Enabling Conditions

The well-defined characteristics of sturgeon population and river ecosystem allowed backcasting of conditions required for population restoration. A series of workshops had been conducted to bring together stakeholders and scientists in fisheries and water management.

Significant Challenges

The real existing size of total sturgeon catch by commercial official fishery and poaching by local communities is hard to assess. Also, assessment of current population size is a challenging task due to lack of reliable information. Taking into account some essential environmental factors is complicated due to forecasted regional climate changes

11. Threshold 21 Model (T21): Weishuang Qu, Millennium Institute

Project theme

- Threshold21 (T21) is a long term national integrated planning model created by the Millennium Institute, focusing on the key long term challenges a country faces. Its focus could be different for different countries, such as carbon emissions and energy security for China, crime reduction and faster economic growth for Jamaica, and poverty reduction for Mozambique. More information is available from:
  http://www.millennium-institute.org/integrated_planning/tools/T21/

Target Groups

- The target groups are national governments, international donors, and research institutions of sustainable development.

Enabling Conditions

- The success of a national T21 project is primarily measured by the continued use and updating of the model by the local team for national policy analysis and support, such as in Jamaica and China. The commitment of the national leading agency of the T21 project and the technical capability of the national team are the most important enabling conditions.

Significant Challenges

- Data availability and data consistency;
- Constant learning for the modeller, as different countries have different conditions and different priorities and challenges;
- Training of the local team;
- Some social, economic, and political variables/factors that are difficult to quantify.

12. Participatory Backcasting Projects: John Robinson, Munk School of Global Affairs and School of the Environment, University of Toronto

Project theme

I have been engaged in backcasting activities and projects since 1977, when I undertook an energy backcasting study that was partially funded by the federal government in Canada. The most recent studies I have been involved in are:

- Georgia Basin Futures Project (GBFP) – a five year project form 2000-05, which involved applying the GB-Quest backcasting software with many stakeholder group in British Columbia, Canada.
- The CIRCUITS project in 2008-09, which involved trying to test the effects of 'clinical;' and 'warm' settings for backcasting projects.
- The Landscape Climate Change Visioning project (LCCVP), which involved adding landscape visualization to backcasting studies of climate change at the municipal level in 2008-09.
- The Measuring Societal Responses of Participatory Sustainability Research project, which tried to develop a framework for evaluating such projects (2008-09).
- The Greenest City Conversations project (GCCP) (ongoing), which is an attempt to engage citizens of Vancouver, BC, in various channels of engagement (workshops, mobile applications, table top games/kiosks, online events and social media and performance art) in discussions about preferred futures in the context of the City of Vancouver's Greenest City 2020 program.

The central focus of our backcasting work over the past several decades has been to make backcasting projects more participatory, and to integrate modeling capability into backcasting processes. To this end we have explored the use of models/games that we have developed as tools to allow participants to explore desired futures (i.e., to allow the participants to create and explore their own scenarios). This has led us to what we call 'second order backcasting', which is backcasting that allows the user to generate, evaluate, and iterate through multiple scenarios and ultimately choose their preferred future. While the original tool developed for this purpose (now called Metroquest), which has been sold to 18 cities in North America, was used in workshop settings, more recent developments have broadened this work in two ways: (i) Metroquest can now be played online and in kiosks, and (ii) we are now exploring other forms of interaction (table top games, social media, mobile applications, performance art).

Target Groups

Our target groups have varied widely. In the GBFP, we had 16 partner organizations, primarily in the public and NGO sectors, and we ran workshops with federal civil servants, politicians, NGO staff, and municipal/regional staff. In CIRCUITS, we used students. In the LCCVP, the audiences consisted of municipal staff and politicians. In the GCCP, our target is citizens interested in the City's plans.

Enabling Conditions

This is a long story but very briefly, we have found that various audiences are very interested in creating their own scenarios, and that the buy-in is higher than when scenarios are simply presented to them. They are also very interested in the future of their region (40 years out) and in the trade-offs and consequences associated with different future choices. Almost invariably we have had enthusiastic participation. Gaming tools can be a useful way to communicate information about collective choices and in shifting mental models of sustainability towards such collective issues. Furthermore, landscape visualization can be a powerful way to communicate complexity about the future to workshop participants.

Significant Challenges

Here is a brief summary of some findings:

- Highly participatory processes create real challenges of expectation management. Citizens can expect that the scenario they choose will in some way be implemented; and government officials often want to control the process and avoid controversial issues.
- It is very difficult to combine the goals of practical utility to users with the goals of academically fruitful research projects in a highly interdisciplinary setting. Our GBFP project was not renewed for a second 5-year term largely because the rate of publication was too low.
- These processes are labour intensive and expensive to run, and the gaming tools are complex and expensive to build.
- The tension between predictive forecasting approaches (and expectations) and normative backcasting approaches remains an issue. Highly participatory processes tend to die with few long-term effects if they are purely project–based. There needs to be some institutionalization of the backcasting and participatory capacity.

13. Dutch Water Sector Intelligence (DWSI): Andrew Segrave, Knowledge Management & Futures Research, Watercycle Research Institute

Project themes

Futures research for the entire Dutch water sector: DWSI (http://www.dwsi.nl/english/) is a strategic learning alliance that was established in 2008 by KWR Watercycle Research Institute and a team of pioneers from Dutch drinking water companies and water boards. Researchers from KWR continuously examine and report on trends in the context of the Dutch water sector (SEPTED Method). National studies are analysed and translated to the sectoral level. The futures research team also participates in various networks and attends conferences to tap into the most important current developments. Clusters, or families, of these trends are discussed in think-tank sessions with strategic thinkers and decision makers from the partner organisations (3 times a year). Experts from outside the water sector are also invited to fuel the strategists with new insights about the relevant trends. These sessions are designed on the principles of social learning and participatory scenario planning. Co-learning is facilitated through a process of collective exploration whereby members make the most of the diversity of knowledge and insights at hand. The aim of these think-tank sessions is to develop conceptual building blocks for (collective) response strategies. The process of devising response strategies involves analysis of: (1) the objectives of the sector itself; (2) the contextual changes, and (3) possible roadmaps for achieving the objectives. It is for this third step that backcasting approaches and methods are needed. For example, KWR aims to ascertain future knowledge needs as input for programming our research agenda in the present.

Target Groups

- Strategists, agenda setters and decision makers from all of the organisations in the Dutch water sector.

Enabling Conditions

- Improved knowledge exchange between futures researchers and decision makers.
- An enthusiastic network of strategic thinkers.
- Co-learning through workshop methods such as Intervision, Speed-dating, and World-cafés.
- Production of relevant trend-alert reports.
- Involvement of external experts as speakers is essential to defending the legitimacy of the trends.
- An expert facilitator, with authority, is needed to steer the think-tank sessions
- Trust is essential to creating an environment conducive to social learning. Personal questions are used during the introduction to each session to create the desired atmosphere.
- The work forms used for backcasting need to be highly structured to achieve the desired results. The following direct question has proven useful: who will do what, when, and why.

Significant challenges

- Backcasting depends on a clear and shared vision of the desired future state while organisations in the water sector are generally/necessarily more motivated by (current) social/political demands.
- With inexperienced practitioners, backcasting from multiple scenarios results in cyclic logic.
- Backcasting is time consuming, especially if the aim is to form a detailed basis for actions/decisions.
- Backcasting from abstract future scenarios to decisions/actions in the present is a real challenge for some people. For example, the 'Implications Wheel' method has proven to be too complex.
- Participants attending the think-tank sessions do not always have the authority within their own organisation to translate the knowledge and insights they have attained into decisions/actions.
- The roughness/fineness of the steps connecting the future to the present depends on the perceived certainty. Uncertainty leads to results that cannot be used as a basis for decisions/actions.
- The timescale of the roadmap extends beyond the motivational space of the decision maker and is thus more of a theoretical exercise than a basis for real decisions/actions.

14. Be For Backcasting and Back Forecasting: Jed Shilling, Millennium Institute

To plan for the future, looking both forward and backward is needed. Looking back from the present helps to learn from the past what major changes have occurred, what caused them, and why they took place in order to better understand the dynamics of the system. Looking back from future goals and visions is useful to better understand the significant changes needed in the system to achieve desired goals beyond just extending current trends in a business-as-usual (BAU) fashion. Looking forward from the present allows an estimation of where things are going and what significant changes are needed to achieve these goals through a discontinuous shifts from current trends. And looking forward from the past helps determine how well models and other planning practices actually represent the system's functions and reactions to different changes as it reached the present. All of these views – forward and backward – are important and need to take account of the relations among the economic, social, and environmental factors. They are all interrelated and can have significant feedbacks on each other.

One simple analogy to forecasting and backcasting is using a map to find out how to get from point A to point B when they are far apart and in quite different areas not linked by the standard highway system. Looking 'backward' from point B will help find routes that lead into point B, including perhaps mountain ranges and river systems that need to be crossed. Looking 'forward' from point A will help find the routes to be taken to get to the mountains and rivers in areas that are easiest to pass through. Looking in both directions helps find where the routes will actually link and not lead to dead ends so the best route can be found. Backcasting shows what changes are needed to achieve a new vision. Forecasting shows how to begin moving from the present to a distinctly different future position that achieves that vision. Viewing the whole picture from both directions is very important for figuring out how best to get from point A to point B in a feasible and sustainable way.

This demonstrates the importance of taking an approach that is integrated across sectors and over time. One very useful modeling approach for this is based on system dynamics. It can generate scenarios of continuing BAU to provide a point of comparison, then generate scenarios to determine how various proposed changes could be implemented and how they would shift the path to reach the new vision goals. The model would incorporate changes based on the backcasting to help find the most feasible ways of shifting to the new paths, identify what additional measures would be needed, show how the interactions among sectors would help or hinder progress, and illustrate when the shifts would occur. By analyzing the routes taken by different scenarios, comparing the results, and determining their feasibility and time frames, it is possible to identify the best set of policies and programs and the necessary changes and innovations needed to reach the goals of the new vision. It is also possible to assure basic goals of providing food and energy security, reducing other risks, improving the living standards of all are achieved in a **sustainable** manner.

This model is the Threshold 21 Model of the Millennium Institute, which has addressed the issues of managing strategic change over time to achieve long term goals in many countries. It would be an excellent complement to backcasting work to help find the best route from now to reach the future vision.

15. Getting into the Right Lane for 2050: Jan Bakkes, PBL Netherlands Environment Assessment Agency

Project Theme

Reasoning back from 2050, specific strategic actions are identified for the EU in the coming five to ten years. Key factors in the analysis are the magnitude and inherently slow pace of change. The European Union is placed in a position of having a visionary global perspective for 2050 of determining the nations of the world can produce food for a global population of nine billion, while minimising biodiversity loss; mitigating climate change and enhancing energy security; and, at the same time, developing a low-carbon transport system for the EU.

In backcasting from 2050 to the present, three strategic similarities among the themes are revealed. The first is a strategic approach to interim solutions; for instance, not allowing energy supply constraints in 2020 to determine the EU energy system of 2050. The second is that diversity emerges as a strategic notion in all three themes – in sources and technology in the EU energy system, in transport solutions, and in the battle against uniformity of landscapes. The third, and perhaps most difficult, is the need for balanced consumption in achieving the visions for 2050 and the role of the EU, if any, in influencing consumer choices.

Getting into the Right Lane for 2050 appeared at the time of the formation of the new European Commission, following the election of a new European parliament in July 2009. It differed from the hundreds of other "letters to the new president", because of its global perspective on the EU; because of its reasoning back from a long-term vision; and because of its national flags, namely a small ensemble of Dutch and Swedish organisations. At the time of publication, Sweden held the rotating presidency of the EU Council.

The core report of the study was published in October 2009 by PBL Netherlands Environment Assessment Agency and the Stockholm Resilience Centre. Supporting papers, presentations and meeting reports can be downloaded from http://www.pbl.nl/en/ publications/2009/Getting-into-the-Right-Lane-for-2050.

Target Groups

The study has been positioned as a primer for debate on the strategic direction of the EU. Its target audience was: commissioners and staff of the European Commission; NGOs, interest groups and national/regional policy makers with an agenda in Brussels; and new parliamentarians. A characteristic event that the compilers kept in mind while finalizing the report was the official hearing by the European Parliament of candidate commissioners, scheduled in late 2009.

Enabling conditions

- Our timing was good. We found that presenting a backcast, anchored to a long-term vision, was a very timely thing to do prior to the elections and the start of the new European Commission in the second half of 2009. At that point in time, it was logical to focus on options for action. In this setting, we found that a rather precise understanding of the policy occasion and of the envisaged users is essential for the study to 'land'.
- We spent some effort upfront to explore what the policy environment would be when the project was launched. A pre-study was commissioned. It confirmed, in detail, that the

period between summer 2009 to summer 2011 would see not only a new Commission and parliament but also the overhaul of many key EU policies, as well as institutional changes. The pre-study strengthened our confidence in communicating the institutional policy environment of the project.

- The project's profile was based on timing. In particular, it sought to highlight the most urgent policy steps among the many important aspects. Thus, the basic position was to help strategic players by selecting the urgent actions rather than to burden them by adding new interesting and important issues. This was generally welcomed.
- Reporting on no more and no less than three themes (land, energy and transport) worked well. Key presentations and meetings were held well before completion of the study. This was not easy, but effective.
- Next time, we would probably plan a structured consultation of stakeholders in order to gather input. Getting into the Right Lane for 2050 was essentially expert-based. Similarly, we would opt to have a quantified vision and a pathway for the 'land' theme as well even though this theme is especially controversial. In the current project we avoided tabling such a quantification in the fear of siding with one particular perspective on the desirable future of global land use.

Significant Challenges

- Backcasting requires a vision. The vision sketches in broad terms how the future looks and feels for the issues under consideration. Thus, it is more than a target. We found that specifying the vision means sticking your neck out more than with regular, explorative scenarios. No problem, if you are prepared to do so, but at a minimum it requires some additional project time. Because of the difficult choices to be made, I am not sure if this kind of project would be feasible with a large consortium - although the Vision 2050 study by the European Climate Foundation seems to prove that it is feasible.
- We at PBL were not aware of any suitable, formal method to conduct the critical-path analysis that could identify, among all aspects that are important, those items that need policy action soon in order to significantly increase the chances of achieving the long-term vision. Conducting such an analysis requires a good amount of additional project time anyway.
- It helps to quantify developments and options as this provides something quasi-objective to stare at during discussions – however conditional and arbitrary this quantification is. Having just a bit more upfront consultation among real players in the arenas under investigation would also have helped us with this step.
- There is a risk that a backcast is perceived as technocratic – at least when we at PBL conduct it. However, the notion of a critical path and the resulting urgency of some policy actions, is not universally accepted. In response, we as researchers were inclined to throw in even more technological reasoning and an overdose of 'shoulds'. Therefore, it is important to explain well the difference between backcasting and planning. Both start with a vision, but backcasting is meant to open up a debate, not close it.
- Some topics are more amenable to backcasting than others. For example, the topical theme of land, agriculture, food security and biodiversity is less homogeneous and is subject to a larger variety of perspectives and issue frames than the topical theme of energy, including energy security and climate change. Thus, establishing a vision of how a global population of nine billion people will be fed and how EU agriculture in that world operates leads to

many choices and requires a lot of decisions, as well as skilful storytelling to keep most stakeholders on board.

- Translating Getting into the Right Lane for 2050 to the national level for the Netherlands (upon the request from a specific audience later in the process) brought quite a few country-specific issues into focus. This was interesting in the context of the Netherlands and would probably be so for any country. It requires some work and is not just a matter of changing the numbers. More generally, specific examples with broad illustrative power are difficult to find.
- The project devoted quite some effort to illuminating the related governance issues for the EU. The findings of this effort probably contributed to a balanced study and resulted in spin-off publications. But I am afraid they were typically taken for granted at the time of publication. Perhaps the challenge is how to better integrate such a governance discussion in the backcast itself.

Epilogue

A richly diverse group of practitioners contributed to the Visioning and Backcasting workshop. Between them, they brought an impressive array of accumulated experience in executing future studies related to the environment and sustainable development. As apparent from the submissions included in this report, some of the participants specialize in backcasting, while others came to learn about it as a new approach, and still others shared recent project experience or offered specialized techniques in visioning and scenario analysis.

Surprisingly, two generations of backcasts emerged in the discussions: one generation of very recent projects, and the other of thirty years ago. It is clear that for some decades the larger environment-related assessments have explored alternative futures by way of scenarios. This practice has contributed some impressive work in 'mapping' the landscape of challenges, opportunities and responsibilities and delivering input to policy discussions. Examples include IPCC Assessment Reports and the Global Environment Outlook (GEO).

Now, in the second decade of the 21th century, the time is right for action-oriented assessments. Some of these continue to employ a traditional, forward-looking format, for example, the OECD Environmental Outlook to 2030. Recently, some high profile projects have reverted to the older approach of backcasting: concretely formulating a long-term strategic vision and then exploring the key societal steps required to realize the vision, for example, for the European Union, or an urban area – as in the *Transition Town*, *Totnes*.

Backcasting projects presented at the workshop placed an even stronger emphasis on their interactive processes than other forward looking studies. Most of their impacts seem to be realized while the project is being carried out, e.g. through participation in vision-building workshops, review sessions and interim briefings for the target audience. In fact, these activities seem to be much more important than delivering the final study report and the underlying documentation, however important this may be. For example, *Vision 2050* of the World Business Council for Sustainable Development (WBCSD) focused on conferences in various parts of the world, supported by only one draft study and delivered the final report as a consensus document later.

Universally, the backcasts identified steps long before the time horizon of the vision as the key to ensuring that the vision is achievable. Typically, a pivotal year is identified after which the necessary steps would be impossible to implement or extraordinarily costly and disruptive. In this spirit, WBCSD coined the phrase 'must haves' and subsequently matched *Vision 2050* with the *Action 2020* project.

Among the projects presented, two aspects received widely different emphasis: participation and quantification. Diverse research traditions play a role here. This being so, there was general appreciation that both public participation and model-based quantification add strength and authority to backcasting studies. Both are indispensable for a convincing and relevant backcasting project.

The bottom line is that visioning and backcasting is a line of work with a future.

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Annex 1: Biographies of Contributors

Jan Bakkes specializes in managing environmental information for decision making, in particular through broad-based assessments and outlooks. He led the *Right Lane* backcasting study into longterm challenges to be addressed by the European Commission. He had a coordinating role for the OECD environmental outlook to 2030. He led the scoping study for DG Environment on Cost of Policy Inaction. Between 1992 and 2002 he was part of the core group that developed UNEP's Global Environment Outlook and its global network and managed the contributions by its eldest collaborating centre. In 1995-1996 he helped establish Indicators for Environmentally Sustainable Development at the World Bank in Washington DC. Throughout the 1990s and the 2000s he contributed to or led activities for a range of Europe-based organisations in the field of indicator systems, scenario analysis, public access to information and performance review. Since 1988 he is staff member of the Netherlands Environmental Assessment Agency (which until 2000 was part of RIVM). Prior to this he coordinated the environment statistics of Statistics Netherlands, was involved in refining the legal methodology for environmental impact assessment and as early as 1971-1974 set up waste water accounting in chemical industry (Pennwalt Nederland). He studied chemistry and spatial planning in Rotterdam, Delft and Utrecht. Jan is a vice-president of TIAS.

Richard Blume is a Senior Advisor with The Natural Step's international team, based in Stockholm, Sweden, and a board member of The Natural Step Australia. He primarily works with international companies that are seeking to become role models in sustainable development. Some of his recent clients include Nike, Rohm & Haas, Omya and Givaudan.

Richard's professional experience covers a range of sustainability-related and engineering roles. Before he joined TNS, Richard worked as a Research Associate in strategic sustainable development at Blekinge Institute of Technology (BTH), Sweden. He was part of the management team of BTH's multi-disciplinary masters programme in Strategic Leadership towards Sustainability and undertook research in sustainable product innovation. He has previously worked as a consultant and project engineer in environmental management and impact assessment, corporate performance auditing and engineering design (transportation & urban planning) in Australia, France and the UK.

Richard holds a Master's Degree in Strategic Leadership towards Sustainability from Blekinge Institute of Technology, Sweden. He also has a combined Bachelor's Degree in Engineering (civil and environmental) and International Studies from the University of Technology, Sydney, Australia.

Marion Cheatle began her career in tertiary education and research at the universities of Malawi and Zambia, and then spent two years in the Solomon Islands, South Pacific, where she undertook land-related consultancy work. In 1989 she moved with her family to Kenya, completed her PhD and, following more consultancy work, joined the United Nations Environment Programme (UNEP) in 1993. At UNEP Marion worked in the Division of Early Warning and Assessment (DEWA) on a range of the activities including development of global observing and monitoring systems, environmental data and indicators, environmental assessment and identification of emerging environmental threats. She coordinated UNEP's flagship global assessment process, the Global Environment Outlook (GEO), for six years and initiated the annual UNEP Year Book series. Marion subsequently held various management level posts in DEWA including Chief of the Early

Warning Branch, Chief of Capacity Development Branch, Deputy Director and Acting Director of the Division.

Since retiring from UNEP in 2010, Marion has provided consultancy services to GRID-Arendal, Norway, and to the Ozone Secretariat of the Ozone Convention. In China she co-chaired a special project for the China Council for International Cooperation on Environment and Development on the feasibility of a China Environment and Development Outlook. She is currently a visiting professor at Tongji University, Shanghai, where she teaches the Integrated Environmental Assessment module of the postgraduate course in Environmental Systems and Sustainable Development.

Peter De Smedt has a background in environmental research on Ecological System Analyses. Connecting science and policy became his major challenge and he has applied his expertise in the fields of Integrated Water Management and Sustainable Development. Peter has worked together with experts and stakeholders in a broad range of regional and EU projects (1999-2007) towards achieving a common understanding on non-sustainable trends, offering scenarios and integrated solutions to support policymakers. From 2004 to 2007, he was also the vice-chair of a European Science Foundation network on advancing Foresight Methodologies. Currently, Peter works as a scientist and Foresight Analyst for the Joint Research Centre (JRC) of the European Commission. Formerly he was an Advisor to the Research Centre of the Flemish Government. Until 2010, he worked with the European Commission's Directorate General Research on Impact Assessment tools in the fields of socio-economic aspects of Environment and Sustainable Development. His portfolio has covered various European Framework projects, such as Sensor and Matisse, that aim at enhancing the synergies between different assessment tools and promoting the use of these tools in EU policy-making.

Gilberto Gallopín is working as an independent scholar. He received his Ph.D. in Ecology from Cornell University in 1969 and is an ecological systems analyst and sustainable development expert. He has worked on ecological systems analysis, food chain and niche theory, global modeling, environmental modeling, environmental impact assessment, environmental and land use prospective, the environment and development nexus, environment and quality of life, impoverishment and sustainable development, scenario analysis, and policy dialogues. He has published more than 100 papers in these areas. He is the editor of a book on ecological perspectives for Latin America, principal author of a book on problems and opportunities for sustainable development in Latin America and of a booklet on global scenarios and human choice, and co-author of the Latin American World Model and of a book on adaptive environmental impact assessment and management. Some of his relevant experience includes: Regional Adviser on Environmental Policies at the United Nations Economic Commission for Latin America and the Caribbean in Santiago; Director of the Systems for Sustainable Development Programme, Stockholm Environment Institute; Leader of the Land Use Program of the International Center for Tropical Agriculture (CIAT), Cali, Colombia; Senior Fellow of the International Institute for Sustainable Development (IISD), Winnipeg, Canada; Senior Expert on Environment and Development in the International Institute for Applied Systems Analysis (IIASA), Austria; Full Professor at the University of Buenos Aires and at the Fundacion Bariloche, Argentina, as well as the Executive President of the latter.

Damien Giurco is the Research Director at the Institute for Sustainable Futures, where he focuses on helping industry and government clients improve their future decisions and policies based on critical analysis of environmental and economic performance. Damien has active research interests in resource futures across the minerals, energy and water sectors; industrial ecology and sustainable production and consumption. With a focus on both individual and collective behaviours, Damien's research aims to realise changes to our urban and industrial infrastructure that will enrich our society and our natural environment.

Presently, Damien leads the UTS component of the Mineral Futures Collaboration Cluster, a three year CSIRO-funded project researching the future of how Australia's mineral resources are utilised to deliver long term national benefit with a focus on future scenario and peak minerals: strategic options. Other collaborators are focussing on the role which innovative new technology can play within this landscape (Sustainable Minerals Institute, University of Queensland) and how new approaches can be developed to meet the social challenges of regions in transition (Research Centre for Stronger Communities, Curtin University of Technology; CQ University; Australian National University)

Mattias Höjer is a professor in Environment and Futures studies and has been employed at KTH Royal Institute of Technology since 1992. He has been working within Environmental Strategies Research (fms) since 1995. His PhD thesis (2000) was on backcasting and sustainable development with a focus on environment, transport and information technology in the future city. After completing his dissertation his research has been mainly focused on future studies of sustainable cities, especially on how various urban forms can be compatible with sustainable development and how energy use in buildings could be reduced. The possible role of information technology for changes of various kinds has been a part in all these studies.

Since 2009 Mattias is the Director of the Vinnova Centre of Excellence for Sustainable Communications. The Centre is a cooperative arrangement between KTH and 6 industrial and public partners, and focuses ICT and sustainable development.

Jill Jäger has worked as a consultant on energy, environment, and climate for numerous national and international organizations. In September 1994 she joined the International Institute for Applied Systems Analysis (IIASA, Laxenburg) as Deputy Director for Programs, where she was responsible for the implementation and coordination of the research program. From 1996 to 1998 she was Deputy Director of IIASA, and from 1999 until 2002, she was Executive Director of the International Human Dimensions Programme on Global Environmental Change (IHDP: www.ihdp.org). Her main field of interest is in the linkages between science and policy in the development of responses to global environmental issues.

Eva Kunseler is a Policy Researcher on participatory assessment methods at PBL - Netherlands Environmental Assessment Agency. She has focused on appraisal of urban sustainability scenarios developed in stakeholder dialogues; policy evaluation of urban environmental policy; review of health valuation approaches to cost-benefit studies and developing guidance for policy-relevant environmental health assessments. Prior to this, Eva has worked as an Environmental Health Researcher at the Finnish National Institute for Health and Welfare and has been an

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Andrew Segrave spearheads scientific futures studies at KWR Watercycle Research Institute. He is fascinated by people's views towards the future and how this influences their behaviour. As senior scientist responsible for research on trends and future perspectives for the Joint Water Sector Research Programme of the Dutch water companies, Andrew also has much experience at applying methods for horizon scanning and strategic planning in practice: Feeding knowledge-action systems for anticipatory, adaptive governance. One example is Dutch Water Sector Intelligence: a strategic leaning alliance for which Andrew was one of the designers/initiators. He received his Ph.D. from Delft University of Technology on the subject of human time perspectives and motivation for dealing with wicked planning problems.

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