Supplementary Materials

Table A: Advantages and disadvantages of adopting a Complex Adaptive Systems Theory, Soft Systems Modeling and a Systems Thinking approaches **(extension Table 1)**

Approach	**Advantages**	**Disadvantages**
Complex Adaptive Systems (CAS) Theory	*Adaptability*: CAS Theory highlights the adaptability of systems to changing environments, which is relevant for dynamic and uncertain situations. *Emergent properties:* CAS Theory recognizes the fact that complex systems exhibit an emergent behavior, which allows for a deeper understanding of the system. *Non-linearity:* It considers the non-linear relationships and feedback loops within systems, providing insights into how small	*Complexity:* Dealing with complex adaptive systems is challenging, and modeling them accurately may be computationally intensive. *Lack of prescriptive solutions:* CAS Theory often focuses on understanding and describing the system rather than providing clear solutions, which can be a limitation in practical applications. *Data requirements:* It may require extensive data in order to model and analyze complex systems, and obtaining these data is challenging itself.

	changes can lead to large and unpredictable consequences. *Applicability:* CAS Theory is well-suited for analyzing complex, self-organizing systems, such as economies, social networks, and ecosystems.	
Soft Systems Modeling (SSM)	*Human-centric approach:* SSM is particularly useful for addressing problems involving human activity systems. It emphasizes the role of stakeholders and their perceptions. *Strcutured Process:* SSM provides a structured process for eliciting and modeling different viewpoints, making it a useful tool for addressing unstructured or ill-defined problems.	*Subjectivity:* The subjective nature of stakeholders' perceptions can introduce biases and make the modeling process less objective. *Limited scope:* SSM may not be as effective when dealing with highly technical or deterministic systems, where quantitative analysis is crucial. *Resource intensive:* The process of engaging stakeholders and creating rich pictures can be time-consuming and resource-intensive.

	Rich pictures: The technique of creating rich pictures in SSM helps in visualizing and communicating complex problem situations.	
Systems Thinking (ST)	*Holistic approach:* ST takes a holistic approach, considering the interconnections and interdependencies within a system, leading to a more comprehensive understanding. *Cross-disciplinary:* It is applicable across various disciplines and industries, providing a common framework for problem-solving. *Feedback loops:* Emphasis on FLs allows for a better understanding of system dynamics.	*Abstraction:* The abstraction in ST can lead to oversimplification of complex systems, potentially overlooking important details. *Learning curve:* Mastering ST concepts can be challenging, especially for those new to the approach. *Ambiguity:* ST may not often provide clear-cut solutions, as it is more about understanding and influencing complex systems, despite this strongly depends on the applicability.

Table B- Causal Loop Diagram and Forrester diagrams related to the sustainability of the energy sector reported by the literature (Extension of the Table 2)

No.	Title	Aim	General description	Combination with other methods	Hypothesis/ Limitations
01	Hydrogen vehicle-infrastructure	To model the simple relationship between complementary goods in a vehicle-fueling station	This CLD contains a reinforcement feedback loop. With certain interventions, this system can move in a positive direction.	No	Actually this loop is acting in a negative direction because of limited incentives to build new refueling stations when vehicle populations are low. There are limited incentives to produce and purchase vehicles when the refueling infrastructure is lacking.

02	The Bass diffusion model	To model the timing of initial purchase of new products.	When the population of adopters increase, there is more information shared among existing and potential users. Thus, the rate of adoption increases under the influence of reinforcing feedback. Then, at some point, this increasing behavior becomes self-sustaining. This is called the *critical mass* or the *tipping point* and refers to a point after which the technology achieves permanent market penetration. The curve ultimately flattens as the technology reaches its market saturation point.	Regression Analysis	The probability of purchase at any time is linearly related to the number of previous buyers.

03	Hydrogen Vehicle and Infrastructure Simulator for Integrated and Operational Transportation Networks (H_2 VISION)	To simulate the diffusion paradigm related to H_2 FCV and refueling infrastructures.	H_2 VISION explores: -the fundamental dynamics of the vehicle-infrastructure. -complementary goods phenomenon. -long-term main stream hydrogen technology diffusion. -consumer preferences regarding FCV. -convenience costs associated with refueling infrastructure. -the potential role that policies aimed at hydrogen technologies may play in market development. -the role of fleet operators, governments and other investors as early adopters of hydrogen technologies.	Probability theory	H_2 VISION does not consider: -home- or residential- refueling options due to the high estimated cost associated with such methods. It explores refueling via refueling stations only. -spillover effects into the transportation sector from hydrogen technology advancements in other industries. -the development of distributed generation fuel cells has not been included. -impact of externalities such as the price of oil.

04	The CLD of the Australian energy sector	1)To design a conceptual model of the energy sector, 2)to analyze the potential consequences of current energy development policies using this model, 3)to provide suggestions for improvement of the policy	Sustainability-related issues and challenges of energy systems are manifold and complex involving competing stakeholder expectations. The authors outline crucial limitations of previous efforts and emphasize the importance of using systems thinking in addressing the energy sector's sustainability challenges. Case study- Australian energy sector. Crucial challenges related to energy supply and use in Australia:	Expert consultation Fixes that Fail Archetype (FFA)- situations where unexpected consequences result form well-planned actions.	-

		towards sustainable energy development.	1)ensure that there are enough accessible energy sources, 2)assess the impact of future energy dependency and high oil prices, 3)reduce greenhouse gas emissions.		
05	Green Hydrogen industry development model under different subsidy scenarios in China	To simulate the Green Hydrogen industry development in China considering different subsidy scenarios	Green hydrogen subsidy policies can be mainly divided into two categories: 1-the investment and operating costs. 2-stimulating the utilization of hydrogen energy through subsidies for various applications. The new model considers: -multiple factors that affected the cost and profitability of Green Hydrogen production.	-	

			-the impact of various government subsidy policies on the development of the GH industry. -a new system consisting of Tradable Green Certificate (TGC) market module, power market module and GH production industry module for research.		
06	Coordinated Development Capacity (CDC) of China's hydrogen energy industry chain	To simulate the CDC of hydrogen energy industry chain of China from 2016 to 2030.	This research provides details to promote the coordinated development of China's hydrogen energy industry chain. -The evaluation index system is constructed and evaluated using the entropy method.	-Evolutionary game, -Delphi method, -Regression analysis, -PLS method,	Due to the large number of factors contained in the hydrogen energy industry chain and the limited capacity of the model, only the factors with great influence can be included in the research process, while the factors that indirectly affect the

			-This is the basis for identifying the key factors. -PLS regression method is used to identify the factors that have a strong influence or large variation between the two phases.	-Input-output analysis, -Multiobjective programming, -Integer programming.	CDC of the hydrogen energy industry chain may be missed, which need follow-up studies to refine.
07	Hydrogen energy (Australia and Global)	To model the hydrogen energy system.	This research focuses on: (1) using a systems thinking approach to build a conceptual model for hydrogen energy, with a special focus on the pathways of hydrogen use, to assess the potential consequences that could lead to unintended impacts, and possible interventions;	-	Energy demand growth has been taken as an exogenous variable, although other studies may take it as an endogenous variable.

			(2) using a system dynamics approach to highlight the possible demand growth of hydrogen energy until 2050.		
08	System dynamics model for Green Hydrogen industry development	To study the policy impact under different terminal demand scenarios in China.	This paper studies the policy impact under different terminal demand scenarios based on a system dynamic model in China. Additionally, this study provides an exhaustive calculation method for computing the tension between supply and demand, which is determined by a comparison among the production, the demand and the reserve of GH.	No	It is based on the investment decision theory.

No.	Main variables/ loops	Database	Software	Previous CLD used	Translation to Flow Diagram	Stocks	Flows	Availability of equations
01	-Hydrogen Fuel Cell Vehicles. -Hydrogen Refueling Infrastructure.	-	-	-	-	-	-	-
02	-Potential Adopters -Adoption Rate -Adopters	Annual time series data for eleven different consumer durables.	-	-	Yes	-Potential adopters -Adopters	-Adoption rate	Yes

	-Adoption from advertising -Adoption from Word of Mouth -Total population -Adoption Fraction -Advertising Effectiveness							
03	H_2 VISION CLD consists of multiple variables and	Data on demographics, consumer preferences,	STELLA	01-Hydrogen vehicle-infrastructure.	Yes	1)The core model captures the FCV and conventional vehicle	Depending on the sub-model	Yes

	six loops: four of which are reinforcing and two of which are balancing. The H_2 VISION system dynamics model is separated into three sections: 1-the core H_2 VISION Model,	and vehicle and station attributes.		02-The Bass diffusion model.		populations, vehicle aging and demographics 2)RSMS-SM captures the hydrogen and fossil fuel refueling station populations, the potential number of new stations. 3)VMS-SM captures the market shares of FCV and		

	2-the refueling station market stores sub-model (RSMS-SM), 3-the vehicle market shares sub-model (VMS-SM).					conventional vehicles.		
04	The CLD includes 9 reinforcing loops and 12 balancing loops.	DISER. Australian Energy Statistics. 2020. Climate Change Performance	-	-	No	-	-	-

	There are: -energy production capacity-economic loops. -energy production capacity-social loop. -energy production capacity-emissions loops.	Index 2017 (CCPI).						

	-energy production capacity- energy policy development loops.							
05	-Electricity supply, -electricity demand, -Government subsidy, -GH production,	China Green Power Certificate Subscription Trading Platform (CGPCSTP), National Energy Administration	Vensim PLE 7.3.5	-	Yes	-RES CIP -GH CIP -FIT -TGC Inventory -TGC vacancy -TGC Market price variation -Electricity demand	-RES EIC -GH EIC -FIT Variation -TGC supply -TGC trading volume	Yes

	-Environmental benefits, -TGC supply.	(NEA), State Taxation Administration (STA), China EV100.					-TGC price variation -Electricity demand growth rate	
06	-Market demand, -employees, -technological innovation, -supply, -total assets	-Database of China hydrogen energy Alliance Research Institute. -Bulletin of listed companies.	Vensim PLE	-	Yes	-Market demand, -employees, -technological innovation, -supply, -total assets	-Change of market demand, -change of employees inflow and outflow, -change of technologic	Yes

		-China HowNet database. -Market analysis report. -China national Government Website, 2022					al innovation, -change of total assets	
07	The model consists of 7 reinforcing loops and 3 balancing loops	‘’Australian Energy Statistics”—Australian Energy Update report 2019–2020	Silico	-	Yes	-Transport, -Energy-intensive manufacturing, -Mining, -Export, -Electricity supply.	-Transport annual growth, -Manufacturing annual growth,	No

	representing the following: -growth of hydrogen and renewable energy, -emissions mitigation, -supply-demand, -energy insecurity, -economic growth, -risk of adoption						-Mining annual growth, -Export annual growth, -Electricity annual growth.	

	hydrogen as a combustion fuel							
08	-Cumulative installed capacity, -governance expenditure, -cumulative investment, -hydrogen storage amount.	Data related to the GH production and policies in 2020	-	-	Yes	-Cumulative installed capacity, -governance expenditure, -cumulative investment, -hydrogen storage amount.	-New installed capacity, -New government expenditure, -unit installed cost, -input and output	Yes

							hydrogen flows	

No.	Key factors	Model output	Conclusions	Future research	Reference
01	-	The relationship between the hydrogen FCV and the hydrogen refueling infrastructure.	Government policies that incentivize hydrogen FCV purchases may stimulate refueling infrastructure development. This would lead to more vehicle purchases.	Integration into other CLDs	Meyer and Winebrake, (2009)

02	During technology diffusion, the early majority will emulate the practices of the early adopters, and this is the key to widespread acceptance of technology.	The model implies exponential growth of initial purchases to a peak and then exponential decay.	-Data for consumer durables are in good agreement with the model. -For planning purposes, the main interest is related to the forecast of the timing and magnitude of the sales peak. -Policies aimed at reaching the early majority need to be designed to ensure that diffusion will reach the critical mass of adopters. -When this critical mass is reached, the technology diffuses to other end-users, and policy incentives become less necessary.	The model may be useful in providing a rationale for long-range forecasting.	Bass, (1969); Sterman, (2000); Meyer and Winebrake, (2009)

03	Four scenarios were analyzed considering different levels of infrastructure investment, FCV investment and hydrogen market condition. Only scenarios 2 and 3 succeeded. Scenario 2: Inf. Inv- high FCV Inv.-moderate H_2 market-moderate Scenario 3:	1)The core model- total vehicles operating by type (FCV and CV) 2)RSMS-SM-essential data regarding total stations operating and the portion of those stations that are hydrogen or	-Focusing on infrastructure leads to faster hydrogen vehicle adoption and station construction (S2). -FCV market conditions will be extremely important for any FCV success. -Investments affecting only one of the complementary good may not be sufficient for FCV diffusion to occur. -Vehicle and fuel-oriented incentives must be accompanied by infrastructure-oriented incentives. -Any incentivization that takes attention to the respective complementary good will yield zero	-	Meyer and Winebrake, (2009)

	Inf. Inv- very low FCV Inv.-high H_2 market-moderate	fossil fuel stations.	or drastically limited market penetration rates.		
04	-	-	-The sustainability of the energy sector is of paramount importance to ensure economic growth and societal development. -The advantages of system thinking greatly outweigh traditional linear approaches that have been previously used in formulating strategic levels of energy management policies and plans.	The developed CLD can serve as a reliable tool to establish a common understanding of the issues that influence sustainability of the energy sector and to provide opportunities for stakeholders to	Laimon et al., (2022)

				share learning and vision planning.	
05	-	-Government subsidies under different scenarios. -Income tax rate modes under different scenarios. -Electricity price for hydrogen production with different scenarios.	-The government's subsidy policies for investment production, hydrogen production electricity price and preferential income tax rate will promote the development of the GH industry to varying degrees. -There is no fixed subsidy methodology that is applicable in all situations. -Diverse subsidy policies are required to accommodate the technological level.	-	Li et al., (2022)

		-Hydrogen price under different scenarios. -Installation of green hydrogen in different government subsidy modes and the corresponding government expenditure. -Installation of green hydrogen in different			

		electricity price. -The impact of different tax rates on installation of green hydrogen. -Cumulative capacity of green hydrogen in different learning rate. -Cumulative capacity of green hydrogen			

		in different hydrogen price.			
06	-Market demand, -employees, -technological innovation, -supply, -total assets	Dynamic behavior of the identified key factors.	-Build a science and technology innovation system. -Improve the policy and institutional guarantee system. -Promote the construction of hydrogen energy infrastructure. -Promote the diversified application of hydrogen energy.	To refine the model	Gao and An, (2022)
07	Using System Archetypes (SAs) for identifying leverage points.	-The potential global demand for hydrogen for four scenarios.	-A system dynamics approach was used to highlight the growth of the possible global demand of hydrogen energy until 2050, and	Implement the model in other countries, as the proposed model can be used in any country.	Yusaf et al., (2022)

		-The potential hydrogen demand in the Australian context compared to the global demand for four scenarios	it has been linked to Australia's potential hydrogen demand in order to leverage global energy opportunities. -Findings indicate that hydrogen global demand is rising and ranges from 73 Mt (pessimistic case) to 568 Mt (optimistic case) by 2050. -For countries seeking to be leaders in hydrogen production like Australia, this is motivating news, as adopting hydrogen for some sectors (heavy and long-distance transport, energy-intensive manufacturing, mining,		

			and grid electrical supply) and replacing fossil fuel (mainly gas) with hydrogen, for export, means that the Australian hydrogen demand could reach 55 Mt. -This study provides insights and information on the future of hydrogen energy demand and highlights the risks that may affect the sector, which may assist policy decision makers to understand and test their options for the transition to a hydrogen economy, which may enable more effective decisions and/or policy changes to		

			obtain much better outcomes and avoid undesirable ones.		
08	Appropriate and reasonable policy combination	GH supply under different levels of demand, and government expenditure under different levels of demand.	The results showed that under the circumstance of a 25% income tax, and no installation subsidy, the production capacity of the GH production industry can hardly meet the demand under different demand scenarios. Hence, finding an appropriate and reasonable policy combination is the right way for addressing the development of the GH industry, and to meet the demand for GH.	To use the model for the prediction of the GH industry scale in other places.	Yang et al., (2023)

List of loops corresponding to the integrated CLD

Loop Number 1 of length 3

H2 Sustainable Prod.

Economic Growth

Jobs

Social Acceptance

Loop Number 2 of length 3

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Loop Number 3 of length 4

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Loop Number 4 of length 4

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Energy insecurity

Energy safety

Loop Number 5 of length 4

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

Loop Number 6 of length 5

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Energy insecurity

Effect. of gov. policies

Loop Number 7 of length 5

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Energy insecurity

Energy safety

Loop Number 8 of length 5

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Investment in RE

Loop Number 9 of length 5

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Inv. Costs

Econ. Profits

Loop Number 10 of length 6

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 11 of length 6

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Effect. of gov. policies

Loop Number 12 of length 6

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Energy insecurity

Effect. of gov. policies

Investment in RE

Loop Number 13 of length 6

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy insecurity

Energy safety

Loop Number 14 of length 6

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Loop Number 15 of length 6

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Energy insecurity

Energy safety

Loop Number 16 of length 6

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Investment in RE

Env. Sust.

Loop Number 17 of length 6

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 18 of length 6

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy insecurity

Effect. of gov. policies

Loop Number 19 of length 7

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Loop Number 20 of length 7

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Supply

Energy insecurity

Energy safety

Loop Number 21 of length 7

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 22 of length 7

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Effect. of gov. policies

Investment in RE

Loop Number 23 of length 7

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Supply

Energy insecurity

Effect. of gov. policies

Loop Number 24 of length 7

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Market price

Demand

Energy insecurity

Effect. of gov. policies

Loop Number 25 of length 7

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 26 of length 7

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 27 of length 7

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Energy insecurity

Effect. of gov. policies

Investment in RE

Env. Sust.

Loop Number 28 of length 7

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Investment in RE

Inv. Costs

Econ. Profits

Loop Number 29 of length 7

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Env. Sust.

Loop Number 30 of length 7

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Energy insecurity

Energy safety

Loop Number 31 of length 7

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Inv. Costs

Econ. Profits

Loop Number 32 of length 8

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Market price

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Loop Number 33 of length 8

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

New non-RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 34 of length 8

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Loop Number 35 of length 8

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 36 of length 8

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Effect. of gov. policies

Investment in RE

Env. Sust.

Loop Number 37 of length 8

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

New RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 38 of length 8

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Energy insecurity

Effect. of gov. policies

Investment in RE

Inv. Costs

Econ. Profits

Loop Number 39 of length 8

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Effect. of gov. policies

Loop Number 40 of length 8

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Loop Number 41 of length 8

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 42 of length 8

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Supply

Energy insecurity

Effect. of gov. policies

Loop Number 43 of length 8

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Supply

Energy insecurity

Energy safety

Loop Number 44 of length 8

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Effect. of gov. policies

Loop Number 45 of length 8

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 46 of length 8

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Energy safety

Loop Number 47 of length 9

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 48 of length 9

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Market price

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Env. Sust.

Loop Number 49 of length 9

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 50 of length 9

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 51 of length 9

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

New non-RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 52 of length 9

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

New RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 53 of length 9

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 54 of length 9

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Loop Number 55 of length 9

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Env. Sust.

Loop Number 56 of length 9

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 57 of length 9

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Env. Sust.

Loop Number 58 of length 9

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Effect. of gov. policies

Investment in RE

Inv. Costs

Econ. Profits

Loop Number 59 of length 9

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Investment in RE

Loop Number 60 of length 9

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Supply

Market price

Demand

Energy insecurity

Effect. of gov. policies

Loop Number 61 of length 9

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Effect. of gov. policies

Loop Number 62 of length 9

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Inv. Costs

Econ. Profits

Loop Number 63 of length 9

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 64 of length 9

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 65 of length 10

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 66 of length 10

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Inv. Costs

Econ. Profits

Loop Number 67 of length 10

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Effect. of gov. policies

Loop Number 68 of length 10

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Inv. Costs

Econ. Profits

Loop Number 69 of length 10

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy insecurity

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 70 of length 10

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Investment in RE

Env. Sust.

Loop Number 71 of length 10

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Energy insecurity

Effect. of gov. policies

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 72 of length 10

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Loop Number 73 of length 10

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Energy insecurity

Effect. of gov. policies

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 74 of length 10

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Env. Sust.

Loop Number 75 of length 10

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Market price

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Inv. Costs

Econ. Profits

Loop Number 76 of length 10

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Env. Sust.

Loop Number 77 of length 10

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Energy safety

Loop Number 78 of length 10

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Loop Number 79 of length 10

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Loop Number 80 of length 11

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Demand

Energy insecurity

Effect. of gov. policies

Loop Number 81 of length 11

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Inv. Costs

Econ. Profits

Loop Number 82 of length 11

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Effect. of gov. policies

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 83 of length 11

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Inv. Costs

Econ. Profits

Loop Number 84 of length 11

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Loop Number 85 of length 11

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 86 of length 11

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 87 of length 11

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 88 of length 11

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Loop Number 89 of length 11

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Investment in RE

Inv. Costs

Econ. Profits

Loop Number 90 of length 11

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 91 of length 11

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Effect. of gov. policies

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 92 of length 11

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Demand

Energy insecurity

Energy safety

Loop Number 93 of length 12

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Loop Number 94 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Inv. Costs

Econ. Profits

Loop Number 95 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 96 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Market price

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 97 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Market price

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Inv. Costs

Econ. Profits

Loop Number 98 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 99 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 100 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 101 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 102 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Market price

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 103 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 104 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Investment in RE

Demand

Energy insecurity

Energy safety

Loop Number 105 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 106 of length 12

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 107 of length 13

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 108 of length 13

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 109 of length 13

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 110 of length 13

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 111 of length 13

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 112 of length 13

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 113 of length 13

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 114 of length 13

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Inv. Costs

Econ. Profits

Loop Number 115 of length 13

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Inv. Costs

Econ. Profits

Loop Number 116 of length 13

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 117 of length 13

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Gas exports

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 118 of length 13

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 119 of length 13

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Loop Number 120 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 121 of length 14

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Market price

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 122 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 123 of length 14

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Supply

Market price

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 124 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 125 of length 14

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 126 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Loop Number 127 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 128 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 129 of length 14

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 130 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 131 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 132 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 133 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 134 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 135 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 136 of length 14

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 137 of length 15

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 138 of length 15

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 139 of length 15

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 140 of length 15

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 141 of length 15

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 142 of length 15

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Loop Number 143 of length 15

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Loop Number 144 of length 15

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 145 of length 15

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 146 of length 15

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 147 of length 15

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Employment opportunities

Immigration

Population

Demand

Energy insecurity

Effect. of gov. policies

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Social Acceptance

Loop Number 148 of length 15

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Loop Number 149 of length 15

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Demand

Energy insecurity

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 150 of length 15

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 151 of length 15

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Demand

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 152 of length 15

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 153 of length 15

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 154 of length 16

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 155 of length 16

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 156 of length 16

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 157 of length 16

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 158 of length 16

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

Energy insecurity

Energy safety

Loop Number 159 of length 16

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

Energy insecurity

Energy safety

Loop Number 160 of length 16

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 161 of length 16

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Loop Number 162 of length 17

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 163 of length 17

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Loop Number 164 of length 17

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

Energy insecurity

Energy safety

Loop Number 165 of length 17

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 166 of length 17

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 167 of length 17

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 168 of length 17

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 169 of length 18

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 170 of length 18

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 171 of length 18

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 172 of length 18

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New non-RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 173 of length 18

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 174 of length 18

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 175 of length 18

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 176 of length 18

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New non-RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 177 of length 18

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

Energy insecurity

Energy safety

Loop Number 178 of length 18

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 179 of length 18

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 180 of length 19

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 181 of length 19

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 182 of length 19

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 183 of length 19

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 184 of length 19

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 185 of length 19

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 186 of length 19

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 187 of length 19

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New non-RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 188 of length 19

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 189 of length 19

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 190 of length 19

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

Energy insecurity

Energy safety

Loop Number 191 of length 19

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Env. Sust.

Loop Number 192 of length 20

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 193 of length 20

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 194 of length 20

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 195 of length 20

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 196 of length 20

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 197 of length 20

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 198 of length 20

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New non-RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 199 of length 20

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

Energy insecurity

Energy safety

Loop Number 200 of length 20

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Energy insecurity

Energy safety

Loop Number 201 of length 21

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 202 of length 21

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Env. Sust.

Loop Number 203 of length 21

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New non-RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 204 of length 21

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Value of Prod.

Econ. Profits

Loop Number 205 of length 21

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Energy dependancy

Risk of supply disruption

Energy insecurity

Energy safety

Loop Number 206 of length 21

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 207 of length 21

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Gas exports

Energy insecurity

Energy safety

Loop Number 208 of length 21

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

Energy insecurity

Energy safety

Loop Number 209 of length 22

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New non-RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 210 of length 22

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 211 of length 22

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

Energy insecurity

Energy safety

Loop Number 212 of length 22

H2 Sustainable Prod.

Economic Growth

Energy prod. capacity

Combustion pathway

Nitrogen oxides

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Imports

Concerns

Policies encouraging reduction in CO2 emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy insecurity

Energy safety

Loop Number 213 of length 23

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 214 of length 23

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New non-RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 215 of length 24

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty infulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New RE capacity

Economic Growth

Jobs

Social Acceptance

Loop Number 216 of length 24

H2 Sustainable Prod.

Integration with other RE sources

Reliability of intermittent RE resources

Investment in RE

Uncertainty in fulfilling demand growth

Inv Non-RE

Net CO2 emissions

Atmospheric GHG conc.

Global Warming

Env. Sust.

The adoption of H2 as a net zero fuel

Fuel cell pathway

Zero emission pathway

Emissions

Environmental deterioration

Policies encouraging reduction in emissions

Effect. of gov. policies

Supply

Market price

Demand

Energy prod. capacity

New non-RE capacity

Economic Growth

Jobs

Social Acceptance