Local Action: What Policies will have the Greatest Impact

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Headline Sponsor

CarbonCredentials

Funding Acknowledgement

The Sustainability Pillar of the EPA's Research Programme 2014-2020 is designed to identify pressures, inform policy and develop solutions to environmental challenges within thematic areas through the provision of strong evidence-based scientific knowledge.

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Research Background

- 2-year project commenced in March 2016.
- Centre for Environmental Research at University of Limerick (PI: Dr Bernadette O'Regan).
- Aims:
  - Identification of resource efficiency opportunities.
  - Evaluation of the feasibility of specific policies and actions.
  - Assessment of potential of HE sector to act as a change agent in community sustainability.
- https://sustainablecampustransition.wordpress.com/

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Purpose of this workshop

- Introduce the “Sustainability Evaluation Metric for Policy Recommendation” - SEMPRe.
- Demonstrate potential use for Higher Education sustainability.
- Guided examples.
- Participative development of tool for the HE sector.

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Relevance of this workshop

"By 2020, substantially increase the number of cities and human settlements adopting and **implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change…"**

- Our campuses are communities
- Our campuses interact with communities
- Our campuses educate the community leaders of tomorrow

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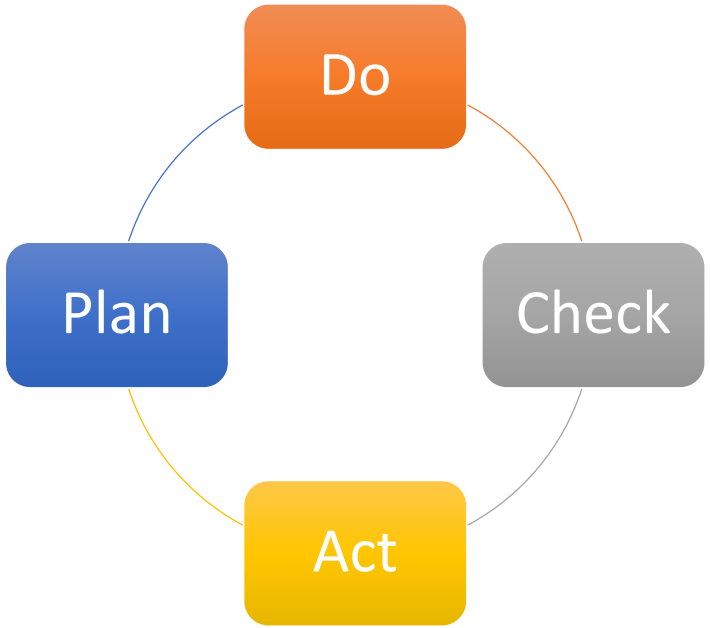
Discuss

How does your campus

- Set targets?
- Decide the most appropriate actions to achieve those targets?



SEMPRe

- SEMPRe is a freely available “policy evaluation” tool:
  - Aids decision-making and communication.
- Designed for “settlements”:
  - Definition: people living in any defined area.
- Demonstrated use in urban and rural areas.
- Can assess impact of local and national level policies.
- Easy to use Microsoft Excel interface.

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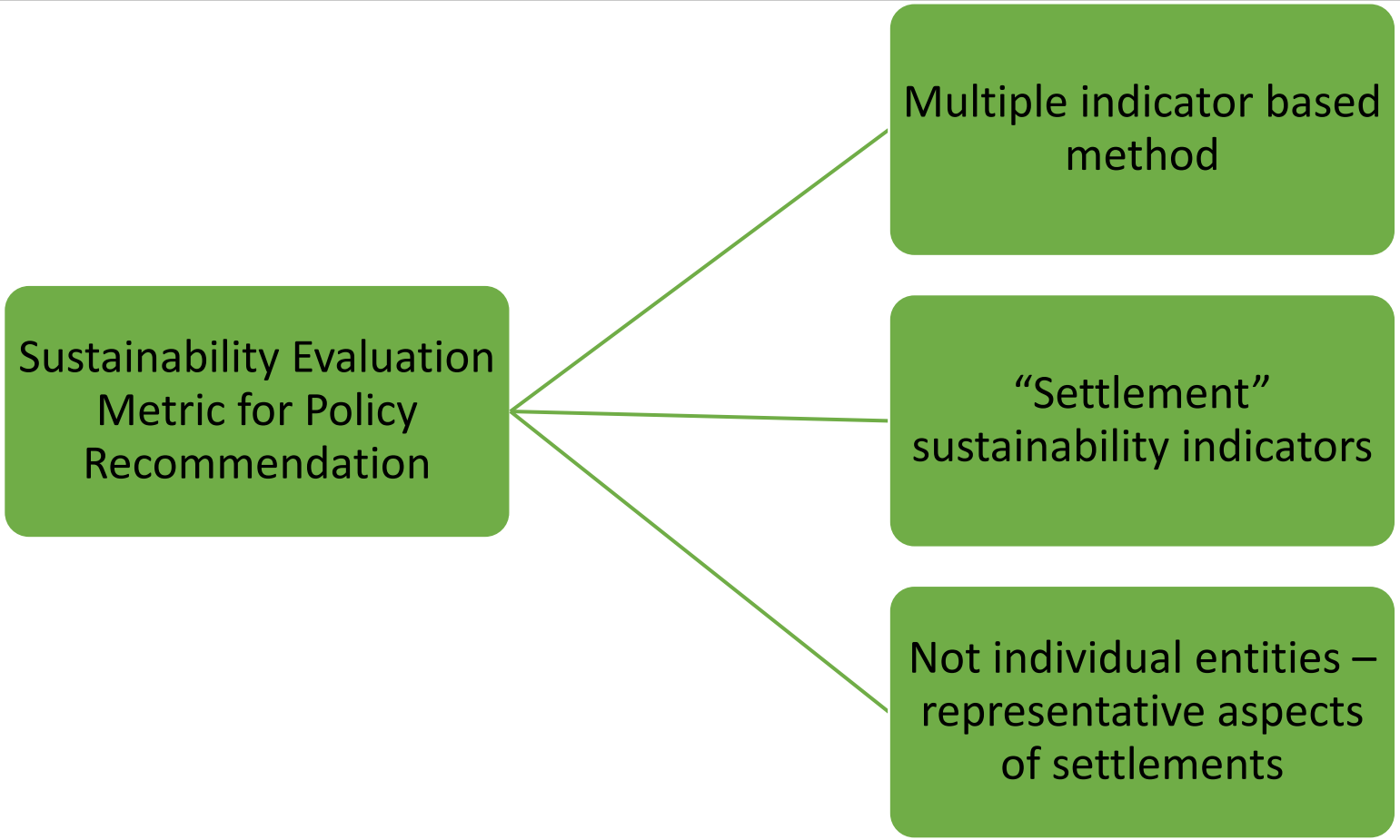
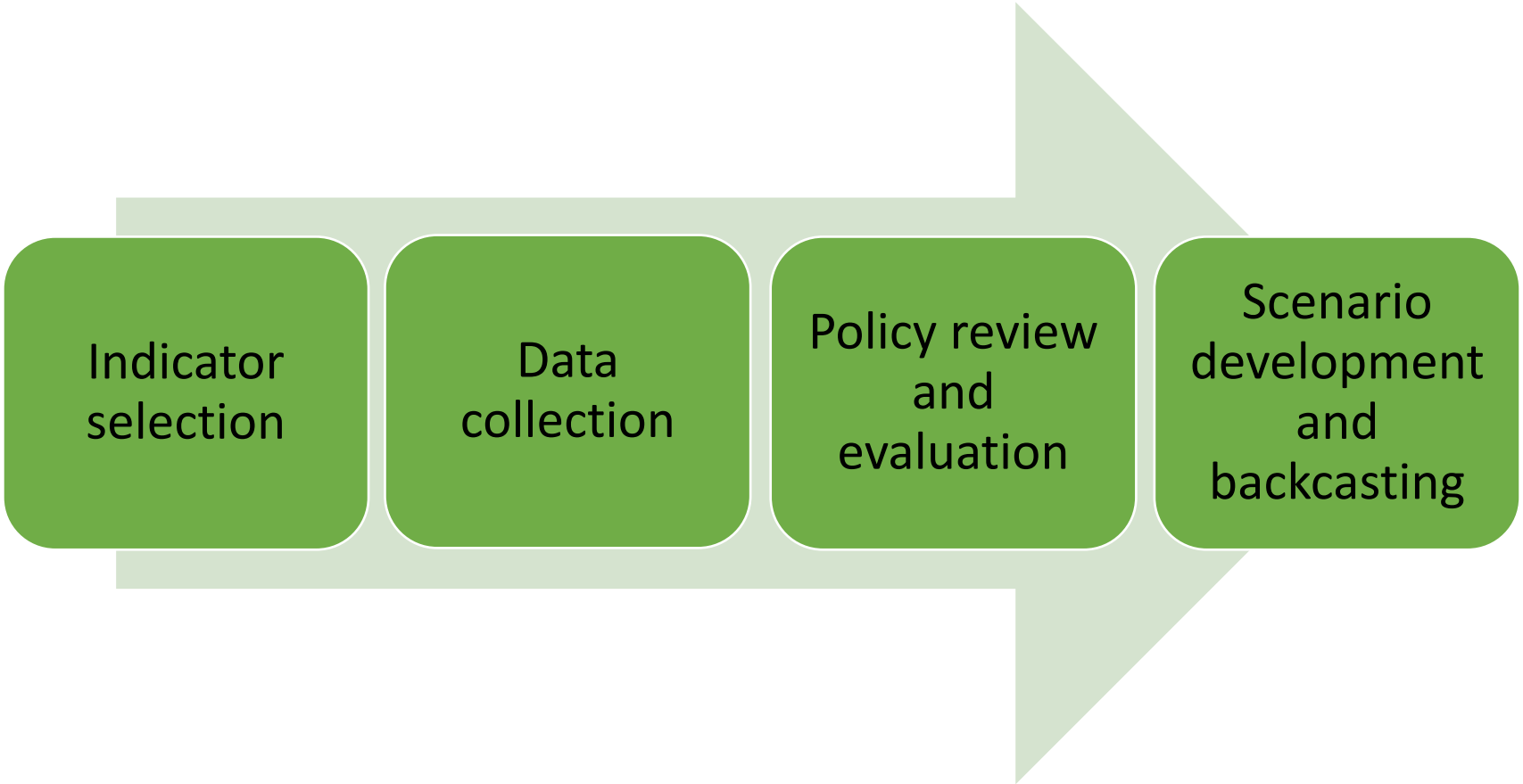
SEMPRe


Sustainability Evaluation Metric for Policy Recommendation
Multiple indicator based method
“Settlement” sustainability indicators
Not individual entities – representative aspects of settlements

SEMPRe


Indicator selection
Data collection
Policy review and evaluation
Scenario development and backcasting

SEMPRe

- SEMPRe doesn't rank settlements against one another.
  - Each settlement ranks against a hypothetical "best case" settlement,
  - SEMPRe assesses what policies would help individual campuses to reach that level – change scenarios.
- Each indicator will have an "optimum" value determined from the baseline data.

SEMPRe Indicators

Settlement studies:

- 40 indicators across 4 indices.
- Bigger score can have either positive or negative impact on sustainability.
- Can accommodate quantitative and qualitative indicators.

Environment index	Quality of Life index
1. % Recycling	11. % Health insurance cover
2. Per capita waste volume	12. Distance to nearest hospital
3. % Sewerage connection	13. % Community involvement
4. Forest area in a 10 km radius	14. % Odour problems
5. National heritage area in a 5 km radius	15. % Noise problems
6. % Green energy interest	16. % Sports area satisfaction
7. Transport CO2 emissions	17. % Green area satisfaction
8. Drinking water NO3	18. % 45+ hours employment
9. Electricity CO2 emissions	19. GPs per 1000 population
10. Level of wastewater treatment	20. % Quality of life satisfaction
Socio-Economic index	**Transport index**
21. Services index	31. % Relative car use
22. Population density	32. % Work in same town
23. Annual income	33. % Households with two or more cars
24. % Households in whole houses	34. % Work distance < 8 km
25. % Rented from LA	35. % Work distance > 24 km
26. % Households with central heating	36. % Public transport use
27. % Primary education as highest level	37. Km to nearest train station
28. % Cert./dipl. as highest level of Education	38. Index of traffic flow
29. House price income ratio	39. Monthly distance travelled to shops
30. % Home internet access	40. Distance to work

SEMPRe Indicators

- A simple transformation equation allows data with different units of measurement to be combined.
  - 2 equations to account for potential for improvement or worsening of SD score.
  - Each indicator receives a transformed score of between 0 and 1.
  - Can compare policy impacts on different indicators.
  - Can weight indicators, if deemed necessary.

SEMPRe Indicators

	A	B	C	D	E	F	G	H	I	J	K	L
1	SETT	POPULATI	RECPERC	WASTEVOL	SEWRGAP	FIPS4	NHA3	GREENPER	TRANSCO2	NO3	ESBCO2	WTREAT
2												
3												
4	Ballynagran	1746.00	100.00	1702.82	38.1							
5	Abbeyfeale	1683.00	74.47	2784.65	88.6							
6	Adare	1102.00	89.29	2588.87	84.5							
7	Annacotty	1342.00	88.89	2691.87	95.0							
8	Ardnacrusha	926.00	77.27	2976.29	85.7							
9	Askeaton	921.00	85.71	2548.65	39.2							
10	Athlone	15936.00	74.19	4112.46	90.4							
11	Ballaghaderreen	1416.00	81.82	3546.12	91.2							
12	Ballinamore	687.00	93.18	3610.10	75.0							
13	Ballinasloe	6219.00	95.51	2841.80	89.5							
14	Ballisodare	853.00	92.11	4878.22	91.6							
15	Ballygar	642.00	69.57	3144.86	95.6							
16	Ballymahon	827.00	73.68	2515.72	70.0							
17	Ballyshannon	2715.00	45.45	2870.58	73.8							
18	Banagher	1553.00	76.36	3553.66	94.8							
19	Birr	4436.00	85.19	3319.78	92.8							
20	Borrisokane	832.00	76.67	3022.55	65.5							
21	Borrisoleigh	598.00	75.00	3213.55	85.0							
22	Boyle	2205.00	75.00	2618.11	92.5							
23	Bruff	695.00	65.38	3209.15	67.8							
24	Bundoran	1842.00	55.56	2171.23	87.8							
25	Caherconlish	616.00	71.79	2794.03	60.5							
26	Cappamore	684.00	72.34	2370.93	61.7							
27	Carrick-on-Shannon	2237.00	84.44	3537.32	93.7							
28	Castleconnell	1343.00	72.73	2414.05	88.6							
29	Castlepollard	895.00	70.59	3708.19	88.2							
30	Charlestown-Bellaghy	753.00	52.17	3956.59	65.2							
31	Collooney	619.00	83.33	2123.39	72.2							
32	Cratloe	656.00	88.24	2717.06	17.6							

	A	B	C	D	E
1	Indicator	Minimum Observed Value	Maximum Observed Value	High or Low Values for SD	Equation used
2	% regular recycling	45.46	100	High	5.1
3	Per Capita Annual Volume of Waste	1702.82	4907.07	Low	5.2
4	% third Bin recycling	4.46	30		
5	%Households, public sewerage	17.65	97.54	High	5.1
6	FIPS_10000	1.56	57.52	High	5.1
7	NHA_5000	0	30	High	5.1
8	% interested in buying green energy	51.52	100	High	5.1
9	Per Capita Tonnes CO_2 Transport	0.9	2.4	Low	5.2
10	Average NO_3 Mg/l 2000-2001	0.57	28.42	Low	5.2
11	Per capita Kg CO_2	77.29	164.48	Low	5.2
12	General level of wastewater treatment	0	3	High	5.1
13	% With Health Insurance	27.3	100	High	5.1
14	Distance to Nearest Hospital in Km	0	57.6	Low	5.2
15	% involved in community activities	16.67	69.57	High	5.1
16	% experience offensive odours	0	66.67	Low	5.2
17	% Experiencing Noise Problems	0	42.42	Low	5.2
18	% 3-bin Service	4.46	37	High	5.1
19	% reg Sufficient Green Spaces	21.43	100	High	5.1
20	% workers with 45+ hours employment	0	71.17	Low	5.2
21	Number of GPs per 1000 Population	0	4.67	High	5.1
22	Quality of life satisfaction	46.43	95.45	High	5.1
23	Services Index	4	79	High	5.1
24	Population Density Persons / sq Km	47.189	4242.31	High	5.1
25	Mean Total Annual Income	9727.58	30764.18	High	5.1
26	% Whole Houses	85.62	100	Low	5.2
27	% rented from LA	0	23.53	Low	5
28	% Private Central Heating	56.91	100	High	5.1
29	% Primary Education	0	27.24	Low	5.2
30	%Certificate/Diploma	2.84	31.18	High	5.1
31	House price income ratio	5.56	38.7	Low	5.2
32	% Home Internet Access	14.77	77.2	High	5.1
33	% Relative car use	16.67	87.51	Low	5.2
34	% Work in same town as residence	11.11	93.88	High	5.2
35	% two or more cars	17.6	81.82	Low	5.2
36	% Travel less than 8Km	7.69	74.51	High	5.1
37	% Travel greater than 24Km	0	69.23	Low	5.2
38	% Using Public Transport	3.13	40.54	High	5.1
39	Mean Kms to nearest train station	0	45.9	Low	5.2
40	Traffic Flow (Km travelled per min)	0.4	1.81	High	5.2
41	Monthly Distance Travelled to Shops in Km	59.09	464.95	Low	5.2
42	Monthly Distance to Work in Km	260.85	4554.89	Low	5.2
43					
44	Optimum Values shaded in Yellow				
45	Worst Values shaded in Blue				

SEMPRe Indicators

Settlement:	Ballynagran												
Index	**Indicator**	**2012 Baseline Data**	**Equation**	**Transformed Score**	**Candidate Policy**	**New indicator level due to Candidate Policy**	**Projected New Data**	**Equation**	**New Transformed Score**	**Sustainability weighting**	**Scores - improvement weighted**	**Quantified improvement due to policy**	**Units of measurement**
Environmental	% Recycling	100.00	1	1.00			100.00	1	1.00	1.00	1.00	0.00	% regular recycling
	Per Capita Waste (kg)	1702.82	2	1.00		90%	1532.54	2	1.05	1.00	1.05	170.28	Per Capita Annual Volume of Waste
	% 3-bin Service	4.46	1	0.00			4.46	1	0.00	1.00	0.00	0.00	% third Bin recycling
	% Sewerage Connection	38.12	1	0.26			38.12	1	0.26	1.00	0.26	0.00	%Households, public sewerage
	Area of forestry (ha)	57.50	1	1.00			57.50	1	1.00	1.00	1.00	0.00	FIPS_10000
	Area of Heritage Area (ha)	30.00	1	1.00			30.00	1	1.00	1.00	1.00	0.00	NHA_5000
	% Green Energy Interest	78.71	1	0.56			78.71	1	0.56	1.00	0.56	0.00	% interested in buying green energy
	Transport CO_2 Emissions (kg)	2.06	2	0.23		90%	1.85	2	0.36	1.00	0.36	0.21	Per Capita Tonnes CO2 Transport
	Water pollution (mg/l)	.57	2	1.00			0.57	2	1.00	1.00	1.00	0.00	Average NO3 Mg/l 2000-2001
	Electricity CO_2 Emissions (kg)	99.60	2	0.74			99.60	2	0.74	1.00	0.74	0.00	Per capita Kg CO2
	Level of Wastewater Treatment	1.00	1	0.33			1.00	1	0.33	1.00	0.33	0.00	General level of wastewater treatment
Environmental Index				**7.12**					**7.31**		**7.31**		
Quality of Life	Distance to Hospital	57.60	2	0.00			57.60	2	0.00	1.00	0.00	0.00	Distance to Nearest Hospital in Km
	% Community Involvement	63.86	1	0.89			63.86	1	0.89	1.00	0.89	0.00	% involved in community activities
	% Odour Problems	.00	2	1.00			0.00	2	1.00	1.00	1.00	0.00	% experience offensive odours
	% Noise Problems	.00	2	1.00			0.00	2	1.00	1.00	1.00	0.00	% Experiencing Noise Problems
	% 45+ Hours Employment	71.17	2	0.00			71.17	2	0.00	1.00	0.00	0.00	% workers with 45+ hours employment
	GP's per 1000 population	.00	1	0.00			0.00	1	0.00	1.00	0.00	0.00	Number of GPs per 1000 Population
Quality of Life Index				**2.89**					**2.89**		**2.89**		
Socio-Economi	Services Index	10.00	1	0.08			10.00	1	0.08	1.00	0.08	0.00	Services Index
	Population Density	47.19	1	0.00			47.19	1	0.00	1.00	0.00	0.00	Population Density Persons / sq Km
	% Households in Whole Houses	94.01	2	0.42			94.01	2	0.42	1.00	0.42	0.00	% Whole Houses
	% Rented from Local Authority	7.45	2	0.68			7.45	2	0.68	1.00	0.68	0.00	% rented from LA
	% Households with Central Heating	92.08	1	0.82			92.08	1	0.82	1.00	0.82	0.00	% Private Central Heating
	% Primary Education as Highest	19.65	2	0.28			19.65	2	0.28	1.00	0.28	0.00	% Primary Education
	% Cert./Dipl. As Highest	26.00	1	0.82			26.00	1	0.82	1.00	0.82	0.00	%Certificate/Diploma
	House Price Income Ratio	5.56	2	1.00			5.56	2	1.00	1.00	1.00	0.00	House price income ratio
	% Home internet Access	56.50	1	0.67			56.50	1	0.67	1.00	0.67	0.00	% Home Internet Access
Socio-Economic Index				**4.76**					**4.76**		**4.76**		
Transport	% Relative Car Use	87.51	2	0.00			87.51	2	0.00	1.00	0.00	0.00	% Relative car use
	% Households with >2 cars	58.91	2	0.36			58.91	2	0.36	1.00	0.36	0.00	% two or more cars
	% Work distance <8 Kms	29.36	1	0.32			29.36	1	0.32	1.00	0.32	0.00	% Travel less than 8Km
	% Work distance >24 Kms	51.06	2	0.26			51.06	2	0.26	1.00	0.26	0.00	% Travel greater than 24Km
	% Public Transport Use	8.42	1	0.14			8.42	1	0.14	1.00	0.14	0.00	% Using Public Transport
	Kms to nearest train station	6.63	2	0.86			6.63	2	0.86	1.00	0.86	0.00	Mean Kms to nearest train station
	Index of Traffic Congestion	.69	2	0.79			0.69	2	0.79	1.00	0.79	0.00	Traffic Flow (Km travelled per min)
	Distance to shops	93.49	2	0.92			93.49	2	0.92	1.00	0.92	0.00	Monthly Distance Travelled to Shops in Km
	Distance to work	425.30	2	0.96			425.30	2	0.96	1.00	0.96	0.00	Monthly Distance to Work in Km
Transport Index				**4.61**					**4.61**		**4.61**		
Overall Sustainable Development Index				**48.46**					**48.94**		**48.94**		
Projected unweighted sustainability change due to Policy				**0.98%**									
Projected weighted sustainability change due to Policy				**0.98%**									

Policy Selection

- SEMPRe predicts the likely outcome of a policy based on published results from implementation elsewhere. These results must be –
  - Described in quantitative terms,
  - Where possible evaluated more than once,
  - Supporting evidence on policy impacts available from reliable sources,
  - Relevant and relatively easily understood and explained,
  - Capable of implementation over relatively short timescales.

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Policy review

Policy no.	General Policy Name	Sustainability improvement %
1.	Eco-driver Training	1.65
2.	Reduced Speed Limits	0.91
3.	Support for Public Transport	1.01
4.	Promotion of Community Based Transport Services	1.01
5.	Promotion of Electric Vehicles	1.65
6.	Electric Recharge Grid	1.65
7.	Vehicle to Grid	1.65
8.	Short Term Car Rental Schemes	1.54
9.	Use of short rotation coppice willow and Miscanthus as home heating fuels	4.87
10.	Wind Energy	4.85
11.	Solar Energy and power generation	4.86
12.	Reduction in standby energy use	4.85
13.	Retrofitting of homes to reduce heat losses	4.88
14.	Smart Electricity Meters	4.86
15.	Mandatory home energy audits	4.86
16.	Waste Prevention Campaign	3.08
17.	Reduced Packaging	3.62
18.	Energy Recovery from Waste	9.21
19.	Third bin for compost collection	3.04

SEMPRe Scenarios and Backcasting

General Policy Name	Emission category	Carbon emitted (tCO_2)	Sustainability Improvement % (SEMPRe)	Carbon abated (tCO_2)
Eco-driver training	Transport CO_2	3834.9	1.65	63.27
Support for public transport	Transport CO_2	3834.9	1.01	38.73
Promotion of electric vehicles	Transport CO_2	3834.9	1.65	63.27
Vehicle to Grid	Transport CO_2	3834.9	1.65	63.27
Wind Energy	Electricity CO_2	7213	4.85	349.83
Third bin for compost collection	Per capita waste (kg)	4436.92 (CO_{2e} of CH_4 emission)	3.04	134.88
Mandatory home energy audits	Electricity CO_2	7213	4.86	350.55
Smart electricity meters	Electricity CO_2	7213	4.86	350.55

Tools relating to SD in HE

- Significant work carried out to date on assessment of sustainability at HE.
- Global goals: local action
  - What gets measured gets managed.
- Assessments focus inwardly or outwardly.
- Assessment is important to determine what is working, but equally what isn't working.
- SEMPRe gathers data on what has worked elsewhere to aid decision making in an environment where resources are limited.

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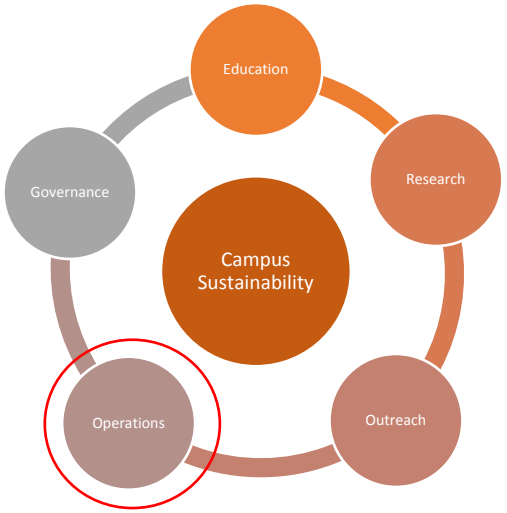
SEMPRe for HE?

- Not an assessment tool.
- Not used to rank “settlements” against one other, rather against a hypothetical “best case” settlement.
- Can be used alongside assessment tools to guide future direction.
- Highly adaptable.
- Current focus: Carbon reduction.



SEMPRe for HE

- Requires three components:
  - Indicators,
  - Baseline data,
  - Examples of policy implementation.

Indicator Selection

- UNEP Greening Universities toolkit
  - 12 indicators that all HEIs should be reporting on,
  - Regions or HEIs should work to identify further “additional” indicators suitable to their context.
  - Participative process.

Table 1. “Core” indicators that all HEIs should report on (UNEP, 2014).

Element	Metric	Units
Energy, carbon and climate change	Scope 1 and 2 GHG emissions	tCO2e/capita
	Electricity consumption	kWh/m2 kWh/capita
	Natural gas consumption	GJ/m2 GJ/capita
	Transport energy consumption	kL fuel, Passenger kilometres
Water use	Potable and non-potable water consumption	kL/m3, kL/capita
	Wastewater production	Kl/capita
Land use	Proportion of certified green buildings per floor area	%
	Proportion of pervious to impervious surfaces	%
	Vegetation cover	%
Material Flows	Solid waste disposal	kg/capita
	Solid waste recovery	kg/kg
	Material use	kg/capita

Data Collection

- Data availability impacts what indicators we can use in the short term.
- HESA estates data freely available for UK campuses.
  - Provides quantitative data on operational aspects of campus sustainability.
  - SEMPRe settlement database can be updated to include new data/indicators as they become available.

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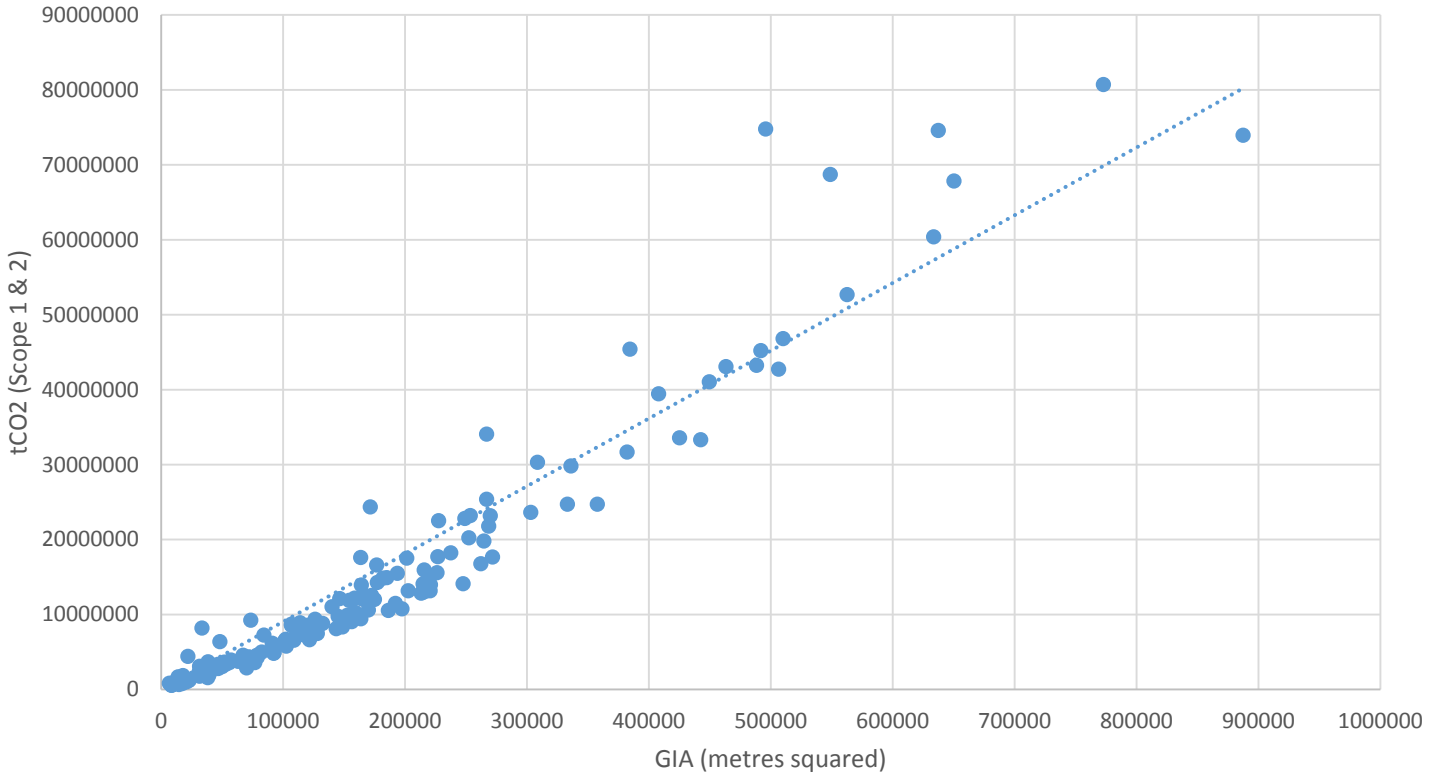
Categorisation: Size



Example Policy

The University of Limerick's Smarter Travel Campus Programme, which involved a combination of hard and soft measures:

- Infrastructural improvements – new paths, cycling facilities.
- Awareness raising to promote low carbon travel options

Example Policy

Policy Impact:

STAFF	2011	2014	2015	2016
Walking	6.6%	8.3%	10.2%	12.6%
Bicycle	8.4%	11.6%	10.8%	7.7%
Bus	2.7%	3.6%	4.3%	4.8%
Driving a car	75.9%	69.1%	68.2%	69.0%

STUDENTS	2011	2014	2015	2016
Walking	46.2%	48.4%	49.8%	44.4%
Bicycle	6.6%	11.6%	12.3%	11.6%
Bus	12.4%	8.4%	6.5%	9.0%
Driving a car	29.4%	22.7%	24.1%	26.6%

Discuss

What policies/actions have had the biggest impact on your campus to date?

- Waste
- Energy
- Water
- Biodiversity
- …?

Behavioural?

- Waste
- Energy
- Water
- Biodiversity
- …?

Structural

Conclusion and Next Steps

- The SEMPRe tool has proven useful in a range of settlement types.
- Significant potential for use in the higher education sector.
- Requires:
  - Indicators,
  - Baseline data,
  - Examples of policy implementation.
- Participative approach could be most beneficial.

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