TranSust.Scan

Scanning Policy Scenarios for the Transition to Sustainable Economic Structures
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TransSust.Scan Working Paper

Task 1: Model Extension

Leader: ZEW

Task 1: Model Extensions

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In the TranSust.Scan project, workpackage 1, task 1 defines the following main activities for the participating modelling groups:

- The increase of the range of indicators covered by the various models either by systematic (complementary) inter-linkages or by straightforward specific model extensions.
- The matching of input variables as a prerequisite for joint model application for forecasting, simulation, and backcasting.

For the interim report, the task leader ZEW sent out a questionnaire to ask all groups for the progress on task 1. In the sections below, the answers are presented for the following models:

MODEL	**GROUP**
DART	IfW, Kiel
DEMETER	IVM-VU, Amsterdam
EU-FASOM	University of Hamburg
GAIN	WIFO, Vienna
ICES	FEEM, Milano
IMACLIM	SMASH-CIRED, Paris
IMPEC	LIFEA, Lodz
KLUM	University of Hamburg
MARKAL	ECN
PACE	ZEW, Mannheim
WITCH	FEEM, Milano
W8D	LIFEA, Lodz

Name of the model: DART (Dynamic Applied Regional Trade)

Name of institution: Kiel Institute for the World Economy

A list of standard variable and indicator extensions follows on the next pages.

1. Are there extensions of your model by variables or indicators beyond the ones in the list? Please write them down.

We are working on including non-CO2 GHG emissions.

2. Describe all variable extensions in words. What is the value added by them?

There are not currently any existing variable extensions. We will start though in this year to extend the model to include land-use changes in Germany and Europe and renewable energy. The goal is to analyze the role of bio-energy in an optimal energy mix.

3. Describe all indicator extensions in words. What is the value added by them?

We have added different definitions of the "Revealed comparative Advantage" Indicator that allows us to assess the international competitiveness effects of different policy analysis taking into account disaggregated changes in sectoral imports and exports.

4. To what extend do the extensions prepare your model for Integrated Assessment?

The planned addition of land-use changes will be achieved by coupling a GIS based land-use model for Germany to an extended version of DART.

Table 1: Variables in model version of the TranSust project and extensions in TranSust.Scan

Theme	Sub-theme	Areas to be addressed	TRANSUST	EXTENSION
Economic development	Investment	1. Investment in R&D		
		2. Investment in Env. Friendly technologies		
		3. Consumption and inflation		
		4. Saving and borrowing		
	Competitiveness	5. Labour productivity	X	
		6. Unit labour costs	X	
		7. Life-long Learning		
	Employment	8. Employment rate		
		9. Unemployment rate		
Poverty and social exclusion	Monetary poverty	10. Income inequality		
		11. Non-monetary deprivation		
	Access to Labour Market	12. Poverty-in-work		
	Other aspect of social exclusion	13. Access to education		
		14. Access to health care		
		15. Access to housing		
		16. Social participation		
Aging Society	Pensions adequacy	17. Income of elder generations		
	Demographic changes	18. Life expectancy		
		19. Fertility		
		20. Migrations		
	Financial Sustainability	21. Age of withdrawal from Labour Market		
		22. Pension expenditures		
Public health	Human health protection and Life styles	23. Financial sustainability		
		24. Disability-free life expectancy		
		25. Premature mortality		
		26 Life styles		
		27. Health and safety at work		
		28. Infectious diseases and resistance to antibiotics		
	Food Safety and Quality	29. Pesticide residues		
		30. Microbiological contamination		
		31. Drinking water quality		
	Chemicals management	32. Chemicals production and consumption		
		33. Exposure to chemicals		
	Health risks due to environmental conditions	34. Air quality		
		35. Noise exposure		
Climate change and energy	Climate change	36. GHG emission reduction	X	
	Energy	37. Energy taxes	X	
		38. Energy efficiency	X	
		39. Renewable energy resources		(X*)
		40. Management of nuclear waste		
		41. Air pollution from energy use		
Production and consumption patterns	Eco-efficiency	42. Decoupling economic growth and resource use		
		43. Decoupling economic growth and emissions	X	
		44. Decoupling economic growth and generation of wastes		
	Agriculture	45. Pesticides use		
		46. Nitrogen balances		
		47. Environmentally-friendly farming		
	Corporate responsibility	48. Triple bottom line		
	Consumer awareness	49. Consumer information		
Management of natural resources	Biodiversity	50. Protection of habitats and natural systems and biodiversity		
		51. Maintaining the carrying capacity		
	Marine ecosystems	52. Over-fishing		
	Fresh water resources	53. Water extraction and use		
		54. Protection of surface and ground water resources		
	Land use	55. Land use change		(X*)
		56. Soil degradation		
		57. Forests		
Transport	Transport growth	58. Decoupling of economic and transport growth		
		59. Road to rail, water and public transport		
		60. Land use by transport systems		
	Environmental impact of transport activities	61. Air pollutants		
Good governance	Policy coherence	62. Citizen's adherence and support to EU actions		
		63. Sustainability of EU actions and measures		
		64. Legislative compliance		
	Public participation	65. Communication and mobilization		
Global partnership	Globalisation of trade	66. Market access for least developed countries (LDC)		
	Financing for SD	67. Foreign direct investments to developing countries		
		68. Official Development Assistance (ODA)		
		69. Other official financing		
	Resource management	70. Resource consumption		
		71. Air emissions & Energy		
		72. Water		
		73. Waste		

Table 2: EC structural indicators in model version of the TranSust project and extensions in TranSust.Scan

EC	Indicator	TRANSUST	EXTENSIONS
I.	GDP per capita	X	
II.	Labor productivity	X	
III.	Employment rate		
IV.	Employment rate of older workers		
V.	Spending on human resources (public exp. on education)		
VI.	Research and Development expenditure		
VII.	Information Technology expenditure		
VIII.	Financial market integration (conv. of bank lending rates)		
IX.	At risk-of-poverty rate		
X.	Long-term unemployment		
XI.	Dispersion of regional employment rates		
XII.	Greenhouse gases emissions	X	
XIII.	Energy intensity of the economy	X	
XIV.	Volume of transport		
XV.	Competitiveness		X

Name of the model: DEMETER

Name of institution: Institute for environmental Studies, Vrije Universiteit Amsterdam (IVM-VU), in collaboration with ECN

A list of standard variable and indicator extensions follows on the next pages.

1. Are there extensions of your model by variables or indicators beyond the ones in the list? Please write them down.

The Carbon Capture and Storage (CCS) technology is added, as well as geological CO2 leakage.

2. Describe all variable extensions in words. What is the value added by them?

Carbon Capture and Storage is likely to be an essential element in the transition towards sustainable energy use, and as proven in the analysis, it will have a substantial impact on the development of non-carbon energy, though this depends on the degree of leakage associated with the CCS technology.

3. Describe all indicator extensions in words. What is the value added by them?

4. To what extend do the extensions prepare your model for Integrated Assessment?

The extension provides a more detailed insight in the transition towards sustainable energy use, and thus prepare for a careful analysis of IA.

Table 1: Variables in model version of the TranSust project and extensions in TranSust.Scan

Theme	Sub-theme	Areas to be addressed	TRANSUST	EXTENSION
Economic development	Investment	1. Investment in R&D		
		2. Investment in Env. Friendly technologies	X	
		3. Consumption and inflation		
		4. Saving and borrowing	X	
	Competitiveness	5. Labour productivity	X	
		6. Unit labour costs		
		7. Life-long Learning		
	Employment	8. Employment rate		
		9. Unemployment rate		
Poverty and social exclusion	Monetary poverty	10. Income inequality		
		11. Non-monetary deprivation		
	Access to Labour Market	12. Poverty-in-work		
	Other aspect of social exclusion	13. Access to education		
		14. Access to health care		
		15. Access to housing		
		16. Social participation		
Aging Society	Pensions adequacy	17. Income of elder generations		
	Demographic changes	18. Life expectancy		
		19. Fertility		
		20. Migrations		
	Financial Sustainability	21. Age of withdrawal from Labour Market		
		22. Pension expenditures		
Public health	Human health protection and Life styles	23. Financial sustainability		
		24. Disability-free life expectancy		
		25. Premature mortality		
		26 Life styles		
		27. Health and safety at work		
		28. Infectious diseases and resistance to antibiotics		
	Food Safety and Quality	29. Pesticide residues		
		30. Microbiological contamination		
		31. Drinking water quality		
	Chemicals management	32. Chemicals production and consumption		
		33. Exposure to chemicals		
	Health risks due to environmental conditions	34. Air quality		
		35. Noise exposure		
Climate change and energy	Climate change	36. GHG emission reduction	X	
	Energy	37. Energy taxes	X	
		38. Energy efficiency	X	
		39. Renewable energy resources	X	
		40. Management of nuclear waste		
		41. Air pollution from energy use		
Production and consumption patterns	Eco-efficiency	42. Decoupling economic growth and resource use		
		43. Decoupling economic growth and emissions	X	
		44. Decoupling economic growth and generation of wastes		
	Agriculture	45. Pesticides use		
		46. Nitrogen balances		
		47. Environmentally-friendly farming		
	Corporate responsibility	48. Triple bottom line		
	Consumer awareness	49. Consumer information		
Management of natural resources	Biodiversity	50. Protection of habitats and natural systems and biodiversity		
		51. Maintaining the carrying capacity		
	Marine ecosystems	52. Over-fishing		
	Fresh water resources	53. Water extraction and use		
		54. Protection of surface and ground water resources		
	Land use	55. Land use change		
		56. Soil degradation		
		57. Forests		
Transport	Transport growth	58. Decoupling of economic and transport growth		
		59. Road to rail, water and public transport		
		60. Land use by transport systems		
	Environmental impact of transport activities	61. Air pollutants		
Good governance	Policy coherence	62. Citizen's adherence and support to EU actions		
		63. Sustainability of EU actions and measures		
		64. Legislative compliance		
	Public participation	65. Communication and mobilization		
Global partnership	Globalisation of trade	66. Market access for least developed countries (LDC)		
	Financing for SD	67. Foreign direct investments to developing countries		
		68. Official Development Assistance (ODA)		
		69. Other official financing		
	Resource management	70. Resource consumption		
		71. Air emissions & Energy		
		72. Water		
		73. Waste		

Table 2: EC structural indicators in model version of the TranSust project and extensions in TranSust.Scan

EC	Indicator	TRANSUST	EXTENSIONS
I.	GDP per capita	X	
II.	Labor productivity	X	
III.	Employment rate		
IV.	Employment rate of older workers		
V.	Spending on human resources (public exp. on education)		
VI.	Research and Development expenditure		
VII.	Information Technology expenditure		
VIII.	Financial market integration (conv. of bank lending rates)		
IX.	At risk-of-poverty rate		
X.	Long-term unemployment		
XI.	Dispersion of regional employment rates		
XII.	Greenhouse gases emissions	X	
XIII.	Energy intensity of the economy	X	
XIV.	Volume of transport		
XV.	Competitiveness		

Name of the model: EU-FASOM

Name of institution: University of Hamburg

A list of standard variable and indicator extensions follows on the next pages.

Note that the model was not part of the original TranSust model set. Therefore no comparison is possible.

1. Are there extensions of your model by variables or indicators beyond the ones in the list? Please write them down.

2. Describe all variable extensions in words. What is the value added by them?

EU-FASOM is a partial equilibrium model of the European forestry and agricultural sectors. It is going to be extended to cover biofuel production opportunities and their influence on GHG emission levels. This way it is possible to assess questions of land use allocation and development of commodity availability in scenarios of growing importance of biofuels as a possible alternative energy source.

3. Describe all indicator extensions in words. What is the value added by them?

4. To what extent do the extensions prepare your model for Integrated Assessment?

EU-FASOM is applied to assess the consequences of changing technology, resources, markets and policies on the agricultural and forestry sectors. While this can already be done with the standalone version of EU-FASOM, it is also possible to link it to other models in an integrated assessment framework. The addition of biofuels to the model does not have any structural implications on the model.

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Theme	Sub-theme	Areas to be addressed	TRANSUST	EXTENSION
Economic development	Investment	1. Investment in R&D		
		2. Investment in Env. Friendly technologies		
		3. Consumption and inflation		
		4. Saving and borrowing		
	Competitiveness	5. Labour productivity		
		6. Unit labour costs		
		7. Life-long Learning		
	Employment	8. Employment rate		
		9. Unemployment rate		
Poverty and social exclusion	Monetary poverty	10. Income inequality		
		11. Non-monetary deprivation		
	Access to Labour Market	12. Poverty-in-work		
	Other aspect of social exclusion	13. Access to education		
		14. Access to health care		
		15. Access to housing		
		16. Social participation		
Aging Society	Pensions adequacy	17. Income of elder generations		
	Demographic changes	18. Life expectancy		
		19. Fertility		
		20. Migrations		
	Financial Sustainability	21. Age of withdrawal from Labour Market		
		22. Pension expenditures		
Public health	Human health protection and Life styles	23. Financial sustainability		
		24. Disability-free life expectancy		
		25. Premature mortality		
		26 Life styles		
		27. Health and safety at work		
		28. Infectious diseases and resistance to antibiotics		
	Food Safety and Quality	29. Pesticide residues		
		30. Microbiological contamination		
		31. Drinking water quality		
	Chemicals management	32. Chemicals production and consumption		
		33. Exposure to chemicals		
	Health risks due to environmental conditions	34. Air quality		
		35. Noise exposure		
Climate change and energy	Climate change	36. GHG emission reduction		
	Energy	37. Energy taxes		
		38. Energy efficiency		
		39. Renewable energy resources		
		40. Management of nuclear waste		
		41. Air pollution from energy use		
Production and consumption patterns	Eco-efficiency	42. Decoupling economic growth and resource use		
		43. Decoupling economic growth and emissions		
		44. Decoupling economic growth and generation of wastes		
	Agriculture	45. Pesticides use		
		46. Nitrogen balances		
		47. Environmentally-friendly farming		
	Corporate responsibility	48. Triple bottom line		
	Consumer awareness	49. Consumer information		
Management of natural resources	Biodiversity	50. Protection of habitats and natural systems and biodiversity		
		51. Maintaining the carrying capacity		
	Marine ecosystems	52. Over-fishing		
	Fresh water resources	53. Water extraction and use		X
		54. Protection of surface and ground water resources		X
	Land use	55. Land use change		X
		56. Soil degradation		X
		57. Forests		X
Transport	Transport growth	58. Decoupling of economic and transport growth		
		59. Road to rail, water and public transport		
		60. Land use by transport systems		
	Environmental impact of transport activities	61. Air pollutants		
Good governance	Policy coherence	62. Citizen's adherence and support to EU actions		
		63. Sustainability of EU actions and measures		
		64. Legislative compliance		
	Public participation	65. Communication and mobilization		
Global partnership	Globalisation of trade	66. Market access for least developed countries (LDC)		
	Financing for SD	67. Foreign direct investments to developing countries		
		68. Official Development Assistance (ODA)		
		69. Other official financing		
	Resource management	70. Resource consumption		
		71. Air emissions & Energy		
		72. Water		
		73. Waste		

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I.	GDP per capita		
II.	Labor productivity		
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IV.	Employment rate of older workers		
V.	Spending on human resources (public exp. on education)		
VI.	Research and Development expenditure		
VII.	Information Technology expenditure		
VIII.	Financial market integration (conv. of bank lending rates)		
IX.	At risk-of-poverty rate		
X.	Long-term unemployment		
XI.	Dispersion of regional employment rates		
XII.	Greenhouse gases emissions		X
XIII.	Energy intensity of the economy		
XIV.	Volume of transport		
XV.	Competitiveness		

Name of the model: GAIN

Name of institution: WIFO

A list of standard variable and indicator extensions follows on the next pages.

1. Are there extensions of your model by variables or indicators beyond the ones in the list? Please write them down.

2. Describe all variable extensions in words. What is the value added by them?

3. Describe all indicator extensions in words. What is the value added by them?

4. To what extend do the extensions prepare your model for Integrated Assessment?

Table 1: Variables in model version of the TranSust project and extensions in TranSust.Scan

Theme	Sub-theme	Areas to be addressed	TRANSUST	EXTENSION
Economic development	Investment	1. Investment in R&D		
		2. Investment in Env. Friendly technologies		X
		3. Consumption and inflation	X	
		4. Saving and borrowing		
	Competitiveness	5. Labour productivity		
		6. Unit labour costs		
		7. Life-long Learning		
	Employment	8. Employment rate		
		9. Unemployment rate		
Poverty and social exclusion	Monetary poverty	10. Income inequality		
		11. Non-monetary deprivation		
	Access to Labour Market	12. Poverty-in-work		
	Other aspect of social exclusion	13. Access to education		
		14. Access to health care		
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Aging Society	Pensions adequacy	17. Income of elder generations		
	Demographic changes	18. Life expectancy		
		19. Fertility		
		20. Migrations		
	Financial Sustainability	21. Age of withdrawal from Labour Market		
		22. Pension expenditures		
Public health	Human health protection and Life styles	23. Financial sustainability		
		24. Disability-free life expectancy		
		25. Premature mortality		
		26 Life styles		
		27. Health and safety at work		
		28. Infectious diseases and resistance to antibiotics		
	Food Safety and Quality	29. Pesticide residues		
		30. Microbiological contamination		
		31. Drinking water quality		
	Chemicals management	32. Chemicals production and consumption		
		33. Exposure to chemicals		
	Health risks due to environmental conditions	34. Air quality		
		35. Noise exposure		
Climate change and energy	Climate change	36. GHG emission reduction		X
	Energy	37. Energy taxes		
		38. Energy efficiency		X
		39. Renewable energy resources		X
		40. Management of nuclear waste		
		41. Air pollution from energy use		
Production and consumption patterns	Eco-efficiency	42. Decoupling economic growth and resource use		X
		43. Decoupling economic growth and emissions		X
		44. Decoupling economic growth and generation of wastes		
	Agriculture	45. Pesticides use		
		46. Nitrogen balances		
		47. Environmentally-friendly farming		
	Corporate responsibility	48. Triple bottom line		
	Consumer awareness	49. Consumer information		
Management of natural resources	Biodiversity	50. Protection of habitats and natural systems and biodiversity		
		51. Maintaining the carrying capacity		
	Marine ecosystems	52. Over-fishing		
	Fresh water resources	53. Water extraction and use		
		54. Protection of surface and ground water resources		
	Land use	55. Land use change		
		56. Soil degradation		
		57. Forests		
Transport	Transport growth	58. Decoupling of economic and transport growth		X
		59. Road to rail, water and public transport		
		60. Land use by transport systems		
	Environmental impact of	61. Air pollutants		
Good governance	Policy coherence	62. Citizen's adherence and support to EU actions		
		63. Sustainability of EU actions and measures		
		64. Legislative compliance		
	Public participation	65. Communication and mobilization		
Global partnership	Globalisation of trade	66. Market access for least developed countries (LDC)		
	Financing for SD	67. Foreign direct investments to developing countries		
		68. Official Development Assistance (ODA)		
		69. Other official financing		
	Resource management	70. Resource consumption		
		71. Air emissions & Energy		
		72. Water		
		73. Waste		

Table 2: EC structural indicators in model version of the TranSust project and extensions in TranSust.Scan

EC	Indicator	TRANSUST	EXTENSIONS
I.	GDP per capita	X	
II.	Labor productivity		
III.	Employment rate		
IV.	Employment rate of older workers		
V.	Spending on human resources (public exp. on education)		
VI.	Research and Development expenditure		
VII.	Information Technology expenditure		
VIII.	Financial market integration (conv. of bank lending rates)		
IX.	At risk-of-poverty rate		
X.	Long-term unemployment		
XI.	Dispersion of regional employment rates		
XII.	Greenhouse gases emissions		X
XIII.	Energy intensity of the economy		X
XIV.	Volume of transport		X
XV.	Competitiveness		

Name of the model: ICES

Name of institution: FEEM

A list of standard variable and indicator extensions follows on the next pages.

1. Are there extensions of your model by variables or indicators beyond the ones in the list? Please write them down.

As standard with CGE models, ICES can allow the investigation of climate change impacts on international trade patterns and of the feedback of changes in trade (and more generally in the economic system) on the environment materialising as changes in major GHG emissions.

2. Describe all variable extensions in words. What is the value added by them?
3. Describe all indicator extensions in words. What is the value added by them?

The ICES model is a standard recursive dynamic computable general equilibrium model of the global economic system. Its time horizon is 2000 – 2050. As a natural feature of CGE models it can analyse international and intersectoral economic impacts of different taxation and trade policies. In particular economic implications of climate change mitigation policies can be assessed as major GHG gases are represented. Emission trading for CO2 is already embedded; N2O and CH4 emissions are modelled, but an emission trading scheme for these gases needs to be built (which is one of the direction of the present research). The inclusion of sulphur emissions is another next step. The issue of sustainability can be addressed as well, this either considering directly the impacts of climate change and of climate change policies on consumption and production levels, or extracting from the model a set of sustainability indicators of environmental, economic, and social nature (e.g. employment, income, use of natural resources, emissions etc.) whose changes respect to a reference case can be measured. Distributional issues can be considered: the model already allows for high and low income workers, this can be further expanded including different income classes (though this is not one of our near term research interest). Finally, at an aggregate (national) level, costs and benefits of "generic" health policies can be simulated. This requires some modification of the model

though, for instance changing the composition of government expenditure in favour of health care services and at the same time simulating the expected impact on labour productivity.

4. To what extend do the extensions prepare your model for Integrated Assessment?

ICES is a recursive dynamic CGE model for the world economy which has been used for the purpose of climate change impact assessment. The two major extensions on which the group is currently working are the inclusion of biodiversity and water resources as new areas of climate change impacts. This will allow (a) a more complete description of climate change impacts on the economic system (b) to consider interactions among impacts (e.g. water and agriculture productivity) (c) a more sophisticated integrated assessment exercise as water and biodiversity modules need to be coupled with the CGE model.

Table 1: Variables in model version of the TranSust project and extensions in TranSust.Scan

Theme	Sub-theme		Areas to be addressed	TRANSUST	EXTENSION
Economic development	Investment	1.	Investment in R&D		
		2.	Investment in Env. Friendly technologies		
		3.	Consumption and inflation		X
		4.	Saving and borrowing		X
	Competitiveness	5.	Labour productivity		-
		6.	Unit labour costs		X
		7.	Life-long Learning		
	Employment	8.	Employment rate		X
		9.	Unemployment rate		-
Poverty and social exclusion	Monetary poverty	10.	Income inequality		X
		11.	Non-monetary deprivation		-
	Access to Labour Market	12.	Poverty-in-work		-
	Other aspect of social exclusion	13.	Access to education		-
		14.	Access to health care		-
		15.	Access to housing		-
		16.	Social participation		-
Aging Society	Pensions adequacy	17.	Income of elder generations		-
	Demographic changes	18.	Life expectancy		-
		19.	Fertility		-
		20.	Migrations		-
	Financial Sustainability	21.	Age of withdrawal from Labour Market		-
		22.	Pension expenditures		-
Public health	Human health protection and Life styles	23.	Financial sustainability		-
		24.	Disability-free life expectancy		-
		25.	Premature mortality		-
		26	Life styles		-
		27.	Health and safety at work		-
		28.	Infectious diseases and resistance to antibiotics		-
	Food Safety and Quality	29.	Pesticide residues		-
		30.	Microbiological contamination		-
		31.	Drinking water quality		-
	Chemicals management	32.	Chemicals production and consumption		-
		33.	Exposure to chemicals		-
	Health risks due to environmental conditions	34.	Air quality		X
		35.	Noise exposure		-
Climate change and energy	Climate change	36.	GHG emission reduction		X
	Energy	37.	Energy taxes		X
		38.	Energy efficiency		X
		39.	Renewable energy resources		
		40.	Management of nuclear waste		
		41.	Air pollution from energy use		X
Production and consumption patterns	Eco-efficiency	42.	Decoupling economic growth and resource use		X
		43.	Decoupling economic growth and emissions		X
		44.	Decoupling economic growth and generation of wastes		-
	Agriculture	45.	Pesticides use		X
		46.	Nitrogen balances		
		47.	Environmentally-friendly farming		-
	Corporate responsibility	48.	Triple bottom line		-
	Consumer awareness	49.	Consumer information		-
Management of natural resources	Biodiversity	50.	Protection of habitats and natural systems and biodiversity		X
		51.	Maintaining the carrying capacity		-
	Marine ecosystems	52.	Over-fishing		-
	Fresh water resources	53.	Water extraction and use		X
		54.	Protection of surface and ground water resources		X
	Land use	55.	Land use change		X
		56.	Soil degradation		-
		57.	Forests		X
Transport	Transport growth	58.	Decoupling of economic and transport growth		-
		59.	Road to rail, water and public transport		-
		60.	Land use by transport systems		-
	Environmental impact of transport activities	61.	Air pollutants		-
Good governance	Policy coherence	62.	Citizen's adherence and support to EU actions		-
		63.	Sustainability of EU actions and measures		-
		64.	Legislative compliance		-
	Public participation	65.	Communication and mobilization		-
Global partnership	Globalisation of trade	66.	Market access for least developed countries (LDC)		-
	Financing for SD	67.	Foreign direct investments to developing countries		-
		68.	Official Development Assistance (ODA)		-
		69.	Other official financing		-
	Resource management	70.	Resource consumption		X
		71.	Air emissions & Energy		X
		72.	Water		X
		73.	Waste		-

Table 2: EC structural indicators in model version of the TranSust project and extensions in TranSust.Scan

EC	Indicator	TRANSUST	EXTENSIONS
I.	GDP per capita		X
II.	Labor productivity		X
III.	Employment rate		X
IV.	Employment rate of older workers		-
V.	Spending on human resources (public exp. on education)		-
VI.	Research and Development expenditure		
VII.	Information Technology expenditure		-
VIII.	Financial market integration (conv. of bank lending rates)		-
IX.	At risk-of-poverty rate		-
X.	Long-term unemployment		-
XI.	Dispersion of regional employment rates		-
XII.	Greenhouse gases emissions		X
XIII.	Energy intensity of the economy		X
XIV.	Volume of transport		-
XV.	Competitiveness		-

Name of the model: IMACLIM[1]

Name of institution: SMASH-CIRED

A list of standard variable and indicator extensions follows on the next pages.

1. Are there extensions of your model by variables or indicators beyond the ones in the list? Please write them down.

2. Describe all variable extensions in words. What is the value added by them?

3. Describe all indicator extensions in words. What is the value added by them?

4. To what extend do the extensions prepare your model for Integrated Assessment?

SMASH-CIRED's contribution to the first year of TranSust.Scan focused on modelling local pollutant emissions from road transportation in Europe. Emissions are computed 'ex post', on the basis of modelling results and assumptions from three distinct sources: the IMACLIM-R and POLES models produce harmonised scenarios of the global economy and energy markets up to 2050; the SMP model provides emission coefficients for 5 local pollutions from transportation activities (particulate matter, nitrogen oxides, carbon monoxide, non burnt hydrocarbons and lead). Road transportation activities are disaggregated in 18 vehicle types, amongst which 9 LDV types discriminated by technology or fuel. The disaggregation remains valid at the margin of the available scenarios (2 so far), and a set of policy levers (market share of technologies, aggregate mobility, emission standards, gap between western and transition economies, etc.) are represented to allow for policy exploration.

The second set of extensions, related to 'Poverty and social exclusion' and 'Aging society' categories, is work-in-progress only. The representative consumer of an open economy of IMACLIM restricted to France is being disaggregated in 3 revenue classes × 2 age classes (active and retired), with the corresponding income tracked on the resource side of the economy (labour vs

[1] IMACLIM runs in both a static and a dynamic recursive version, IMACLIM-S and IMACLIM-R. With the two versions closely connected, a unique table is filled in aggregating the variables (modelling abilities) of both versions.

transfer revenues). The purpose is to explore the tensions that develop on financing transfer revenues (pensions) as the age structure of the economy evolves—demography remains exogenous, drawn from UN 2004 scenarios. Alternative scenarios will assess different means of addressing the underlying challenge: age of withdrawal from labour market, decrease of the pensions in real terms and their welfare consequences, increase of fiscal pressure to maintain retirement conditions inc. recycling of the revenues from a carbon tax.

Table 1: Variables in model version of the TranSust project and extensions in TranSust.Scan

Theme	Sub-theme		Areas to be addressed	TRANSUST	EXTENSION
Economic development	Investment	1.	Investment in R&D		
		2.	Investment in Env. Friendly technologies	X	
		3.	Consumption and inflation	X	
		4.	Saving and borrowing	X	
	Competitiveness	5.	Labour productivity	X	
		6.	Unit labour costs	X	
		7.	Life-long Learning		
	Employment	8.	Employment rate	X	
		9.	Unemployment rate	X	
Poverty and social exclusion	Monetary poverty	10.	Income inequality		X
		11.	Non-monetary deprivation		
	Access to Labour Market	12.	Poverty-in-work		
	Other aspect of social exclusion	13.	Access to education		
		14.	Access to health care		
		15.	Access to housing		
		16.	Social participation		
Aging Society	Pensions adequacy	17.	Income of elder generations		X
	Demographic changes	18.	Life expectancy		
		19.	Fertility		
		20.	Migrations		
	Financial Sustainability	21.	Age of withdrawal from Labour Market		X
		22.	Pension expenditures		X
Public health	Human health protection and Life styles	23.	Financial sustainability		
		24.	Disability-free life expectancy		
		25.	Premature mortality		
		26	Life styles		
		27.	Health and safety at work		
		28.	Infectious diseases and resistance to antibiotics		
	Food Safety and Quality	29.	Pesticide residues		
		30.	Microbiological contamination		
		31.	Drinking water quality		
	Chemicals management	32.	Chemicals production and consumption		
		33.	Exposure to chemicals		
	Health risks due to environmental conditions	34.	Air quality		X
		35.	Noise exposure		
Climate change and energy	Climate change	36.	GHG emission reduction	X	
	Energy	37.	Energy taxes	X	
		38.	Energy efficiency	X	
		39.	Renewable energy resources	X	
		40.	Management of nuclear waste		
		41.	Air pollution from energy use		X
Production and consumption patterns	Eco-efficiency	42.	Decoupling economic growth and resource use	X	
		43.	Decoupling economic growth and emissions	X	
		44.	Decoupling economic growth and generation of wastes		
	Agriculture	45.	Pesticides use		
		46.	Nitrogen balances		
		47.	Environmentally-friendly farming		
	Corporate responsibility	48.	Triple bottom line		
	Consumer awareness	49.	Consumer information		
Management of natural resources	Biodiversity	50.	Protection of habitats and natural systems and biodiversity		
		51.	Maintaining the carrying capacity		
	Marine ecosystems	52.	Over-fishing		
	Fresh water resources	53.	Water extraction and use		
		54.	Protection of surface and ground water resources		
	Land use	55.	Land use change		
		56.	Soil degradation		
		57.	Forests		
Transport	Transport growth	58.	Decoupling of economic and transport growth	X	
		59.	Road to rail, water and public transport	X	
		60.	Land use by transport systems		
	Environmental impact of transport activities	61.	Air pollutants		X
Good governance	Policy coherence	62.	Citizen's adherence and support to EU actions		
		63.	Sustainability of EU actions and measures		
		64.	Legislative compliance		
	Public participation	65.	Communication and mobilization		
Global partnership	Globalisation of trade	66.	Market access for least developed countries (LDC)	X	
	Financing for SD	67.	Foreign direct investments to developing countries	X	
		68.	Official Development Assistance (ODA)		
		69.	Other official financing		
	Resource management	70.	Resource consumption	X	
		71.	Air emissions & Energy	X	
		72.	Water		
		73.	Waste		

Table 2: EC structural indicators in model version of the TranSust project and extensions in TranSust.Scan

EC	Indicator	TRANSUST	EXTENSIONS
I.	GDP per capita	X	
II.	Labor productivity	X	
III.	Employment rate	X	
IV.	Employment rate of older workers		
V.	Spending on human resources (public exp. on education)		
VI.	Research and Development expenditure		
VII.	Information Technology expenditure		
VIII.	Financial market integration (conv. of bank lending rates)		
IX.	At risk-of-poverty rate		
X.	Long-term unemployment	X	
XI.	Dispersion of regional employment rates		
XII.	Greenhouse gases emissions	X	
XIII.	Energy intensity of the economy	X	
XIV.	Volume of transport	X	
XV.	Competitiveness	X	

Name of the model: IMPEC (input-output), W8D (econometric)

Name of institution: LIFEA (Łódź, Poland)

A list of standard variable and indicator extensions follows on the next pages.

1. Are there extensions of your model by variables or indicators beyond the ones in the list? Please write them down.

YES, at least three very important – from the point of view of sustainability – variables:

   a. human capital,
   b. total factor productivity,
   c. Human Development Index

2. Describe all variable extensions in words. What is the value added by them?

(see the paper Modeling Various Aspects of Sustainability. The Case of Poland)

a) human capital: crucial measure for economic growth; one of the most important measures of social sustainability; positive correlation between human capital and social perception and attitude towards sustainability,
b) total factor productivity: in short – variable associated with and approximating technological progress, thus crucial for decreasing environmental pressure

3. Describe all indicator extensions in words. What is the value added by them?

c) Human Development Index: one of the most frequently quoted aggregate measure of sustainable development; slightly modified for the purpose of current investigation (stress put on secondary and tertiary education rather than on literacy ratio)

4. To what extend do the extensions prepare your model for Integrated Assessment?

They seem to vastly enrich investigations into various aspects of sustainability as they all are frequently used in such research. Besides, the measure of human capital proposed in the analysis

comprises – at least implicitly – all the main aspects of what is associated with human capital in its broad definition, namely: education, learning by doing and health status.

NOTE on the list

Some of the variables indicated in the table will be only exogenous in the models. The whole W8D model will be updated to take advantage of the latest information, so that finally a new model will emerge, which justifies ticking *core* and *extended* columns at the same time.

Table 1: Variables in model version of the TranSust project and extensions in TranSust.Scan

Theme	Sub-theme	Areas to be addressed	TRANSUST	EXTENSION
Economic development	Investment	1. Investment in R&D	X	X
		2. Investment in Env. Friendly technologies		
		3. Consumption and inflation	X	X
		4. Saving and borrowing	X	X
	Competitiveness	5. Labour productivity	X	X
		6. Unit labour costs	X	X
		7. Life-long Learning		X
	Employment	8. Employment rate	X	X
		9. Unemployment rate	X	X
Poverty and social exclusion	Monetary poverty	10. Income inequality		
		11. Non-monetary deprivation		
	Access to Labour Market	12. Poverty-in-work		
	Other aspect of social exclusion	13. Access to education		X
		14. Access to health care		
		15. Access to housing		
		16. Social participation		
Aging Society	Pensions adequacy	17. Income of elder generations		X
	Demographic changes	18. Life expectancy		X
		19. Fertility		X
		20. Migrations		X
	Financial Sustainability	21. Age of withdrawal from Labour Market		X
		22. Pension expenditures		X
Public health	Human health protection and Life styles	23. Financial sustainability		
		24. Disability-free life expectancy		
		25. Premature mortality		X
		26 Life styles		
		27. Health and safety at work		
		28. Infectious diseases and resistance to antibiotics		
	Food Safety and Quality	29. Pesticide residues		
		30. Microbiological contamination		
		31. Drinking water quality		X
	Chemicals management	32. Chemicals production and consumption		
		33. Exposure to chemicals		
	Health risks due to environmental conditions	34. Air quality		X
		35. Noise exposure		
Climate change and energy	Climate change	36. GHG emission reduction		X
	Energy	37. Energy taxes		X
		38. Energy efficiency		
		39. Renewable energy resources		
		40. Management of nuclear waste		
		41. Air pollution from energy use		
Production and consumption patterns	Eco-efficiency	42. Decoupling economic growth and resource use		
		43. Decoupling economic growth and emissions		X
		44. Decoupling economic growth and generation of wastes		
	Agriculture	45. Pesticides use		
		46. Nitrogen balances		
		47. Environmentally-friendly farming		
	Corporate responsibility	48. Triple bottom line		
	Consumer awareness	49. Consumer information		
Management of natural resources	Biodiversity	50. Protection of habitats and natural systems and biodiversity		
		51. Maintaining the carrying capacity		
	Marine ecosystems	52. Over-fishing		
	Fresh water resources	53. Water extraction and use		
		54. Protection of surface and ground water resources		
	Land use	55. Land use change		
		56. Soil degradation		
		57. Forests		
Transport	Transport growth	58. Decoupling of economic and transport growth		
		59. Road to rail, water and public transport		
		60. Land use by transport systems		
	Environmental impact of transport activities	61. Air pollutants		
Good governance	Policy coherence	62. Citizen's adherence and support to EU actions		
		63. Sustainability of EU actions and measures		
		64. Legislative compliance		
	Public participation	65. Communication and mobilization		
Global partnership	Globalisation of trade	66. Market access for least developed countries (LDC)		
	Financing for SD	67. Foreign direct investments to developing countries		
		68. Official Development Assistance (ODA)		
		69. Other official financing		
	Resource management	70. Resource consumption		
		71. Air emissions & Energy		
		72. Water		
		73. Waste		

Table 2: EC structural indicators in model version of the TranSust project and extensions in TranSust.Scan

EC	Indicator	TRANSUST	EXTENSIONS
I.	GDP per capita	X	X
II.	Labor productivity	X	X
III.	Employment rate	X	X
IV.	Employment rate of older workers		X
V.	Spending on human resources (public exp. on education)		
VI.	Research and Development expenditure	X	X
VII.	Information Technology expenditure		
VIII.	Financial market integration (conv. of bank lending rates)		
IX.	At risk-of-poverty rate		
X.	Long-term unemployment		
XI.	Dispersion of regional employment rates		
XII.	Greenhouse gases emissions		X
XIII.	Energy intensity of the economy		
XIV.	Volume of transport		
XV.	Competitiveness		

Name of the model: KLUM

Name of institution: University of Hamburg

A list of standard variable and indicator extensions follows on the next pages.

Note that the model was not part of the original TranSust model set. Therefore no comparison is possible. The EC structural indicators do not apply to the stand-alone version of the model. These could be addressed only when coupled to a CGE or DGVM.

1. Are there extensions of your model by variables or indicators beyond the ones in the list? Please write them down.

The original version of KLUM determined optimal land use allocations based on potential agricultural yields, land availability, and commodity prices. The extension to KLUM-W also includes water resources by recognizing that irrigation has profound impacts on agricultural production and therefore land allocation particularly in scenarios of increased water scarcity.

2. Describe all variable extensions in words. What is the value added by them?

The inclusion of water resources in a land use allocation model leads to improvements in the optimal land allocation algorithm since the important role of the substantial area of irrigated agriculture is no longer neglected. Furthermore, increased competition for water and a larger water scarcity can then be considered in model simulations.

3. Describe all indicator extensions in words. What is the value added by them?

4. To what extent do the extensions prepare your model for Integrated Assessment?

KLUM and KLUM-W are supposed to be used as a coupling tool to attach to another CGE or DGVM as needed in an integrated assessment framework. Such analyses have already been conducted with KLUM and will therefore also be possible with the extended KLUM-W version.

Table 1: Variables in model version of the TranSust project and extensions in TranSust.Scan

Theme	Sub-theme	Areas to be addressed	TRANSUST	EXTENSION
Economic development	Investment	1. Investment in R&D		
		2. Investment in Env. Friendly technologies		
		3. Consumption and inflation		
		4. Saving and borrowing		
	Competitiveness	5. Labour productivity		
		6. Unit labour costs		
		7. Life-long Learning		
	Employment	8. Employment rate		
		9. Unemployment rate		
Poverty and social exclusion	Monetary poverty	10. Income inequality		
		11. Non-monetary deprivation		
	Access to Labour Market	12. Poverty-in-work		
	Other aspect of social exclusion	13. Access to education		
		14. Access to health care		
		15. Access to housing		
		16. Social participation		
Aging Society	Pensions adequacy	17. Income of elder generations		
	Demographic changes	18. Life expectancy		
		19. Fertility		
		20. Migrations		
	Financial Sustainability	21. Age of withdrawal from Labour Market		
		22. Pension expenditures		
Public health	Human health protection and Life styles	23. Financial sustainability		
		24. Disability-free life expectancy		
		25. Premature mortality		
		26 Life styles		
		27. Health and safety at work		
		28. Infectious diseases and resistance to antibiotics		
	Food Safety and Quality	29. Pesticide residues		
		30. Microbiological contamination		
		31. Drinking water quality		
	Chemicals management	32. Chemicals production and consumption		
		33. Exposure to chemicals		
	Health risks due to environmental conditions	34. Air quality		
		35. Noise exposure		
Climate change and energy	Climate change	36. GHG emission reduction		
	Energy	37. Energy taxes		
		38. Energy efficiency		
		39. Renewable energy resources		
		40. Management of nuclear waste		
		41. Air pollution from energy use		
Production and consumption patterns	Eco-efficiency	42. Decoupling economic growth and resource use		
		43. Decoupling economic growth and emissions		
		44. Decoupling economic growth and generation of wastes		
	Agriculture	45. Pesticides use		
		46. Nitrogen balances		
		47. Environmentally-friendly farming		
	Corporate responsibility	48. Triple bottom line		
	Consumer awareness	49. Consumer information		
Management of natural resources	Biodiversity	50. Protection of habitats and natural systems and biodiversity		
		51. Maintaining the carrying capacity		
	Marine ecosystems	52. Over-fishing		
	Fresh water resources	53. Water extraction and use		X
		54. Protection of surface and ground water resources		X
	Land use	55. Land use change		X
		56. Soil degradation		X
		57. Forests		X
Transport	Transport growth	58. Decoupling of economic and transport growth		
		59. Road to rail, water and public transport		
		60. Land use by transport systems		
	Environmental impact of transport activities	61. Air pollutants		
Good governance	Policy coherence	62. Citizen's adherence and support to EU actions		
		63. Sustainability of EU actions and measures		
		64. Legislative compliance		
	Public participation	65. Communication and mobilization		
Global partnership	Globalisation of trade	66. Market access for least developed countries (LDC)		
	Financing for SD	67. Foreign direct investments to developing countries		
		68. Official Development Assistance (ODA)		
		69. Other official financing		
	Resource management	70. Resource consumption		
		71. Air emissions & Energy		
		72. Water		
		73. Waste		

Table 2: EC structural indicators in model version of the TranSust project and extensions in TranSust.Scan

EC	Indicator	TRANSUST	EXTENSIONS
I.	GDP per capita		
II.	Labor productivity		
III.	Employment rate		
IV.	Employment rate of older workers		
V.	Spending on human resources (public exp. on education)		
VI.	Research and Development expenditure		
VII.	Information Technology expenditure		
VIII.	Financial market integration (conv. of bank lending rates)		
IX.	At risk-of-poverty rate		
X.	Long-term unemployment		
XI.	Dispersion of regional employment rates		
XII.	Greenhouse gases emissions		
XIII.	Energy intensity of the economy		
XIV.	Volume of transport		
XV.	Competitiveness		

Name of the model: MARKAL

Name of institution: ECN

A list of standard variable and indicator extensions follows on the next pages.

1. Are there extensions of your model by variables or indicators beyond the ones in the list? Please write them down.

The Carbon Capture and Storage (CCS) technology is added, as well as geological CO2 leakage.

2. Describe all variable extensions in words. What is the value added by them?

item 34 : NOx, SOx emission of the energy system -> acidification
item 59 : modal shift could be included as exogenous determined or using a fixed substitution elasticity
item 63 : the impact of EU energy policies and measures (RES-E, biofuels, …) can be provided

3. Describe all indicator extensions in words. What is the value added by them?

-

4. To what extend do the extensions prepare your model for Integrated Assessment?

-

Table 1: Variables in model version of the TranSust project and extensions in TranSust.Scan

Theme	Sub-theme		Areas to be addressed	TRANSUST	EXTENSION
Economic development	Investment	1.	Investment in R&D		
		2.	Investment in Env. Friendly technologies	X	
		3.	Consumption and inflation		
		4.	Saving and borrowing		
	Competitiveness	5.	Labour productivity		
		6.	Unit labour costs		
		7.	Life-long Learning		
	Employment	8.	Employment rate		
		9.	Unemployment rate		
Poverty and social exclusion	Monetary poverty	10.	Income inequality		
		11.	Non-monetary deprivation		
	Access to Labour Market	12.	Poverty-in-work		
	Other aspect of social exclusion	13.	Access to education		
		14.	Access to health care		
		15.	Access to housing		
		16.	Social participation		
Aging Society	Pensions adequacy	17.	Income of elder generations		
	Demographic changes	18.	Life expectancy		
		19.	Fertility		
		20.	Migrations		
	Financial Sustainability	21.	Age of withdrawal from Labour Market		
		22.	Pension expenditures		
Public health	Human health protection and Life styles	23.	Financial sustainability		
		24.	Disability-free life expectancy		
		25.	Premature mortality		
		26	Life styles		
		27.	Health and safety at work		
		28.	Infectious diseases and resistance to antibiotics		
	Food Safety and Quality	29.	Pesticide residues		
		30.	Microbiological contamination		
		31.	Drinking water quality		
	Chemicals management	32.	Chemicals production and consumption		
		33.	Exposure to chemicals		
	Health risks due to environmental conditions	34.	Air quality		X
		35.	Noise exposure		
Climate change and energy	Climate change	36.	GHG emission reduction	X	
	Energy	37.	Energy taxes	X	
		38.	Energy efficiency	X	
		39.	Renewable energy resources	X	
		40.	Management of nuclear waste	X	
		41.	Air pollution from energy use	X	
Production and consumption patterns	Eco-efficiency	42.	Decoupling economic growth and resource use	X	
		43.	Decoupling economic growth and emissions	X	
		44.	Decoupling economic growth and generation of wastes		
	Agriculture	45.	Pesticides use		
		46.	Nitrogen balances		
		47.	Environmentally-friendly farming		
	Corporate responsibility	48.	Triple bottom line		
	Consumer awareness	49.	Consumer information		
Management of natural resources	Biodiversity	50.	Protection of habitats and natural systems and biodiversity		
		51.	Maintaining the carrying capacity		
	Marine ecosystems	52.	Over-fishing		
	Fresh water resources	53.	Water extraction and use		
		54.	Protection of surface and ground water resources		
	Land use	55.	Land use change	X	
		56.	Soil degradation		
		57.	Forests	X	
Transport	Transport growth	58.	Decoupling of economic and transport growth		
		59.	Road to rail, water and public transport		X
		60.	Land use by transport systems		
	Environmental impact of transport activities	61.	Air pollutants	X	
Good governance	Policy coherence	62.	Citizen's adherence and support to EU actions		
		63.	Sustainability of EU actions and measures		X
		64.	Legislative compliance		
	Public participation	65.	Communication and mobilization		
Global partnership	Globalisation of trade	66.	Market access for least developed countries (LDC)		
	Financing for SD	67.	Foreign direct investments to developing countries		
		68.	Official Development Assistance (ODA)		
		69.	Other official financing		
	Resource management	70.	Resource consumption	X	
		71.	Air emissions & Energy	X	
		72.	Water		
		73.	Waste		

Table 2: EC structural indicators in model version of the TranSust project and extensions in TranSust.Scan

EC	Indicator	TRANSUST	EXTENSIONS
I.	GDP per capita		
II.	Labor productivity		
III.	Employment rate		
IV.	Employment rate of older workers		
V.	Spending on human resources (public exp. on education)		
VI.	Research and Development expenditure		
VII.	Information Technology expenditure		
VIII.	Financial market integration (conv. of bank lending rates)		
IX.	At risk-of-poverty rate		
X.	Long-term unemployment		
XI.	Dispersion of regional employment rates		
XII.	Greenhouse gases emissions	X	
XIII.	Energy intensity of the economy	X	
XIV.	Volume of transport		
XV.	Competitiveness		

Name of the model: PACE

Name of institution: ZEW

A list of standard variable and indicator extensions follows on the next pages.

1. Are there extensions of your model by variables or indicators beyond the ones in the list? Please write them down.

Revealed comparative advantage indicators: RCA-Indicator, RTB-Indicator, RWS-Indicator

2. Describe all variable extensions in words. What is the value added by them?

3. Describe all indicator extensions in words. What is the value added by them?

The indicators introduced into PACE represent a number of indicators from the literature used to analyse explicitly international competitiveness issues, such as comparative advantages in trade.

4. To what extend do the extensions prepare your model for Integrated Assessment?

The new indicators allow for an analysis of the impact on competitiveness of environmental policy scenarios that are analysed in an integrated assessment framework.

Table 1: Variables in model version of the TranSust project and extensions in TranSust.Scan

Theme	Sub-theme		Areas to be addressed	TRANSUST	EXTENSION
Economic development	Investment	1.	Investment in R&D	X	
		2.	Investment in Env. Friendly technologies	X	
		3.	Consumption and inflation	X	
		4.	Saving and borrowing	X	
	Competitiveness	5.	Labour productivity	X	
		6.	Unit labour costs	X	
		7.	Life-long Learning		
	Employment	8.	Employment rate	X	
		9.	Unemployment rate	X	
Poverty and social exclusion	Monetary poverty	10.	Income inequality	X	
		11.	Non-monetary deprivation		
	Access to Labour Market	12.	Poverty-in-work		
	Other aspect of social exclusion	13.	Access to education		
		14.	Access to health care		
		15.	Access to housing		
		16.	Social participation		
Aging Society	Pensions adequacy	17.	Income of elder generations		
	Demographic changes	18.	Life expectancy		
		19.	Fertility		
		20.	Migrations		
	Financial Sustainability	21.	Age of withdrawal from Labour Market		
		22.	Pension expenditures		
Public health	Human health protection and Life styles	23.	Financial sustainability		
		24.	Disability-free life expectancy		
		25.	Premature mortality		
		26	Life styles		
		27.	Health and safety at work		
		28.	Infectious diseases and resistance to antibiotics		
	Food Safety and Quality	29.	Pesticide residues		
		30.	Microbiological contamination		
		31.	Drinking water quality		
	Chemicals management	32.	Chemicals production and consumption		
		33.	Exposure to chemicals		
	Health risks due to environmental conditions	34.	Air quality		
		35.	Noise exposure		
Climate change and energy	Climate change	36.	GHG emission reduction	X	
	Energy	37.	Energy taxes	X	
		38.	Energy efficiency	X	
		39.	Renewable energy resources	X	
		40.	Management of nuclear waste		
		41.	Air pollution from energy use	X	
Production and consumption patterns	Eco-efficiency	42.	Decoupling economic growth and resource use	X	
		43.	Decoupling economic growth and emissions	X	
		44.	Decoupling economic growth and generation of wastes		
	Agriculture	45.	Pesticides use		
		46.	Nitrogen balances		
		47.	Environmentally-friendly farming		
	Corporate responsibility	48.	Triple bottom line		
	Consumer awareness	49.	Consumer information		
Management of natural resources	Biodiversity	50.	Protection of habitats and natural systems and biodiversity		
		51.	Maintaining the carrying capacity		
	Marine ecosystems	52.	Over-fishing		
	Fresh water resources	53.	Water extraction and use		
		54.	Protection of surface and ground water resources		
	Land use	55.	Land use change		
		56.	Soil degradation		
		57.	Forests		
Transport	Transport growth	58.	Decoupling of economic and transport growth	X	
		59.	Road to rail, water and public transport	X	
		60.	Land use by transport systems		
	Environmental impact of transport activities	61.	Air pollutants	X	
Good governance	Policy coherence	62.	Citizen's adherence and support to EU actions		
		63.	Sustainability of EU actions and measures		
		64.	Legislative compliance		
	Public participation	65.	Communication and mobilization		
Global partnership	Globalisation of trade	66.	Market access for least developed countries (LDC)		
	Financing for SD	67.	Foreign direct investments to developing countries		
		68.	Official Development Assistance (ODA)		
		69.	Other official financing		
	Resource management	70.	Resource consumption		
		71.	Air emissions & Energy		
		72.	Water		
		73.	Waste		

Table 2: EC structural indicators in model version of the TranSust project and extensions in TranSust.Scan

EC	Indicator	TRANSUST	EXTENSIONS
I.	GDP per capita	X	
II.	Labor productivity	X	
III.	Employment rate	X	
IV.	Employment rate of older workers		
V.	Spending on human resources (public exp. on education)		
VI.	Research and Development expenditure	X	
VII.	Information Technology expenditure		
VIII.	Financial market integration (conv. of bank lending rates)		
IX.	At risk-of-poverty rate		
X.	Long-term unemployment		
XI.	Dispersion of regional employment rates		
XII.	Greenhouse gases emissions		
XIII.	Energy intensity of the economy	X	
XIV.	Volume of transport	X	
XV.	Competitiveness		X

Name of the model: WITCH

Name of institution: FEEM

A list of standard variable and indicator extensions follows on the next pages.

1 Are there extensions of your model by variables or indicators beyond the ones in the list? Please write them down.

Investments in:

- Traditional Coal
- Advanced Coal and CCS
- Gas
- Oil
- Biofuels and biomass
- Average Temperature

Net import of permits given a specified carbon market

Energy Technology Spillover

2 Describe all variable extensions in words. What is the value added by them?

Better understanding of the energy sector, technical progress, climate policy and climate damages

3 Describe all indicator extensions in words. What is the value added by them?

4 To what extend do the extensions prepare your model for Integrated Assessment?

The model has been prepared to better mimic energy technological progress which is a key factor in decoupling economic growth from GHGs emissions. In addition, it is a very important factor when dealing with distributional issues.

Table 1: Variables in model version of the TranSust project and extensions in TranSust.Scan

Theme	Sub-theme		Areas to be addressed	TRANSUST	EXTENSION
Economic development	Investment	1.	Investment in R&D		X
		2.	Investment in Env. Friendly technologies		X
		3.	Consumption and inflation		X
		4.	Saving and borrowing		X
	Competitiveness	5.	Labour productivity		-
		6.	Unit labour costs		X
		7.	Life-long Learning		
	Employment	8.	Employment rate		-
		9.	Unemployment rate		-
Poverty and social exclusion	Monetary poverty	10.	Income inequality		X
		11.	Non-monetary deprivation		-
	Access to Labour Market	12.	Poverty-in-work		-
	Other aspect of social exclusion	13.	Access to education		-
		14.	Access to health care		-
		15.	Access to housing		-
		16.	Social participation		-
Aging Society	Pensions adequacy	17.	Income of elder generations		-
	Demographic changes	18.	Life expectancy		-
		19.	Fertility		-
		20.	Migrations		-
	Financial Sustainability	21.	Age of withdrawal from Labour Market		-
		22.	Pension expenditures		-
Public health	Human health protection and Life styles	23.	Financial sustainability		-
		24.	Disability-free life expectancy		-
		25.	Premature mortality		-
		26	Life styles		-
		27.	Health and safety at work		-
		28.	Infectious diseases and resistance to antibiotics		-
	Food Safety and Quality	29.	Pesticide residues		-
		30.	Microbiological contamination		-
		31.	Drinking water quality		-
	Chemicals management	32.	Chemicals production and consumption		-
		33.	Exposure to chemicals		-
	Health risks due to environmental conditions	34.	Air quality		X
		35.	Noise exposure		-
Climate change and energy	Climate change	36.	GHG emission reduction		X
	Energy	37.	Energy taxes		X
		38.	Energy efficiency		X
		39.	Renewable energy resources		X
		40.	Management of nuclear waste		X
		41.	Air pollution from energy use		X
Production and consumption patterns	Eco-efficiency	42.	Decoupling economic growth and resource use		X
		43.	Decoupling economic growth and emissions		X
		44.	Decoupling economic growth and generation of wastes		-
	Agriculture	45.	Pesticides use		-
		46.	Nitrogen balances		-
		47.	Environmentally-friendly farming		-
	Corporate responsibility	48.	Triple bottom line		-
	Consumer awareness	49.	Consumer information		-
Management of natural resources	Biodiversity	50.	Protection of habitats and natural systems and biodiversity		-
		51.	Maintaining the carrying capacity		-
	Marine ecosystems	52.	Over-fishing		-
	Fresh water resources	53.	Water extraction and use		-
		54.	Protection of surface and ground water resources		-
	Land use	55.	Land use change		-
		56.	Soil degradation		-
		57.	Forests		X
Transport	Transport growth	58.	Decoupling of economic and transport growth		-
		59.	Road to rail, water and public transport		-
		60.	Land use by transport systems		-
	Environmental impact of transport activities	61.	Air pollutants		-
Good governance	Policy coherence	62.	Citizen's adherence and support to EU actions		-
		63.	Sustainability of EU actions and measures		-
		64.	Legislative compliance		-
	Public participation	65.	Communication and mobilization		-
Global partnership	Globalisation of trade	66.	Market access for least developed countries (LDC)		-
	Financing for SD	67.	Foreign direct investments to developing countries		-
		68.	Official Development Assistance (ODA)		-
		69.	Other official financing		-
	Resource management	70.	Resource consumption		X
		71.	Air emissions & Energy		X
		72.	Water		-
		73.	Waste		-

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III.	Employment rate		-
IV.	Employment rate of older workers		-
V.	Spending on human resources (public exp. on education)		-
VI.	Research and Development expenditure		X
VII.	Information Technology expenditure		-
VIII.	Financial market integration (conv. of bank lending rates)		-
IX.	At risk-of-poverty rate		-
X.	Long-term unemployment		-
XI.	Dispersion of regional employment rates		-
XII.	Greenhouse gases emissions		X
XIII.	Energy intensity of the economy		X
XIV.	Volume of transport		-
XV.	Competitiveness		-

Name of the model: W8D (econometric)

Name of institution: LIFEA (Łódź, Poland)

See under IMPEC