*German Law Journal* (2024), pp. 1–19
doi:10.1017/glj.2024.31

CAMBRIDGE UNIVERSITY PRESS

ARTICLE

# Scenario Analysis in Karlsruhe: Exploring New Argumentative Steps of the Federal Constitutional Court

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(Received 06 January 2024; accepted 19 April 2024)

**Abstract**

This Article examines scenario analysis, a disruptive argumentation technique used by the German Federal Constitutional Court (GFCC) in recent high-profile cases, such as the so-called climate protection case (Klimaschutz) and other decisions on the fundamental right to intergenerational justice (Grundrecht auf Generationengerechtigkeit). After explaining the basic argumentative steps involved in scenario analysis, for example designing scenarios, identifying stakeholders, relating scenarios to strategies, determining the main driving forces, estimating scenario probabilities, the Article sketches a normative model for rational scenario design. The normative model is used as a lens for evaluating the arguments developed by the GFCC in the climate protection case. Such evaluation also builds on game-theoretic insights and points out some weaknesses in the Court's argument. Finally, the Article observes that, as scenario analysis is used to assess the future impact of legislative decisions, it has the effect of imposing greater constraints on legislatures.

**Keywords:** Climate change; constitutional argumentation; fundamental right to intergenerational justice; inferential patterns; scenario analysis

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https://doi.org/10.1017/glj.2024.31 Published online by Cambridge University Press

## A. Introduction

This Article explores the argumentative structure of the so-called *Klimaschutzbeschluss*, the recent German Federal Constitutional Court's decision on climate change.[1] Our research hypothesis is that this ruling is disruptive to standard constitutional argumentation because it revolves explicitly and extensively around *scenario analysis,* a form of impact assessment generally not employed in constitutional argumentation. Specifically, the German Federal Constitutional Court (GFCC) uses scenario analysis to estimate the possible consequences triggered by the governmental failure to adopt effective greenhouse gas containment measures for the 2031-2050 period. The Court argues that the legislative targets for contrasting climate change, although not "manifestly unsuitable,"[2] were insufficient to prevent the risk of disproportional violations of the fundamental rights of future generations (*Grundrecht auf Generationengerechtigkeit*).[3] From the Karlsruhe Court's perspective, the German Federal government "has violated fundamental rights by not taking sufficient measures to reducing greenhouse gas emissions and limit global warming."[4] This is to say that a legislative measure is taken to infringe upon a fundamental right for the consequences that the measure is not likely to bring about in time to come. To put it another way, the GFCC imputes responsibility to the State not for an action, but for the *likely* consequences of omissive conduct. To this effect, the Court's argumentation designs 'what if' scenarios as inferential tools for applying constitutional principles "in a forward-looking manner."[5]

The research objectives of our Article are twofold: First, to isolate the inferential patterns underpinning scenario analysis; second, to evaluate the use of scenario analysis by the GFCC. More broadly, the Article aspires to clarify the *inferential potential* of a new dogmatic construction, the fundamental rights of future generations, by making explicit the paths of reasoning that justify the application of this principle, and some of their implications in the legal domain. The dogmatic construction of *Generationengerechtigkeit* combines proportionality not only with counterfactual reasoning, but also with future-craft analysis. By this we mean "a hypothetical sequence of events constructed from the purpose of focusing on the causal process and decision points."[6] Future thinking involves a variety of complicated steps including recognizing trends, analyzing data, exploring possible outcomes, and performing strategic foresight all under conditions of uncertainty.[7]

The *Klimaschutz* decision deserves close attention for its fundamental social importance too: The GFCC established for the first time the duty to achieve climate neutrality so as not to harm the rights of future generations. Determining the long-term consequences of governmental policies presupposes forming expectations about possible futures. No less authority than Keynes observed that our activities are generally the result of "animal spirits"[8]: They are spontaneous and based on instability rather than being the "outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities." Still, policymakers and parliaments are increasingly attempting to make decisions based on scientific forecast, or on a rational evaluation of the impact of their actions. In this case, it is the judiciary itself—namely, the GFCC—which uses the impact assessment for applying "the obligation to contain the risks of significant impairments of fundamental rights."[9]

[1]BVerfG, 1 BvR 2656/18, Mar. 24, 2021, paras. 1–270, https://www.bverfg.de/e/rs20210324_1bvr265618en.html [hereinafter *Klimaschutz*].

[2]*Klimaschutz* at para. 154.

[3]*Id.* at paras. 192–200.

[4]*Id.* at paras. 92, 198–220.

[5]*Id.* at para. 243.

[6]*See* Herman Kahn H. & Anthony J. Weiner, The Year 2000: A Framework for Speculation on the Next Thirty-Three Years 6 (1967).

[7]*See* Peter Schwartz, The Art of the Long View: Planning for the Future in an Uncertain World 219–72 (1996).

[8]*See* John Maynard Keynes, The General Theory of Employment, Interest, and Money 141 (1936).

[9]*Klimaschutz* at para. 245.

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As we shall explain in greater detail, scenario analysis is a strategic form of risk assessment that helps make reasonable choices under uncertainty about future events in complex environments.[10] The decision-maker designs a set of possible futures, and assesses their likelihood and impact, to reach a go or no-go decision.[11] Our Article will illustrate how scenario design is the main argument used by the GFCC for striking down several provision of the Federal Climate Change Act.

## B. The Decision on Climate and Possible Futures

In the *Klimashutz* decision, the GFCC held that §3(1) and §4(1) of the Federal Climate Protection Act *(Bundes-Klimaschutzgesetz – KSG)*[12], in conjunction with Annex 2 of the same statute, are *unconstitutional*, because they fail to set down an effective update protocol for the greenhouse gas reduction targets after 2030.[13] The complainants—young German citizens, mostly—claimed that

[10]This essential feature of the decision has been overlooked by the comments that appeared in the last years. *See, e.g.*, Andreas Buser, *Die Freiheit der Zukunft: Zum Klima-Beschluss des Bundesverfassungsgerichts*, VERFASSUNGSBLOG (Apr. 30, 2021), https://verfassungsblog.de/die-freiheit-der-zukunft/; Julia Saiger, *The Constitution Speaks in the Future Tense: On the Constitutional Complaints Against the Federal Climate Change Act*, VERFASSUNGSBLOG (Apr. 29, 2021), https://verfassungsblog.de/the-constitution-speaks-in-the-future-tense/; Katja Gelinsky & Marie-Christine Fuchs, *Bitte noch mehr: Rechtsprechungsdialog im Karlsruher Klimabeschluss,* VERFASSUNGSBLOG (May 26, 2021), https://verfassungsblog.de/bitte-noch-mehr/; Gerald Becker-Neetz, *Klimaschutz oder Sozialstaat? Zwei Dimensionen zur Verteilung der Emissionsrechte*, VERFASSUNGSBLOG (July, 14 2021), https://verfassungsblog.de/klimaschutz-oder-sozialstaat/. None of these comments tackle extensively on the Court's future-craft activity. However, as emphasized by an anonymous reviewer, there is a wealth of literature on the potential impact of climate change and related forecast methods. *See, e.g.*, WALLACE E. OATES & HENK FOLMER, DISTRIBUTIONAL IMPACT OF CLIMATE CHANGE AND DISASTERS: CONCEPTS AND CASES (Matthias Ruth & Maria Eugenia Ibarraran eds., 2009); *see generally* THE NEXT ECONOMICS: GLOBAL CASES IN ENERGY, ENVIRONMENT, AND CLIMATE CHANGE (Woodrow W. Clark II ed., 2013); *see generally* EU CLIMATE CHANGE POLICY: THE CHALLENGE OF NEW REGULATORY INITIATIVES (Marijan Peeters & Kurt Deketelaere eds., 2006); *see generally* FRIEDRICH SOLTAU, FAIRNESS IN INTERNATIONAL CLIMATE CHANGE LAW AND POLICY (2009); CLIMATE CHANGE LIABILITY (Michael Faure & Marjan Peeters eds., 2011); REIMUND SCHWARZE, LAW AND ECONOMICS OF INTERNATIONAL CLIMATE CHANGE POLICY (2001); *see generally* CRIMINOLOGICAL AND LEGAL CONSEQUENCES OF CLIMATE CHANGE (Stephen Ferrall et al. eds., 2012); *see generally* CLIMATE CHANGE AND HUMAN RIGHTS: AN INTERNATIONAL AND COMPARATIVE LAW PERSPECTIVE (Ottavio Quirico & Mouloud Boumghar eds., 2015); *see generally* THE IMPLEMENTATION OF PARIS AGREEMENT ON CLIMATE CHANGE (Vasselin Popovski ed., 2018); *see generally* RESEARCH HANDBOOK ON CLIMATE CHANGE LAW AND LOSS & DAMAGE (Meinhard Doelle & Sara L. Seck eds., 2021); *see generally* THE OXFORD HANDBOOK OF INTERNATIONAL CLIMATE CHANGE LAW (Cinnamon P. Carlane et al. eds., 2016); *see generally* Thomas Schomerus, *Climate Change Litigation: German Family Farmers and Urgenda — Similar Cases, Differing Judgments,* 17 J. EUR. ENV'T & PLANNING L. 322 (2020). There is also an ongoing, lively debate on the economic impact of intergenerational justice. *See, e.g.,* Humberto Llavador, John E. Roemer & Joaquim Silvestre, *Intergenerational Justice when Future Worlds are Uncertain,* 46 J. MATHEMATICAL ECON. 728, (2010); RICHARD P. HISKES, THE HUMAN RIGHT TO A GREEN FUTURE: ENVIRONMENTAL RIGHTS AND INTERGENERATIONAL JUSTICE (2008); Richard P. Hiskes, *Environmental Rights, Intergenerational Justice, and Reciprocity with the Future,* 19 PUB. AFFAIRS. Q 177 (2005); JANA THOMPSON, INTERGENERATIONAL JUSTICE: RIGHTS AND RESPONSIBILITIES IN AN INTERNATIONAL POLITY (2009); *see generally* INTERGENERATIONAL JUSTICE (Axel Gosseries & Lukas H. Meyer eds., 2009); Juliana Bidadanure, *The Precariat, Intergenerational Justice and Universal Basic Income,* 3 GLOB. DISCOURSE 554 (2014); Stephen Riley, *Architectures of Intergenerational Justice: Human Dignity, International Law, and Duties to Future Generations*, 15 J. HUM. RTS. 272 (2016).

[11]DAVID A. AAKER & DAMIEN MCLOUGHLIN, STRATEGIC MARKET MANAGEMENT 87 (10th ed. 2013).

[12]Bundes-Klimaschutzgesetz [KSG] [Federal Climate Protection Act], Dec. 12, 2019, BUNDESGESETZBLATT [BGBL I] at 2513.

[13]*See State of the Netherlands v. Urgenda Foundation*, ECLI:NL:HR:2019:2007, Judgment (Sup. Ct. Neth. Dec. 20, 2019) (Neth.) (displaying a decision drafted by the Dutch Supreme Court which is very similar to the Klimashutz decision). *See, e.g.*, *Juliana v. United States,* 947 F.3d 1159 (9th Cir. 2020) (showing how climate change jurisprudence is increasing on a global scale). *See also Friends of the Irish Environment v. The Government of Ireland et al.* [2020] IR 391 (H. Ct.) (Ir.) (rejecting a challenge to Ireland's National Planning Framework (NPF) which, according to the applicants, was based on a wrong strategic environmental assessment (SEA) in terms of climate change mitigation; the Court upheld the NPF); *Sarah Thomson v. The Minister for Climate Change Issues* [2017] NZHC 733 (challenging the New Zealand's 2050 greenhouse gas (GHG) reduction target based on Section 225 of the Climate Change Response Act and the report of the Intergovernmental Panel on Climate Change (IPCC)) (dismissing the application for judicial review, considering *inter alia* that the Government correctly followed

https://doi.org/10.1017/glj.2024.31 Published online by Cambridge University Press

the German Federal Government had not introduced a legal framework sufficient for reducing greenhouse gases, especially carbon dioxide ($CO_2$), and, thus, a framework contributing to decreasing the global temperature of at least 2°C. Thus, several provisions of the Federal Climate Protection Act are partly in conflict with fundamental rights, as they do not specify the emission reduction measures that must be taken from 2031 onwards. The German Government is invited to adopt effective measures for the post-2031 period. At the same time, the Court considers it unnecessary to endorse more demanding thresholds and benchmarks, for example, the zero-emissions target by 2040 requested by some complainants. The Court agreed on the point: The Federal Government breached the duty of protecting the rights of "tomorrow's generations" to a "future consistent with human dignity" (*menschenwürdige Zukunft*) and to a "minimum standard of living" (*ökologisches Existenzminimum*). Both principles derive from a systematic reading of Article1(1), Article2(2), Article20a of the Basic Law (*Grundgesetz – GG*).[14]

Based on this reading, the GFCC held that contrasting climate change is necessary for preserving the rights of future generations (*Grundrecht auf Generationengerechitgkeit*) according to the principles of security, intergenerational responsibility, and proportional distribution of goods or opportunities among different generations. The fundamental right to intergenerational justice is the notion that present generations have an obligation to act in a way that protects the rights and interests of future generations. This judicial and dogmatic construction—suggested *inter alia* by the semantics of Article20a GG, which establishes the State's responsibility to protect the environmental foundations of life for both present and future persons—is often linked to the fundamental principles of fairness, sustainability, and equity. The fundamental right to intergenerational justice takes seriously the consideration that current policies also have long-term impacts that may affect life, health, environment, and development. Against this backdrop, the Court considered that, as proved by scientists, the risks connected to climate change are objective,[15] and the Federal Republic of Germany is responsible for the damages caused by gas emissions.[16] The progressive thresholds endorsed by the German Federal Government, in pursuit of the objectives established by the international community with the Paris Agreements,[17] are insufficient for ensuring long-term climate neutrality by 2050, cutting emissions by 85-90% compared to 1990 levels.[18]

From the Court's perspective, the pitfalls of climate change can sweep away the liberties of the future generations, which the GFCC considers as a violation of the core of legal correctness *qua* formal equality. The natural environment is a common good that belongs also to the future generations, based on Article2(2) (the protection of life and physical integrity), Article20a, and Article79(3) GG. Therefore, the Federal Government must endorse an adequate climate policy for

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the international standards); *Massachusetts v. Environmental Protection Agency*, 549 U.S. 497 (2007) (presenting how the Court addressed the problem of $CO_2$ emissions using traditional interpretive methods as opposed to scenario analysis, and Chief Justice Roberts, in his dissenting opinion, argued that Massachusetts lacked standing because the potential harm from global warming was not concrete or particularized).

[14]*Klimaschutz* at paras. 1, 38, 113–14, 182–270. One point shall be clarified from the outset: Strictly speaking, the rights of the future generations are not the rights of 'the unborn' (which, for obvious reasons, lacks standing), but the rights of the younger generations that are expected to live also after 2030 (*Klimaschutz* at paras. 96, 109, 182).

[15]*Id.* at paras. 16–28.

[16]*Id.* at paras. 29–30.

[17]Paris Agreement, Sept. 28, 2016, 21 U.N.T.S 1082.

[18]The German Federal Government has adopted the resolution of moving towards climate neutrality in several acts: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (*Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit – BMU*), Climate Action Programme 2020, Cabinet decision of 3 December 2014, p. 7ff. Climate Action Plan 2050 (BMU, Climate Action Plan 2050, Principles and goals of the German government's climate policy, 2016) and the Climate Action Programme 2030 (BMU, Climate Action Programme 2030, Measures to achieve the 2030 climate protection goals, October 2019). Similarly, the European Union has undertaken a commitment of reducing its greenhouse gas emissions by at least 40% by 2030 compared to 1990 with the Commission Implementing Decision (EU) 2020/2126 of 16 December 2020, implementing Regulation (EU) 2018/842 of the European Parliament and of the Council, OJ L 426/58.

https://doi.org/10.1017/glj.2024.31 Published online by Cambridge University Press

preserving the fundamental rights and the "intemporal liberties" (*intertemporale Freiheiten*) of the people affected by environmental degradation.[19] The inertia of the German Government is incompatible with the Basic Law.[20]

Much of the *Klimaschutz* judgment is, in fact, an argument from risk assessment, which ascribes consequences to a set of indicators that mark an "irreversible impairment" of the fundamental rights, for example, a fundamental right to property, minimum standards of existence, and others of future generations. According to the GFCC, if the German Federal Government does not undertake serious action towards greenhouse gas emissions, future generations will be condemned to "radical abstinence" and loss of rights for a lack of sufficient precautionary measures. For preventing this dramatic implication, the GFCC must act through a "dynamic protection" of fundamental rights (*dynamischer Grundrechtsschutz*).

A wealth of semantic triggers suggest a reading of the *Klimaschutz* judgment in terms of hypothetical scenarios. First, the Court recognizes that assessing the environmental impact of the German Government's policies is a decision taken under "risk";[21] second, the Court's analysis designs a "conceivable scenario" in which there is a "potential loss" for future generation;[22] third, specifically the GFCC's model focuses on a "warming scenario", a possible world whose probabilistic accessibility of scenarios is defined in terms of "medium confidence";[23] fourth, in determining the degree of confidence, the Court clearly presupposes the existence of a variety of scenarios with different degrees of probability, even though the decision explores only a small subset of these possible worlds, focusing on two scenarios in particular; fifth, the Justices explicitly characterize their argument as a future-oriented design when they state that the aim of the decision is to evaluate "forward-looking precautionary measures"; finally, the argument discusses more extensively the "levels of uncertainty" involved in their policy-impact assessment, distinguishing between "residual uncertainties", "significant uncertainties", and "strength of correlations." In assessing the possible future impact of anthropogenic climate change and establishing the causal links between the omissions of the German government and climate change, the Court is highly deferential to the analysis of the Intergovernmental Panel on Climate Change (IPCC), whose expert analyses are basically endorsed in the decision. All these points, which are central for our argument, require further elaboration.[24]

The GFCC derives from Article2(2) GG the Federal Government's objective duty (*eine objektivrechtliche Schutzverpflichtung*) to protect the life and health of future generations from the risks posed by climate change. Furthermore, the Court emphasizes that Article20a GG imposes on the State the obligation of achieving "climate neutrality" (*Herstellung von Klimaneutralität*). Sure enough, the interest in "climate neutrality" must be balanced with competing constitutionally protected interests and rights; however, the relative weight environmental protection increases as climate change intensifies. The Court recognizes that there is "uncertainty" on the causal inference between climate change and foreseeable consequences on future generations. Still, the GFCC argues that "sufficiently reliable indicators" suggests a possible scenario yielding serious and irreversible impairments. Thus, the Federal Climate Protection Act will probably fail to effectively mitigate $CO_2$ emissions and, accordingly, reduce the burdens imposed on younger generations after 2030.

Although this is not part of the decision, at a theoretical level, the conceptual core of the GFCC's forecast can be represented graphically through a cone of plausibility that plots the linear projection of the Court. The concept of plausibility is appropriate here as, strictly speaking, the

[19] *Klimaschutz* at para. 123.
[20] *Id.* at para. 114.
[21] *Id.* at paras. 114, 148.
[22] *Id.* at para. 118.
[23] *Id.* at paras. 160–62.
[24] *Id.* at para. 222.

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Court does not focus quantitatively on the probability of the two scenarios, but rather identifies, qualitatively, two plausible futures.[25]

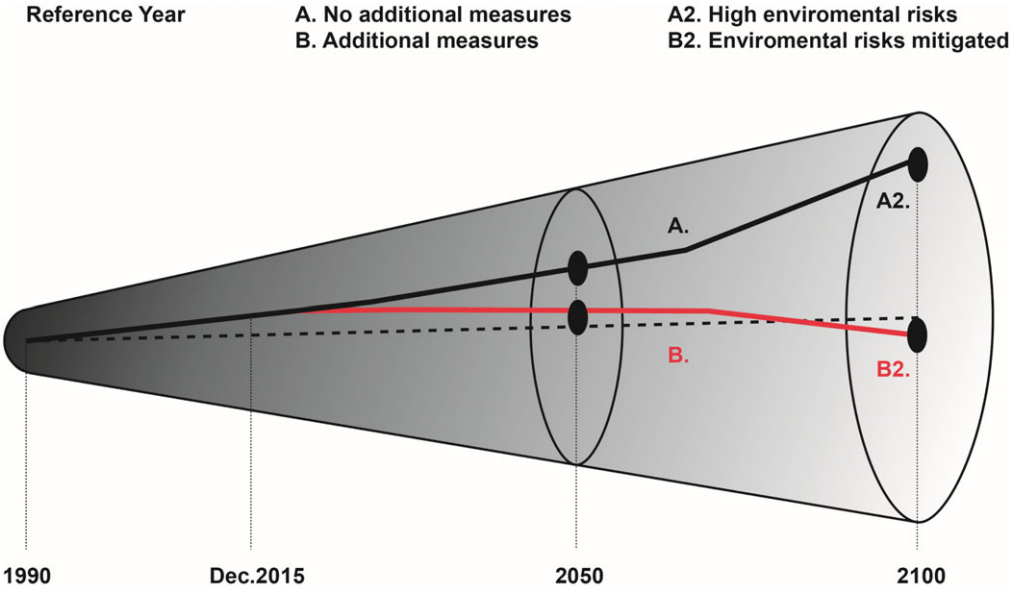


**Figure.** Authors' own elaboration of the cone of plausibility based on standard models

As the reconstruction through the cone of plausibility shows, the GFCC essentially compares two alternative scenarios: 'Scenario A', in which the German government does not take further additional measures for contrasting $CO_2$ emissions, which the Court calls "warming scenario"[26] and 'Scenario B', in which these measures are taken.[27] Finally, the Court infers a series of dramatic consequences under 'Scenario A' determined by the higher levels of $CO_2$ where omissive conduct is imputed to the government: The argument points out that data show with medium confidence there will be high environmental risks in Scenario A, such as, irreversible ice melting, which could be instead contained and mitigated in Scenario B.

The data used by the Court for evaluating the possible impacts of governmental policies on climate change vis-à-vis "the factual background of anthropogenic climate change" are extrapolated from the reports of the Intergovernmental Panel on Climate Change (IPCC), which the Court considers "reliable" (*zuverlässig*) for several reasons. This data is relied upon also by other institutions: The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), the Federal Environment Agency (*Umweltbundesamt – UBA*), the German Advisory Council on the Environment (*Sachverständigenrat für Umweltfragen – SRU*), the European Union, and several international agencies.[28] The Court considers the IPCC findings as an "objective" and "comprehensive representation" of climate change that provides "the basis for science-based

[25]As a theoretical point, it is debatable whether a Constitutional Court should limit itself to *plausibility* claims or instead engage in *probability* findings (*à la* 'Brandeis brief'). However, precise scenario analysis needs to some extent probabilistic considerations.

[26]*Klimaschutz* at para. 160.

[27]*Id.* at paras. 21, 160–62.

[28]*Id.* at paras. 17, 159.

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decisions."[29] The reliability of the IPCC data is also based on the interdisciplinary approach, the commitment to scientific values and transparency of the research—which also specifies the degree of confidence and the possible gaps and uncertainties of the findings—and the peer-review evaluation involved in the process.[30]

Generally, there is a unanimous consensus on the fact that atmospheric concentration of $CO_2$ has dramatically increased, and that greenhouse gases are the main cause of global warming.[31] The GFCC also emphasizes that there is a "nearly linear" relationship between greenhouse gas emissions and temperature increase.[32] Without effective measures, the temperature will probably increase by more than 3° by 2100, having a serious impact on ecological stability.[33] Furthermore, the frequency of extreme climate-related events such as floods, heat waves, ice melting, and storms will certainly increase also in Europe. The unconstitutionality of the Federal Climate Protection Act was therefore triggered by the inertia of the legislature, exposed by scenario analysis: "The legislator has violated fundamental rights by failing to take sufficient precautionary measures to manage the obligations to reduce emissions in ways that respect fundamental rights–obligations that could be substantial in later periods due to the emissions allowed by law until 2030."[34] Even if there is no actual violation of Article20a GG, the Federal Climate Change Act yields "disproportionate risk that freedom protected by fundamental rights will be impaired in the future."[35]

## C. The Building Blocks of Scenario Analysis

As the semantic triggers of the *Klimaschutz* decision suggest, the scenario analysis is front and center in the Court's argument. Scenario analysis is a complex form of strategic forecast under conditions of uncertainty or risk:[36] It designs models of future courses of events, in other words, ways in which the future might unfold, to explore salient expectations about the time to come. In other words, scenario analysis is "a description of a possible set of events that might reasonably take place. The main purpose of developing scenarios is to stimulate thinking about possible occurrences, assumptions relating these occurrences, possible opportunities and risks, and courses of action."[37]

This kind of future-oriented analysis presupposes at least a plausibility account, or, better, a probabilistic approach to dealing systematically with the impact of decision-making on possible futures. Notably, scenario analysis does not aim to predict the future with certainty, as this method rather examines different possibilities and their consequences to make decisions under uncertainty.[38] Financial institutions, economists, policy makers, and companies generally turn to scenario analysis to draw forecasts on possible developments of the market, for example, rapid

[29] *Id.* at paras. 16, 158–60.
[30] *Id.* at para. 222.
[31] *Id.* at paras. 19, 128–30.
[32] *Id.*
[33] *Id.* at paras. 21–28, 157.
[34] *Id.* at para. 182.
[35] *Id.* at para. 183.
[36] *See* FRANK KNIGHT, RISK, UNCERTAINTY, AND PROFIT (1921) (describing risk and uncertainty as different concepts, where risk is calculable probability and uncertainty is a state in which the decision-maker does not know how to assign probabilities). *See generally,* CASS R. SUNSTEIN, WORST CASE SCENARIOS (2009) (discussing the "maximin rule"). The maximin rule suggests the elimination of highly improbable scenarios—and, accordingly, also worst-case scenarios—in regulatory policy making and cost-benefit analysis. If applied to the *Klimaschutz*, the maximin rule would suggest not considering highly improbable scenarios such as unforeseeable technological developments. It would also justify the Court's (implicit) strategy of "eliminating" worst- and best-case scenarios to focus, instead, on "conceivable scenarios".
[37] Matthias Jarke, X. Tung Bui & John M. Carroll, *Scenario Management: An Interdisciplinary Approach*, 3 REQUIREMENTS ENG'G 155, 155 (1998).
[38] *See, e.g.,* KEES VAN DER HEIJDEN, SCENARIOS: THE ART OF STRATEGIC CONVERSATION 153–320 (2004); WADE WOODY SCENARIO PLANNING. A FIELD GUIDE TO THE FUTURE 26–208 (2012). *See also* Paul J.H. Schoemaker, *Scenario Planning: A Tool for Strategic Thinking,* 36 MIT SLOAN MGMT. REV. 25, 25–40 (1995).

https://doi.org/10.1017/glj.2024.31 Published online by Cambridge University Press

growth, moderate growth, slow growth, financial market returns for bonds, stocks and cash, product development, financial assets, bank exposures in short term, and, more broadly, for determining the potential economic consequences of their decisions.[39] The roots of this method for future craft can be traced back to the Manhattan project, which used Monte Carlo simulations to identify the possible scenarios caused by an atomic explosion, to the Rand Corporation, which designed MSA strategic method for the Pentagon,[40] and, finally, to SRI International, which developed scenario analysis for corporate planning.[41]

Designing a future scenario is a way of replying to a 'what if' question.[42] When applied to a policy impact assessment, scenario analysis responds to questions such as "If authority X endorses policy measure M, what would be the consequence of M for Scenarios $S_1$, $S_2 \ldots S_n$?" By designing multiple scenarios, decision-making is not constrained to *ceteris paribus* clauses anymore, and this plays a fundamental function in crisis management.

Although economists and scientists generally use quantitative or combined methods, mixing qualitative and quantitative approaches, scenario analysis does not necessarily contain quantitative analyses. The selection of indicators, the constructions of possible worlds, and the causation-correlations models can be, in principle, qualitative, or based on an intuitive application of probabilistic considerations, or, in other terms, on plausibility claims. Scenario analysis has been also widely used in environmental impact assessment (EIA), for impact forecast on climate.[43]

In social sciences, scenarios are understood as realistic—namely, non-fictional—sequences of events, or the development of possible states of the world including information about single events, individuals, timeframes, locations, actions, and consequences/outcomes. To put it roughly, scenario analysis offers a picture of the riskiness of a choice, policy, or asset decision across possible future worlds. This intellectual activity of imaginative design can be useful for minimizing the drawbacks of a decision. Already at this point it is quite apparent why the GFCC turned to scenario design in the *Klimaschutz* decision: The Court was evaluating the constitutionality of a statute based on its potential long-term negative consequences on the environment and individuals. This assessment is far from being entirely objective. Scenario analysis cannot be reduced to a *simple* forecast or *trend analysis*,[44] for "it embraces a variety of techniques to create well-grounded menus of choices about the future by describing and studying alternative possibilities."[45]

Decision-makers must make several epistemic and normative choices for performing a possible scenario assessment.[46] This is precisely what the GFCC attempted to do. Robust scenario analysis is based on sound statistical reasoning, which considers variability within single scenarios and possible relations between scenarios. In general, decision-makers performing this kind of future-oriented impact assessment evaluate strategies and outcomes based on a possible narrative made of conditional probability distributions.

To illustrate the negative impact of the Federal Climate Protection Act, the GFCC, too, develops a *narrative*—namely, an explanation of a chain of multiple events—for assessing the risk

[39]*See* Eric K. Clemons, Steve Barnett & Jaron Lanier, *Fortune Favors the Forward-Thinking*, Fin. Times (2005).

[40]The original Rand Corporation's Report (1973) considered scenario analysis not as "a predictive or operational tool" but as an "interdisciplinary" method for "crisis management" in decision-making. *See* Peter DeLeon, Scenario Designs: An Overview (1973).

[41]Lee A. Gilbert, *Using Multiple Scenario Analysis to Map the Competitive Futurescape: A Practice-based Perspective*, 11 Competitive Intel. Rev. 12, 13 (2000).

[42]Schoemaker, *supra* note 38, at 25.

[43]*See generally,* Peter N. Duinker & Lorne A. Greig, *Scenario Analysis in Environmental Impact Assessment: Improving Explorations of the Future*, Env't Impact Assessment Rev. 27, 206 (2007). *See also* Jia Liu, Wenying Chen & Deshun Liu, *Scenario Analysis of China's Future Energy Demand Based on TIMES Model System*, 5 Energy Procedia 1803 (2011).

[44]*See generally,* John Naisbitt, Megatrends: Ten New Directions Transforming Our Lives (1982).

[45]Duinker & Greig, *supra* note 43, at 207.

[46]Schwartz, *supra* note 7.

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connected to this governmental policy.[47] Therefore, the Court's argument outlines a probability weighted *likely* scenario. Under a condition of uncertainty, the argument advances *expectations* about future events concerning climate change based on the data provided by the experts and the hypotheses entertained by the Justices. An inference from *possible* futures is also used by the Court for evaluating the precautionary measures currently endorsed by Germany and the protection or enforcement of Fundamental Rights over time.

It is worth noting that the expectations of the GFCC seem to be *exogenous* rather than *endogenous,* as they are primarily borrowed from expert opinions that are not entirely transparent to the Court. Clearly there is an asymmetry of knowledge between the GFCC, composed by individuals who studied law and the experts of the IPCC, formed by professional scientists. To be sure, this does not exclude the possibility that the Justices have some personal beliefs about climate, either firm or open to revision, based on some heuristics and biases. Still, the Court's forecast adheres closely to the opinions of the IPPC, even though the Justices seem willing to offer independent confirmation of the expert's conclusions with an adaptive extrapolation through induction from observed events, shared knowledge, and maxims of experience.

Of course, one can be skeptical about the very possibility of possible scenarios. However, it is worth stressing that the skeptical take against possible scenarios might be the result of a misconception, which looks at possible scenarios as if they were "purely metaphysical constructions." We do not see it in this uncharitable way: A possible scenario—or possible world—can also be understood as a test for counterfactual reasoning. Namely, a set of propositions which offers a maximal consistent world description. If I say, "in a possible world, event *E* will probably happen," I simply mean that there is an imaginary situation—a conceivable scenario—where event *E* can happen. This scenario is given by the descriptive conditions we associate with it,[48] which, in turn, can be conceived as stipulations controlled by probabilistic reasoning and cognitive filters that select the salient properties the decision-maker should variate to design possible scenarios or possible worlds. In Kripke's words: "'Possible worlds' are *stipulated*, not *discovered* by powerful telescopes."[49]

## D. The Basic Argumentative Steps

As explained above, scenarios are reliable sequences or development of possible states of the world. States of the world are generated through probabilistic reasoning starting from an initial set of data—field data or experimental data—and baseline assumptions. There are different models for scenario design.[50] However, we submit that they share a common *inferential* scheme which spells out the semantic potential of the 'what if' clause, even when applied intuitively. The inferential patterns used for carrying out scenario analysis in social sciences include the following.[51]

### *1. Selection of the objective, domain, sample, stakeholders, and indicators*

The first step of scenario analysis consists in identifying the research objective or the question that shall be addressed, the key factors, and critical uncertainties. For example, in the GFCC's decision the domain is the Federal Climate Protection Act and its potential implications; the Court focuses

[47] *See, e.g.,* Robert J. Shiller, Narrative Economics (2017), https://projects.iq.harvard.edu/files/pegroup/files/shiller2017.pdf.

[48] Saul Kripke, Naming and Necessity 44 (1980).

[49] *Id.*

[50] Edward Cornish, Futuring: The Exploration of the Future 93–112 (2004).

[51] Dough Randall & Chris Ertel, *Moving Beyond the Official Future*, Fin. Times Special Reps.: Mastering Risk (2005). *See also* Aaker & McLoughlin, *supra* note 11, at 87; Cornish, *supra* note 50, at 128–172; Saskia Sardesai et al., *Future Scenarios for Supply Chains*: *Scenario Planning for the Generation of Future Supply Chains* (2019), https://www.iml.fraunhofer.de/content/dam/iml/de/documents/101/12_Whitepaper_NextNet_web.pdf.

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on the impact on climate and human life and it disregards other kinds of impacts, such as economic ones; the sample, although not well defined, includes primarily Germany and a few Asian Countries; and the result indicators include, among others, temperature, percentage of $CO_2$ emissions, the frequency of extreme climate events such as floods. The scenarios considered in the analysis will reflect "a range of values for all key indicators and variables."[52] Furthermore, the scope of a scenario depends upon the form of the 'what if' question addressed by the decision-maker: Open-ended questions favor wide scope scenarios, whereas constrained questions favor narrow-scope scenarios.[53] Result indicators are generally defined as quantitative or qualitative variables that show, or measure, changes, achievements, impacts, and results of strategies—for example, a business plan or a series of measures for reducing criminality—and actions. There are several taxonomies that distinguish types of indicators. A simple taxonomy distinguishes input indicators, process and monitoring indicators, outcome indicators, and impact indicators. Determining the indicators for structural variables involves different levels of uncertainty, as some indicators are more or highly predictable, for example, the definition of U.S. borders next year, and other are less predictable or essentially unpredictable, for example, the possible development of cryptocurrencies in 2040.[54] In the *Klimaschutz* decision, the input indicators and salient properties range from the global output of the powerplants and factories, to the response of other States and institutional actors, and to the possibility of new technologies for contrasting $CO_2$ emissions and producing energy. In general, analysts tend to isolate a limited number of critical factors and indicators. The sample selection, too, is fundamental for avoiding "garbage in/garbage out" phenomena derived from sampling biases: The samples must be representative, obtained randomly, etcetera. As for the impact indicators, the Court is interested in assessing "possible future losses of freedom" to determine whether the burden imposed on future generation by the Federal Climate Protection Act violates the principle of proportionality.[55] When decision-makers deal with complex macro-social systems, such as in this case, the identification of stakeholders is puzzling, as the spectrum of reference groups might be broad.[56]

### 2. Determining the number and framework of the scenarios to analyze for each factor

During this second phase, the decision-maker defines the logic of the scenarios using mental matrices. The analyst develops alternative scenarios that represent possible futures by playing with key factors. These scenarios must be plausible, internally consistent, and based on realistic assumptions. Both the timeframe and the extension of a possible future are determined. The larger the timeframe is, for example, near-term, or long-term, the higher is the level of uncertainty. For instance, long-term business disruptions are almost impossible to predict.[57] Generally, establishing the number, scope, and framework of scenarios is an operation that requires a set of strong assumptions about states of the worlds, including grow rates, geopolitical framework, technology development, energy costs, availability of raw materials, and so forth.[58] We will return to this point below.

The number and complexity of scenarios may vary depending on the question and the level of accuracy desired. The decision-maker may also present the key assumptions underlying the scenario in varying degrees of detail. The analyst here faces a methodological dilemma:

[52]Gilbert, *supra* note 41, at 14.

[53]Liam Fahey, *Competitor Scenarios*, 31 Strategy & Leadership 32, 33–44 (2003).

[54]Gilbert, *supra* note 41, at 14.

[55]*Klimaschutz* at para. 189.

[56]*See, e.g.*, David Nunn, *Scenario Analysis as a Background for Important Energy Policy Decisions* 11 Eur. J. Operational Rsch. 276, 278 (1982).

[57]Hugh Courtney, *Decision-driven Scenarios for Assessing Four Levels of Uncertainty*, 31 Strategy & Leadership 14, 16–22 (2004).

[58]Nunn, *supra* note 56, at 279.

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Considering a higher number of scenarios provides a more realistic and granular assessment but collecting information and differentiating between scenarios becomes harder. Conversely, working with a limited number of scenarios provides less realistic outputs but the process is easier to handle. In the case of climate, an estimate that focuses only on variations of two or three factors, for example, the presence or absence of a certain policy and the impact on the German territory, disregarding other factors, for example the possible conducts of other countries, such as China and India, is easier to perform, although the forecast might be unrealistic and off the track. Conversely, selecting twenty, thirty, or hundreds of scenarios, built through variations on multiple parameters, is much more complex but yields more accurate and granular estimates. Consider also that some indicators—for example economic growth, interest rates, and so forth—are difficult to analyze. This yields further complexity in scenario analysis. In the *Klimaschutz* decision, the GFCC focuses mainly on the German territory, considering *inter alia* groundwater formation, the effect of global rise of sea level on coastal towns, and the impact of dryness on soil of specific areas, for example, the Rhein-Main Region.[59] From observations about the present negative effects of $CO_2$ emissions, the Court forecasts what would be their devastating effect in the future, which shows the urgency of "a climate-neutral behavior."[60]

### 3. Baseline survey for elaborating the baseline scenario, in other words, an initial study of projection, possibly using assignments, for example, selecting randomly territories, groups of individuals, etc.

The distance between the baseline scenario and other possible futures is given by degrees of probability that, in turn, are a function of the pertinent indicators. In the *Klimaschutz* decision, the initial survey of the GFCC suggests that Germany historically has produced 4.6% of greenhouse gas emissions and is currently responsible for almost 2% of current emissions.[61] Taking cues from IPCC's analysis, the argument examines possible discrepancies in data, degree of reliability, and likelihood of the $CO_2$ emission impact estimates.[62] The Court also reviews the remaining emission budget, expressed in gigatons.[63] The Court duly reconstructs the relations between the 55% $CO_2$ reduction goal for 2030 and the expected impact on temperature, and infers from the uncertainty of precisely determining the distribution of $CO_2$ budget between the pre-2030 period and post-2030 period a *contributory reason* for endorsing a precautionary approach.[64] However, the Court does not perform a random assignment, although that was, in principle, possible. It does not consider the impact on people with different ages or health conditions, nor does it differentiate between impact in Germany and other countries. Still, the Court's baseline survey shows the urgency of implementing more effective $CO_2$ containment strategy. Even though the Justices concede the difficulties of setting precise standards, the legislators must, instead, "create the underlying conditions and incentives" for reaching climate-neutrality.[65]

### 4. Determining the causal relations within and across possible futures

Scenario analysis is typically used by decision-makers to evaluate the possible consequences of their choices. To this purpose, one might wish to determine, given background information, the effects of a certain policy, filtered through the technology and knowledge available at a specific

[59] *Klimaschutz* at paras. 25–27.
[60] *Id.* at paras. 186–87.
[61] *Id.* at para. 29.
[62] *Id.* at paras. 224–38.
[63] *See* Gelinsky & Fuchs, *supra* note 10 (explaining that the GFCC mentions the foreign precedent *Urgenda* for supporting the use of scientific concepts, such as the budget approach, in the analysis).
[64] *Klimaschutz* at paras. 242–48.
[65] *Id.* at paras. 248–89.

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point in time or in each world. In *Klimaschutz,* for instance, the Court carried out this form of reasoning, drawing a forward-looking causal chain. First, increases in temperature lead to extreme events, for example, heat waves, floods, ice-melting, loss of property and stable community relations.[66] Second, due to the vulnerability of humans to climate change, extreme events have an impact on their health, for example, intensification of symptoms related to respiratory and cardiovascular illness.[67] Therefore, when the Court does not establish causal links, the Justices still aim at showing "direct correlation" and "linear correlations" between indicators and effects, such as—for example—maximum warming or temperature targets and global warming[68] or level of warming and emitted $CO_2$ quantities.[69] The GFCC infers consequences also beyond the German territory by recognizing that the *status quo* legislation will probably generate losses of freedom in Asian countries, such as Bangladesh and Nepal, whose citizens will probably struggle to cope with the environmental situation after 2030.[70] In its reasoning, the Court also considers that in a scenario where climate change progression proceeds unconstrained following the current trend adaptive measures would be insufficient to protect health and curb serious or catastrophic effects on natural and human systems.[71]

### 5. Stress test analysis

To confirm their hypotheses, decision-makers perform stress tests, simulating the impact of adverse scenarios on a specific strategy, choice, or policy. As a stress test, the Court briefly addresses the situation in which Germany's efforts to reduce $CO_2$ are in vain.[72] Taking cues from the consideration that Germany is responsible of 2% of the global emissions, and that climate neutrality can be achieved only through a global effort, the GFCC holds that Germany is still under legal obligation to do its part also in the worst case. It is worth noticing that this conclusion does not necessarily follow from the "worst case scenario." The Court might have considered that the obligation to endorse an effective climate policy is conditional upon the commitment of the international community to endorse similar policies and is thus suspended if the German governments realizes that, due to a lack of cooperation, the efforts made by the Germans are largely ineffective.

### 6. Inferring results, by assigning probability to each scenario, and connecting results to strategies like actions, policies, general directions

In the final step, the different scenarios, probabilistically distributed, are coupled with potential strategies for deciding which strategy offers the *best response*—or which strategy is *optimal*—given the goals of the decision-makers, background contextual assumptions, and the strategies chosen by other players within a specific scenario. The circumstance of evaluation includes past knowledge and background information about the pertinent domain. If only a few scenarios are evaluated, then the probability of each scenario does not exhaust the full range of possibilities. Determining the probability of a possible scenario is as complex as establishing a causal relationship within a scenario: In both cases, the decision-makers must consider "a rich combination of different variables."[73] The GFCC, for instance, focuses on a "plausible scenario" and infers that only an intense strategy of "carbon dioxide removal" (CDR) would be effective.

[66]*Id.* at paras. 171–73
[67]*Id.* at paras. 21–270.
[68]*Id.* at paras. 35, 165–66.
[69]*Id.* at para. 36.
[70]*Id.* at paras. 90, 173–81.
[71]*Id.* at paras. 156–66.
[72]*Id.* at para. 202.
[73]Aaker & McLoughlin, *supra* note 11, at 88.

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Then, it couples this scenario with a best response or best strategy: The State has the obligation to make the necessary efforts to prevent catastrophic conditions and take the precautionary measures "that are sufficient to respect future freedoms,"[74] first and foremost the fundamental right to an ecological minimum standard of living. Eventually, the GFCC turns to causal inference to determine the scope of the constitutional duties to protection imposed on the government, which—unlike "defensive obligations" in other words, rights that prohibit peculiar forms of conduct—are "essentially unspecified."[75]

The inferential steps just examined can be schematized as follows:

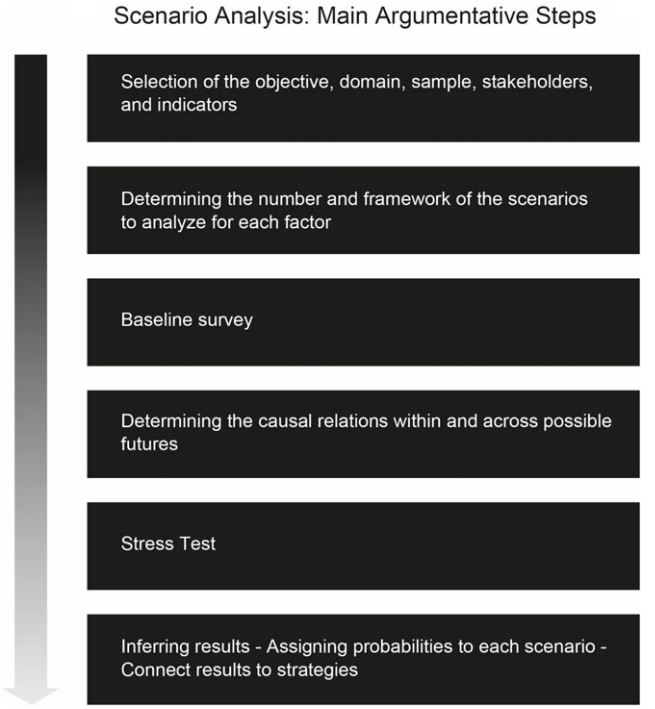


**Figure.** Authors' own elaboration of the main steps in scenario analysis

It is worth underlying that this Section has analyzed the minimal set of inferences involved in a, mostly, qualitative version of scenario analysis, such as the one performed by the GFCC. More refined models include additional steps, such as pre- and post- sample comparison, estimation of variance,[76] cross-impact analysis,[77] use of control groups, revising conflicting data, eliminating redundancies, using other data-validation procedures—'cleaning' the model—or handling data gaps by modelling or other extrapolations to name only a few. Moreover, the result of the scenario analysis can be updated, refined, and reevaluated over time. One can reconstruct scenario analysis as a qualitative method, but the use of sophisticated quantitative

[74] *Klimaschutz* at para. 123.

[75] *Id.* at para. 153.

[76] *See generally,* Giovanni Lafratta, *Efficiency Evaluation of MEV Spatial Sampling Strategies: A Scenario Analysis*, 50 Computational Stats. & Data Analysis 878 (2006).

[77] Ayami Hayashi et al., *Narrative Scenario Development Based on Cross-Impact Analysis for the Evaluation of Global-Warming Mitigation Options*, 83 Applied Energy 1062 (2006).

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tools, for example, multivariate regressions and Monte Carlo simulations, is quite common in both economics and data science.

## E. Evaluating the Court's Argument

The use of scenario analysis in the *Klimaschutz* decision has some relevant implications from the perspective of legal reasoning and legal argumentation. The Court promotes an enhanced version of the proportionality test, which is shaped as a future-looking 'what if' reasoning. This kind of reasoning allows to strike a balance among fundamental rights with an eye to "advance interference-like effect" of current policies on the fundamental liberties of individuals.[78] Accordingly, constitutional principles, such as Article20a GG, are seen as truly "eternal entities" which project their effects into possible futures and operate an even distribution of burdens over time. As it was shown elsewhere,[79] this trend was somehow implicit, although not fully developed, in previous balancing cases, such as the landmark *Tabak Entscheidung*.[80]

By breaking down the inferential patterns of the proportionality judgment on the constitutionality of restrictive measures on the sale of tobacco products, one realizes that the GFCC did not determine the negative effects produced by tobacco consumption based on a "mono-causal relationship" between, on the one hand, smoking and, on the other, lung cancer and coronary diseases. Instead, the causal inference was based on the assessment of the potential risks and benefits of scenarios in which persons either quit or keep smoking.[81] Each possible course of action was associated by the Court with specific consequences on health, whose degree of risk is understood in probabilistic terms, and whose level of harm is ranked in a three-value scale: 'Light', 'moderate', and 'serious.' In other words, "balancing requires the use of an argument from comparative consequence" which justifies a crucial premise of the balancing argument, "stating the degree of non-satisfaction of (principle) P1 or interference with (principle) P1" for the benefit of P2.[82] The argument from comparative consequence, in turn, presupposes the construction of "hypothetical or counterfactual arguments,"[83] which the Court uses for assessing the hypothetical consequences associated with alternative regulatory approaches.

It may be tempting to consider that scenario analysis has, after all, always been implicit in German fundamental rights doctrine. Particularly in *prima facie* rights to positive action, possible courses of action are identified by a kind of teleological method, in other words, possible empirical consequences are first identified and secondly legally evaluated. Scenario analysis becomes clearer when long periods of time are considered, and the court unfolds various possible futures. However, even if this should be correct in principle, the climate change decision must still be considered disruptive because the scenario analysis—often future-oriented—becomes fully explicit and conscious for the first time in the Court's reasoning. The assessment of possible futures is carried out in an informed and deliberate manner that draws extensively on impact assessment. This is clearly unprecedented.

The constitutional right to intertemporal protection of liberty is also a highly innovative construction. The Court's main concern is that future generations will bear a heavier and more disproportionate burden than the present population: This is the core of intertemporal equality, which is necessarily linked to the evaluation of future scenarios. The disruptive nature of climate

[78]*Klimaschutz* at paras. 182–83.

[79]Damiano Canale & Giovanni Tuzet, *Can Constitutional Rights Be Weighed? On the Inferential Structure of Balancing in Legal Argumentation?* 20 Ius Dictum 2, 5–14 (2020).

[80]BVerfG, 2 BvR 1915/91, Jan. 22, 1997.

[81]Canale & Tuzet, *supra* note 79, at 10.

[82]*Id.*

[83]Canale & Tuzet, *supra* note 79, at 11.

https://doi.org/10.1017/glj.2024.31 Published online by Cambridge University Press

change mitigation is also evident in the Court's failure to follow the robust line of precedent on equity rights. In this decision, scenario analysis prevails over both precedent and traditional interpretive methods, although it is not entirely clear whether the new construction—intertemporal protection of liberty—is understood by the Court as a negative or a positive right.

Yet, the scenario analysis carried out by the GFCC in the *Klimaschutz* case is oversimplified and imprecise. We agree with the outcome of the decision: The climate emergency is undeniable, it poses a risk to humanity, and it is one of the greatest global challenges facing governments, states, and international organizations. We are all called upon to act now, to reduce $CO_2$ emissions and help fight the climate crisis. We also do not reject the method: Scenario analysis can be a valuable tool for analyzing policy implications. One possible criticism addresses the oversimplified way in which scenario analysis is used. Above, we tried to show how complicated this technique is, even if applied without quantitative methods, and how much uncertainty exists at each step of the process. Therefore, the reasoning process should be more precise and more robustly justified, especially when applied to highly complex issues such as climate change and $CO_2$ reduction and overturning parliamentary majorities.

In the *Klimaschutz* case, the Justices focus only on some scenarios: for instance a "conceivable scenario" where the policies are not implemented and climate change has serious effects; and "another conceivable scenario," in which "adaptation measures would have to be so extreme that they would no longer allow for meaningful social, cultural, and political interaction and participation."[84] Furthermore, the game-theoretic dimension is entirely neglected: The possible moves of other major States are completely overlooked. This approach opens the door to several criticisms. First, there are significant temporal and spatial variations in exposure to climate-related events and different economic, social, and demographic impacts based on time and place. Precise forecasts must consider a large amount of data on possible demographic changes in population change and density, location identifiers, and economic productivity indices. For instance, how could one estimate the impact of German policies on Asian countries without considering possible demographic changes caused by extreme climate events, such as a slowdown in population growth or displacement phenomena connected to climate migration? Social scientists generally use sophisticated regression models that map these variables over time and space. Instead, the GFCC here plays fast and loose. Second, sound scenario analysis proceeds through the assessment of multiple scenarios, ranging from the best to the worst, varying the assumption of the main variables involved in the scenario. As Duinker and Greig have pointed out, "scenario-based work is most powerful when several alternative scenarios are created and analyzed, and each should provide significant contrast from the others."[85] In this respect, the GFCC could have endorsed a more fine-grained analysis, distinguishing, for example, a high growth scenario, an average growth scenario, and a low growth scenario through multiple scenario analysis (MSA).[86]

Also, the Court does not include in its analysis the possible strategies endorsed by the countries that have the highest levels of pollution and $CO_2$ emissions, for example, China. What would happen in a scenario in which China becomes a partner in curbing $CO_2$ emissions? What would happen, instead, in a possible scenario in which China increases production without any

[84] *Klimaschutz* at para. 114.

[85] *See* Duinker & Greig, *supra* note 43, at 211.

[86] To be sure, the Court considers *en passant* a worst-case scenario, for example assessing the impact of the policy at the worst feasible outcome. Still, the Judges do not reckon with the *best-case scenario,* in other words assessing the impact of the policy at the best feasible outcome, nor take they into consideration possible alternative results to the two previously outlined. On the problems faced by the proportionality test in situations of uncertainty, *see* Matthias Klatt & Johannes Schmidt, *Abwägung unter Unsicherheit*, 137 Archiv des öffentlichen Rechts 545 (2012).

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environmental precaution? The GFCC, on the one hand, was very careful in building evidence-based, likely, and consistent scenarios, but, on the other, overshadowed the fundamental role of socio-political and economic drivers,[87] for example geopolitical strategies, shifts in the market forces, and possible development of new technologies, to name only a few. These elements seem to be treated as *constants* across possible future worlds, which is quite misleading.

As hinted above, the Justices could have included strategic considerations into the decision by relying on game-theoretic tools. The GFCC could have designed a wider range of possible scenarios by combining two or more variables. For example, the argument could have at least combined the level of emissions with the severity of their impact, resulting in nine different, and more accurate, scenarios: (A) Low Emissions – Low Climate Impacts; (B) Moderate Emissions – Low Climate Impacts; (C) High Emissions – Low Climate Impacts; (D) Low Emissions – Moderate Climate Impacts; (E) Moderate Emissions – Moderate Climate Impacts; (F) High Emissions – Moderate Climate Impacts; (G) Low Emissions – High Climate Impacts; (H) Moderate Emissions – High Climate Impacts; (I) High Emissions – High Climate Impacts. These combinations of emissions and impacts can be represented through the following matrix:

| | Low Emissions | Moderate Emissions | High Emissions |
|---|---|---|---|
| Low Climate Impacts | Scenario A | Scenario B | Scenario C |
| Moderate Climate Impacts | Scenario D | Scenario E | Scenario F |
| High Climate Impacts | Scenario G | Scenario H | Scenario I |

**Figure.** Authors' own elaboration of nine different GFCC scenarios

Of course, all these scenarios are conceivable. For example, the development of new technologies could lead to Scenario B, in which emissions are moderate and climate impacts are low. In contrast, reckless behavior by China and the U.S. in terms of $CO_2$ reduction could lead to Scenario G, in which climate impacts are high, even though Germany has low emissions. Combating climate change is a coordination problem that affects the entire global community, not just Germany.

Of course, this is just a simplified snapshot of how scenario analysis can be refined: The analyst, in this case the GFCC, should consider a whole range of variables that affect the reduction of $CO_2$ emissions—change in consumption habits, improvement in energy efficiency, carbon price, share of renewables, to name a few—to create a more structured and complex framework that allows multivariate analysis.

In addition, we can assign a numerical value to each combination of variables, in other words, each scenario that represents the payoffs that the analyst associates with the scenario outcomes

[87]Paul J.H. Schoemaker, *Twenty Common Pitfalls in Scenario Planning, in* Learning from the Scenarios: Competitive Foresight Scenarios 422, 422–31 (Fahley & R.M. Radall eds., 1998).

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based on expected utility functions. This process can be represented by adding the expected utility—or, in this case, negative "disutility" values—to each cell of the matrix as follows:

| | Low Emissions | Moderate Emissions | High Emissions |
|---|---|---|---|
| Low Climate Impacts | Scenario A (-1,-1) | Scenario B (-1,-2) | Scenario C (-1,-3) |
| Moderate Climate Impacts | Scenario D (-2,-1) | Scenario E (-2,-2) | Scenario F (-2,-3) |
| High Climate Impacts | Scenario G (-3,-1) | Scenario H (-3,-2) | Scenario I (-3,-3) |

**Figure.** Authors' own elaboration of numerical values being added to the GFCC scenarios

For example, Scenario A is preferable because the payoffs are higher: We have both low emissions and low climate impacts. The least favorable scenario is Scenario I, in which we have both high climate impacts and high emissions.

It should be noted that the value associated with each payoff depends on the utility function considered. For example, "reckless tycoons" might prefer Scenario C to Scenario A, where they can pollute the environment with low climate impacts, and attribute higher utility to the payoffs in Scenario C. Either way, the payoffs depend on both the economic model and the qualitative/quantitative data collected. For example, Horizon Scanning can be used to build an economic model to predict environmental trends and changes,[88] and the model, in turn, is used to analyze data such as reports and statistical metrics.

The GFCC could have done more to introduce a sound methodology for 'strategic foresight', considering that the decision concerns such an uncertain and complex issue as climate change. In particular, the GFCC overlooks several fundamental variables that economists and data analysts typically consider in scenario analysis using frameworks such as the so-called PESTLE methodology.[89] The acronym PESTLE stands for political, economic, sociocultural, technological, legal, and environmental factors. For example, macroeconomic variables such as the stability of the Chinese government, cultural trends as the development of new social norms on energy consumption, and technological factors clearly influence the future course of climate change.

The potential actions of governments can be examined using game theory. For example, the gains associated with the German decision to reduce $CO_2$ emissions even further depend largely on strategic interactions with other countries' reduction policies. Again, this can be illustrated using a simplified matrix:

[88]Effie Amanatidou et al., *On Concepts and Methods in Horizon Scanning*, 39 Sci. Pub. Pol'y 208, 210–16 (2012).

[89]*See, e.g.,* Maria José Casañ, Marc Alier & Ariadna Llorens, A *Collaborative Learning Activity to Analyze the Sustainability of an Innovation Using PESTLE*, 13 Sustainability 8756, 8758–71 (2021).

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| Germany/China | Low targets x < 2° | Moderate targets x = 2 to 4° | High targets x > 4° |
|---|---|---|---|
| Low targets x < 2° | (-5-5) | (-5,-3) | (-5,-1) |
| Moderate targets x = 2 to 4° | (-3,-5) | (-3,-3) | (-3,-1) |
| High targets x > 4° | (-1,-5) | (-1,-3) | (-1,-1) |

**Figure.** Authors' own elaboration of GFCC scenarios

This shows that the German Court focuses only on one "conceivable" scenario, without considering optimistic, pessimistic, and most likely alternative futures as outlined in the matrix. Furthermore, the Court overlooks both the strategic dimension of the decision and the PESTLE variables. To be sure, the Court seems to also consider the option in which the increase of temperature by 2050 is lower than expected, namely, less than 3°, even without additional measures, emphasizing that, also in these cases, the consequences will be dramatic.[90] The Court then addresses very quickly the necessity of a strong international cooperation and the technical feasibility of the measures, two salient parameters that should have played an essential role in designing possible futures that are probabilistically accessible, as well as a ranking of future scenarios based on probability distributions.

In sum, using scenario analysis in the context of climate necessarily involves high levels of complexity, as the issue involves risks that are continuous, in other words, non-discrete, sequential or "multi-stage"—event *a* is conditional upon *b* which in turn depends, or is conditional upon, *c* and *d*—and long-term so that the expected outcomes depend on a large set of variables. On the contrary, the Court explores only two decisional paths, and considers sufficient the analysis of one single plausible scenario, which "cannot be ruled out", for establishing a breach of fundamental rights. This is the scenario in which the members of the younger generations, such as the complainants, "will see climate changing advancing to such a degree in their own lifetime that their rights protected under Article2(2) first sentence GG and Article14(1) GG will be impaired."[91] Why did the Court not carry out a more extensive and articulate investigation of the way the world might turn out to be as a result of Germany's climate policy? Based on what we have observed so far, it is apparent that the Court was essentially interested in "minimizing the risk" of throwing an excessive burden on future generations,[92] and preventing "an absolute level of unreasonableness."[93] In the *Klimaschutz* decision, therefore, the standard endorsed by the GFCC for human rights protections is not a but-for causation, or "current harm," but a, lower, "significant risk" standard, which the Court considers satisfied even if there is only a possible scenario in which the conduct of the German government does not favor the reduction of $CO_2$ emission beyond a specific level. The significant risk of an "absolute level of unreasonableness" (*absoluter Unzumutbarkeit*) in compressing future freedom is a sufficient reason for imposing

[90] *Klimaschutz* at paras. 22, 245.
[91] *Id.* at para. 108.
[92] *Id.* at paras. 194, 220.
[93] *Id.* at para. 194.

https://doi.org/10.1017/glj.2024.31 Published online by Cambridge University Press

constitutional constraints in the actual choices of the legislature.[94] Even if the causal relations are uncertain, the Constitution imposes on the legislature a "special duty of care."[95]

## F. Taking Stock

We have outlined how the GFCC relies on scenario analysis to assess the increased risk of serious loss of liberty due to the ineffectiveness of the 2019 Climate Protection Act in setting appropriate $CO_2$ reduction targets. To explain the "encroachment-like prior effect" (*eingriffsähnliche Vorwirkung*) on fundamental liberties, the Court conducts an impact assessment that imagines possible futures. This decision introduced a new understanding of Article20a of the Basic Law, which is interpreted as a benchmark for future legislative action and a platform for intergenerational justice, the basic application mechanism of which is proportionality. The burdens of climate change must not be imposed disproportionately on future generations. In the *Klimaschutz* case, the GFCC carried out the proportionality test by means of scenario analysis, which seems well suited to forecast and evaluate the level of infringement of fundamental rights which is likely to take place because of the present climate policy in Germany. Scenario analysis is conceptually linked to the fundamental right to intergenerational equity, which requires an assessment of the potential long-term impacts of policies to protect the fundamental interests and rights of future generations.

Then, we briefly explained the core of the scenario analysis and decomposed this decision-making process into several argumentative steps. Scenario analysis involves designing alternative hypothetical worlds to analyze how they relate to a particular policy, strategy, or decision, and weighing the potential consequences—benefits, risks, and losses—associated with different circumstances. In this respect, we have seen that the scenario analysis carried out by the GFCC, although correctly articulated, is oversimplified and imprecise, as the Court does not adopt a full-fledged multiple-scenario approach and a multivariate, game-theoretic analysis. Is this entirely wrong? The simplified path of reasoning followed by the Court finds its justification in the risk adverse attitude of the GFCC. According to the Justices, the existence of even one possible scenario in which the current climate policy unreasonably compresses the fundamental rights of future generations makes it the case that that policy is in breach of Article20a of the Basic Law. Irrespective of the evaluation of that decision, we he have argued that the inferential structure of scenario analysis is useful in explaining the semantic potential of the fundamental right to intergenerational justice and, accordingly, the mechanisms underlying its concretization and application in constitutional decisions.

Constitutional obligations are generally obligations of all branches of government—that is, the task of scenario analysis is primarily the task of the democratically legitimized legislature. Should the constitutional court merely review the legislature's decision without making policy decisions or should it engage in policy analysis? A high degree of uncertainty is usually cited as an argument in favor of broad legislative discretion. In the context of climate change, scenario analysis is instead used to assess the future impact of legislative decisions under conditions of risk and uncertainty and to impose greater constraints on legislatures.

**Acknowledgments.** The authors wish to thank Martin Borowski for helpful comments on an earlier draft.

**Funding Statement.** No specific funding has been declared for this article.

**Competing Interests.** The authors declare none.

[94] *Id.* at paras. 194–95.
[95] *Id.* at para. 229.

**Cite this article:** Tuzet G, Canale D, and Sardo A (2024). Scenario Analysis in Karlsruhe: Exploring New Argumentative Steps of the Federal Constitutional Court. *German Law Journal*, 1–19. https://doi.org/10.1017/glj.2024.31

https://doi.org/10.1017/glj.2024.31 Published online by Cambridge University Press