EECONE PROJECT:

European ECOsystem for Green Electronics

PRESENTED BY: **JUI ROY**

Supervised By:
Jean-Christophe CREBIER
CNRS Senior Scientist
Laboratoirede Génie Electrique
de Grenoble, G2ELab

Purpose of the Project

To reduce E-waste in Europe working on already existing E-waste, developing new tooling to extend lifetime and recyclability of E-waste, deploy at European level the new best practices and more important to develop a strong European ecosystem in this domain.

To move toward a zero-waste electronic industry fully guided by the “6R concept”.

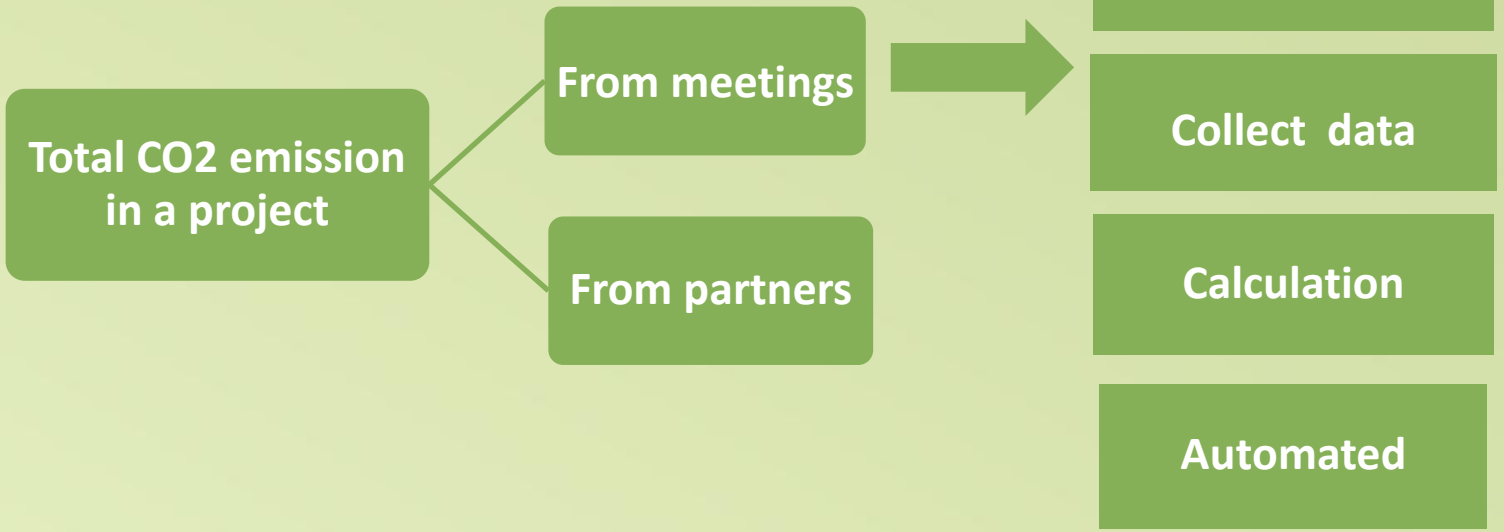
My purpose

- Create a methodology for optimizing/minimizing the total CO2 emissions of meetings in the defined European projects.
- Create a methodology to assess the total CO2 emission of a European project.

Problem Statement

- Model Development
- Methodology Formulation
- Collect data
- Automation Challenges
- Implementation for plug and play

Process of Work



Model illustration

Car, Bus, Tram
Type of vehicle/fuel

Airport

Energy Consumption: Lighting, Air Conditioning, Internet

If Delayed:
Additional Time

Layover

Total Time

If using Transport:
Car, Bus, Tram

Total Time
Airline Name
Class: Premium Economy, Business, First

Airport

Short Trips

Total Time Transport:

Conference

Total time in meeting
-Energy Consumption: Lighting, Air Conditioning, Internet

Same as Home to Airport

Airport

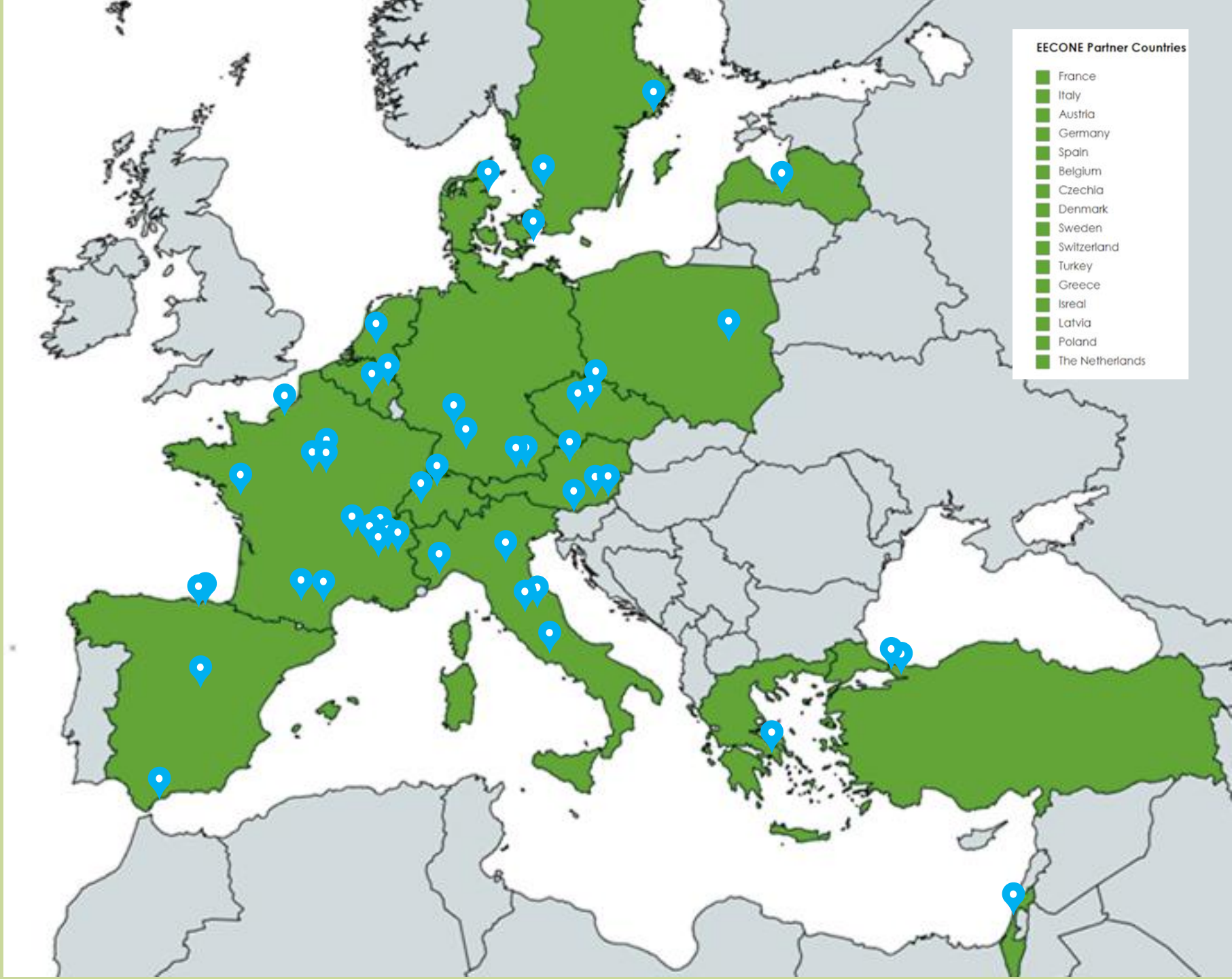
Layover

Airport

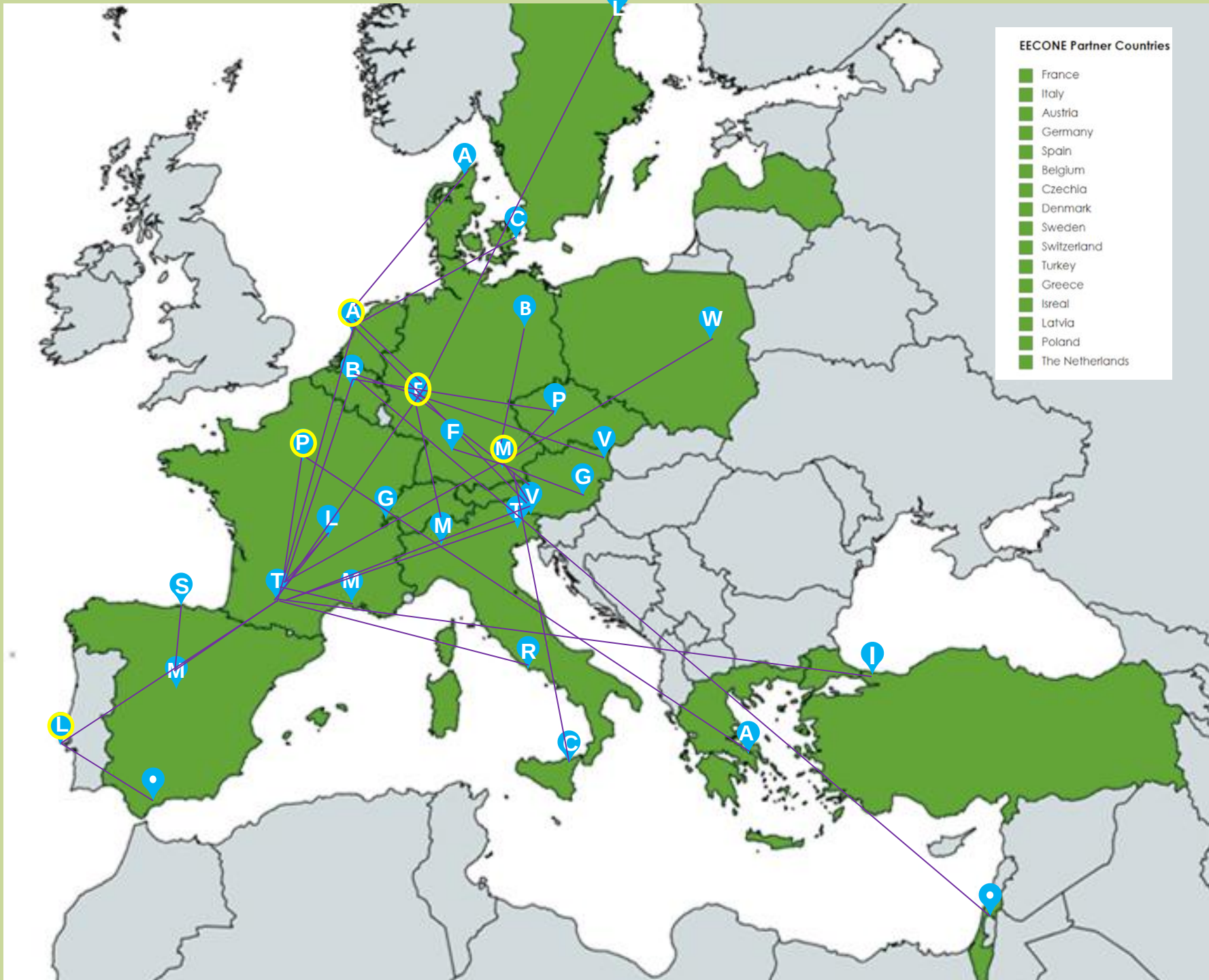
Total Time
Building Category:
Old, New

Same as previous

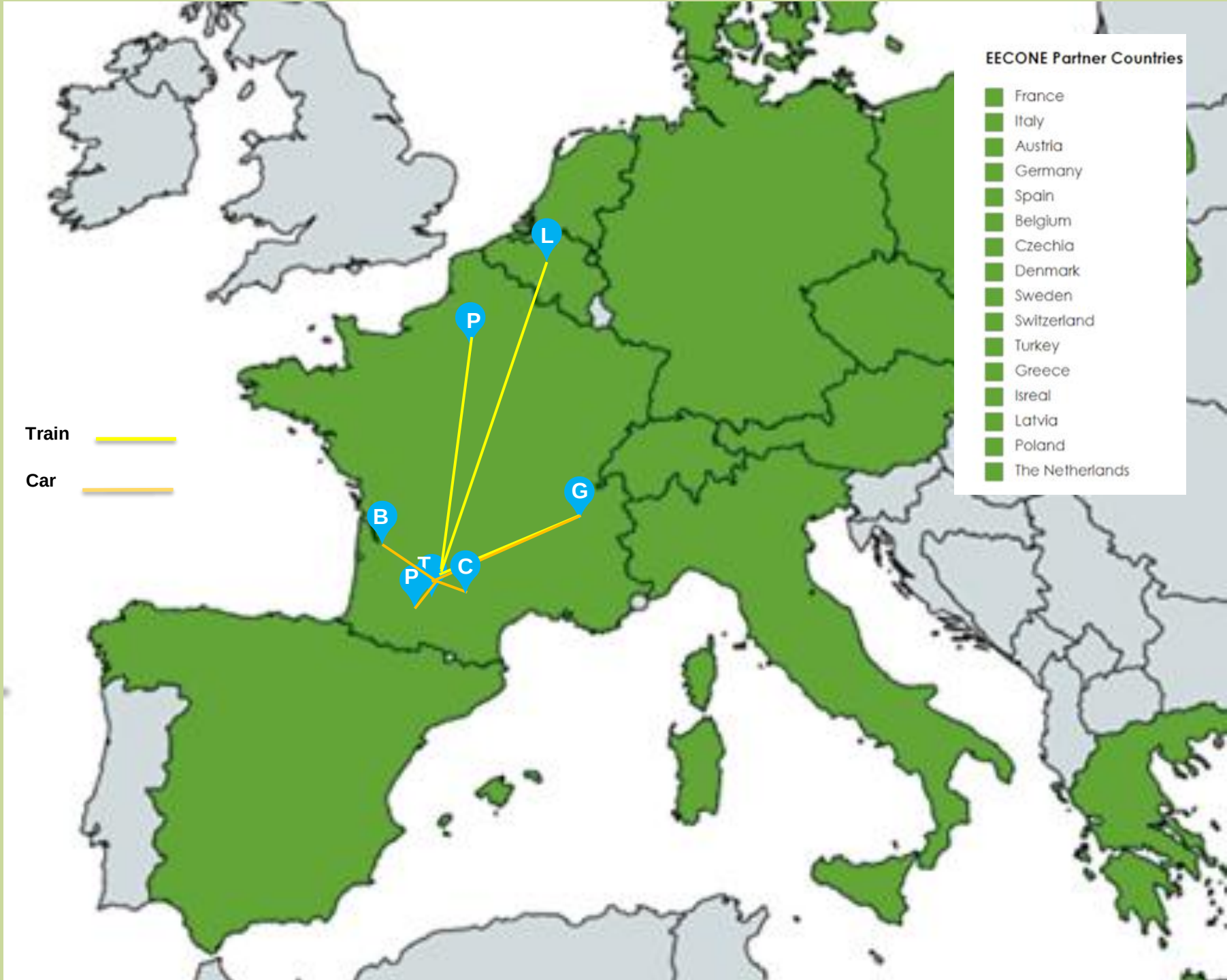
EECONE MAP
50 Partner location



MAP on Flight to kick-off meeting in Toulouse



MAP on Train and Car to kick-off meeting in Toulouse



Manual Calculation for kick-off meeting

Total CO2 emission from kick-off meeting (Kg)

Transport

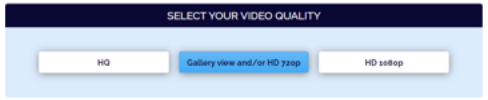
TOTAL (Kg) 14527.07

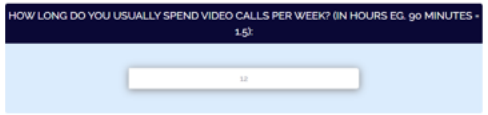
Plane	Train
153.00	2.00
92.00	2.00
202.00	2.00
202.00	2.00
324.00	2.00
80.00	17.00
80.00	2.00
296.00	Car_thermal_engine
103.00	59.00
106.00	107.00
269.00	107.00
106.00	18.00
235.00	431.89
247.00	3.07
105.00	18.58
213.00	Total
161.00	773.53
476.00	1547.07
243.00	
345.00	
146.00	
233.00	
233.00	
139.00	
99.00	
190.00	
241.00	
168.00	
246.00	
162.00	
153.00	
215.00	
65.00	
57.00	
105.00	
6490	**12980**

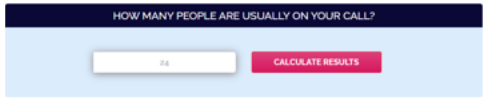
Online Participants

TOTAL (Kg) 325.44

Participants	23.00
Host	1.00
Days	2.00
Hours	12.00



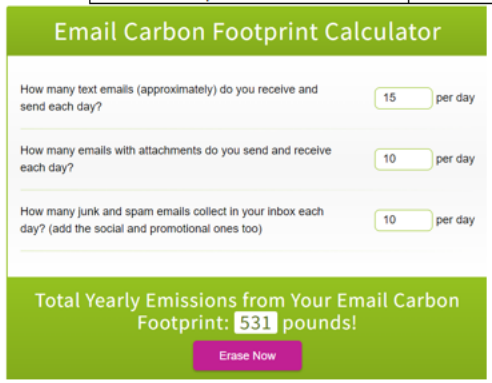




ICT

TOTAL (Kg) 45.83

Total computer use	35.00
CO2 emission per day	0.65
For 2 days	1.31
For 35 computers total emission	45.83 Kg

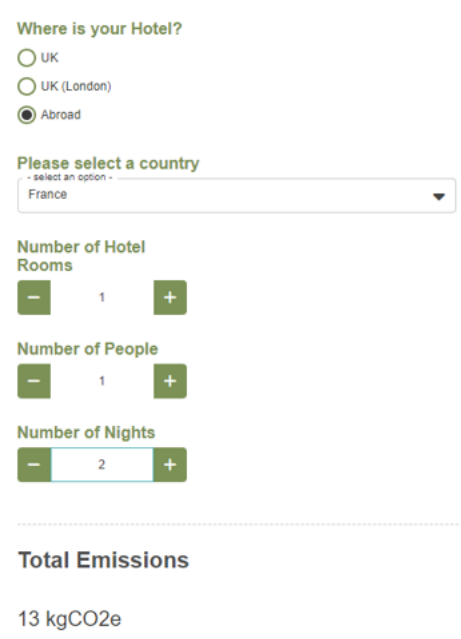


Total CO2 Emission (kg) from Primary tavel	6810	Kg
Total CO2 Emission (kg) from Auxilary tavel	454	Kg

Hotel

TOTAL (Kg) 923.00

Number of people stay in the hotel	71.00	
CO2 emission per person	13.00	Kg
Total CO2 emission for all people	923.00	Kg



CO2 emission for 22 participants (no information)

49 participants total CO2 emission	**14527**	kg
22 participants total CO2 emission	**6522**	kg

Total CO2 emission 22344 kg

Automated Model

Departure_ City	Latitude	Longitude	Connection_ City	Latitude	Longitude	Arrival City		Main_Traveling_ Mode	Distance	Emission Factor(kg)	CO2 emission
Santander, Spain	43.4667	-3.8000	Madrid	40.4169	-3.7033	Toulouse		Plane	861	0.1416	135.36
Madrid	40.4169	-3.7033				Latitude	Longitude	Plane	522	0.1416	87.33
Graz	47.0708	15.4386	Frankfurt	50.1106	8.6822	43.6047	1.4442	Plane	1588	0.1416	238.28
Graz	47.0708	15.4386	Frankfurt	50.1106	8.6822			Plane	1588	0.1416	238.28
Athens	37.9842	23.7281	Paris	48.8567	2.3522			Plane	2608	0.1416	382.81
Geneva	46.2000	6.1500						Plane	469	0.1416	79.81
Rome	41.8931	12.4828						Train	854	0.0033	3.13
Aalborg	57.0500	9.9167	Amsterdam	52.3728	4.8936			Plane	1707	0.1416	255.16
Venice	45.4397	12.3319	Munich	48.1375	11.5750			Plane	1258	0.1416	191.58
Yavne			Brussels	50.8467	4.3525			Plane	6494	0.1416	932.95
Istanbul	41.0100	28.9603						Plane	2068	0.1416	306.29
Luleå	65.5838	22.1915	Frankfurt	50.1106	8.6822			Plane	3065	0.1416	447.47
Feuerbach	48.8116	9.1589	Munich	48.1375	11.5750			Plane	1166	0.1416	178.61
Warsaw	52.2300	21.0111	Munich	48.1375	11.5750			Plane	1877	0.1416	279.17
Warsaw	52.2300	21.0111	Munich	48.1375	11.5750			Plane	1877	0.1416	279.17
Treviso	45.6722	12.2422						Plane	874	0.1416	137.16
Paris	48.8567	2.3522						Plane	589	0.1416	96.79
Milan	45.4669	9.1900	Frankfurt	50.1106	8.6822			Plane	1449	0.1416	218.64
Catania	37.5027	15.0873	Munich	48.1375	11.5750			Plane	2163	0.1416	319.79
Amsterdam	52.3728	4.8936	Frankfurt	50.1106	8.6822			Plane	1345	0.1416	203.86
Amsterdam	52.3728	4.8936	Venice	45.4397	12.3319			Plane	1863	0.1416	277.24
Prague	50.073658	14.41854	Munich	48.1375	11.5750			Plane	1273	0.1416	193.77
Santander, Spain	43.4667	-3.8000	Madrid	40.4169	-3.7033			Plane	861	0.1416	135.36
Copenhagen	55.6761	12.5689	Amsterdam	52.3728	4.8936			Plane	1797	0.1416	267.98
Marignane	43.4169	5.2147						Plane	289	0.1416	54.43
Rome	41.8931	12.4828						Plane	854	0.1416	134.36
Bordeaux	44.8378	-0.5794						Car_thermal_engine	208	0.2234	60.52
Grenoble	45.1869	5.7264						Car_thermal_engine	377	0.2234	109.40
Grenoble	45.1869	5.7264						Car_thermal_engine	377	0.2234	109.40
Plaisance-du-Touch	43.5656	1.2964						Car_thermal_engine	12	0.2234	3.53
Castres	43.6076	2.2419						Car_thermal_engine	61	0.2234	17.77
Grenoble	45.1869	5.7264						Train	377	0.0033	1.49
Grenoble	45.1869	5.7264						Train	377	0.0033	1.49
Grenoble	45.1869	5.7264						Train	377	0.0033	1.49
Limal	50.6939	4.5733						Train	828	0.0033	3.28
Grenoble	45.1869	5.7264						Train	377	0.0033	1.49

Result Analysis

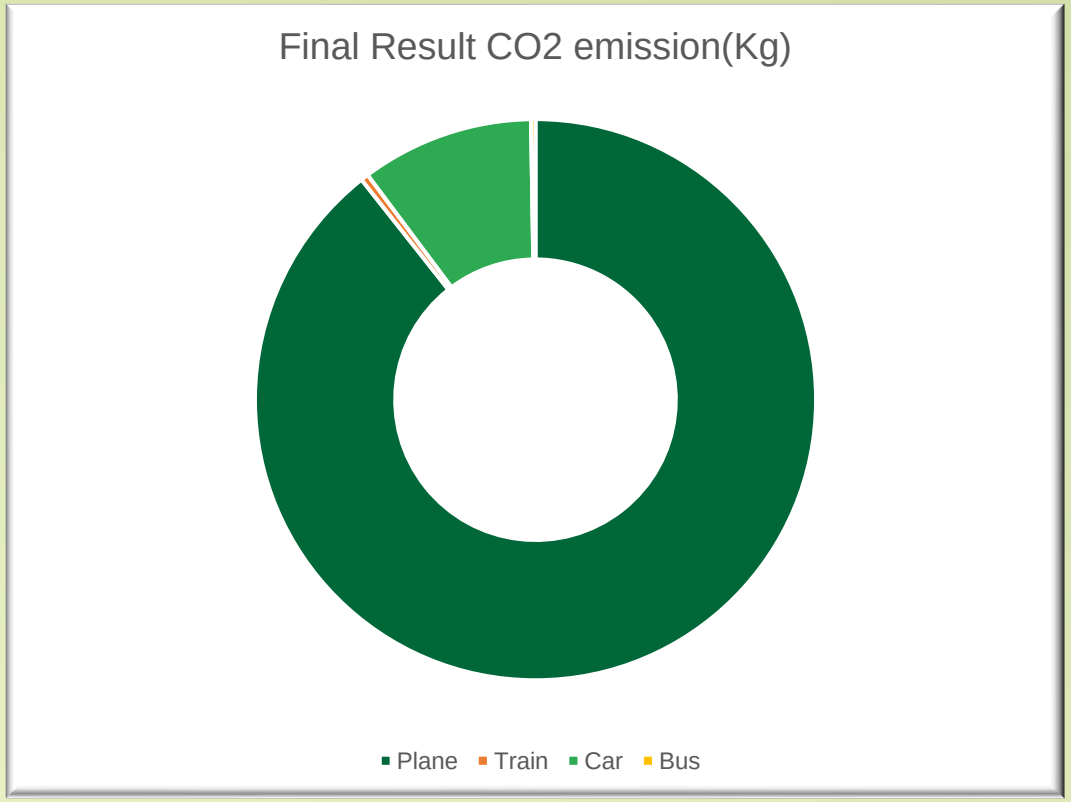
Total CO2 Emission (kg) from Primary tavel		Online Participant		ICT		Hotel	
7736	kg	325	kg	46	kg	923	kg

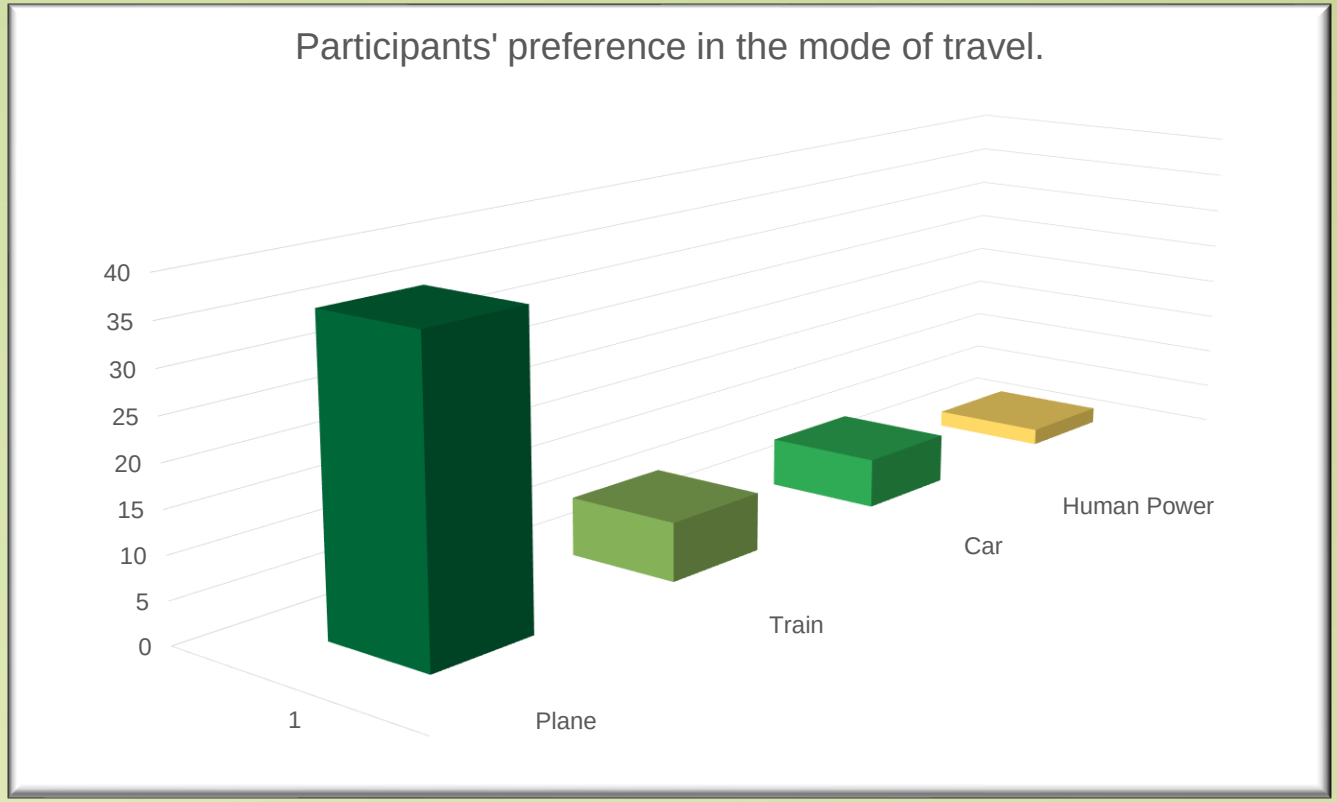
one way

Total CO2 Emission (kg) from Auxilary tavel		For travel total CO2 emission	
454	kg	16379	Kg

49	participants total CO2 emission	17673	kg
22	participants total CO2 emission	7935	kg

Total CO2 emission from the cick-off meeting	25609	Kg





CO2 emission per person

- Plane – 412kg
- Car – 100kg
- Train – 4kg

Survey form

CO2 emission from partners

CO2 emission from cost

- Equipment cost
- Other goods and services Cost
- Internally invoiced goods & services Cost (€)

CO2 emission from staff

- Energy consumption from electricity
- Energy consumption from heating system

Assumption data

Energy consumption for electricity (W)				
WP1 200 W	WP2 800 W	WP3 500 W	WP4 800 W	WP5 200 W

Surface area per employee				
WP1 7m2	WP2 15m2	WP3 7m2	WP4 15m2	WP5 7m2

Electricity consumption for buildings		
Old 450kWh	Medium 230kWh	New 90 kWh

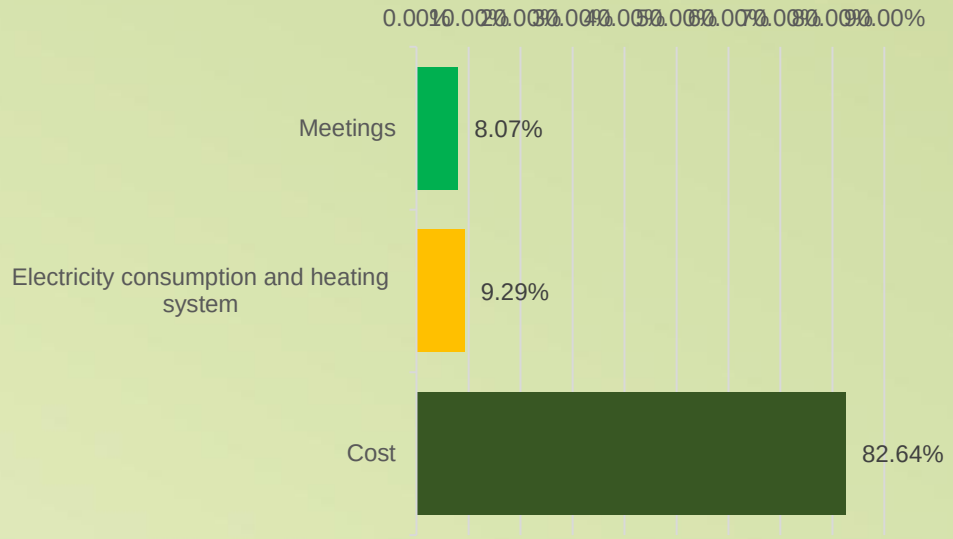
CO2 emission from partner

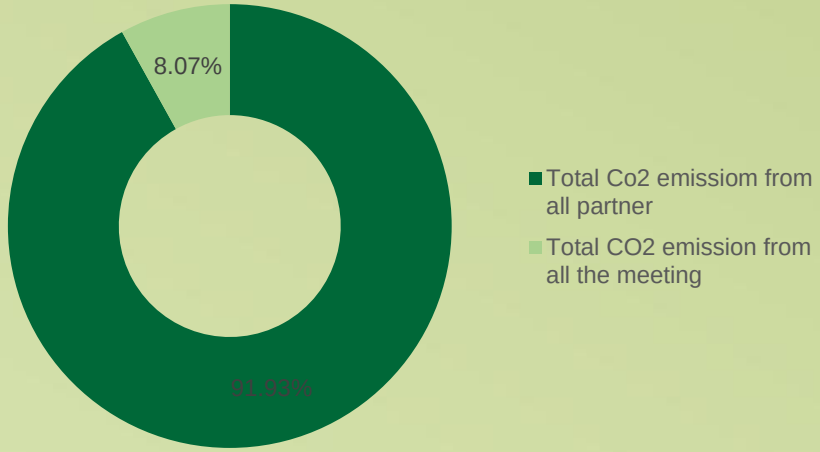
Co2 emission from the cost of all partner		
Type of Purchase costs	**Total Co2 emission in kg**	
Equipment Cost (€)	477798	Kg
Other goods and services Cost (€)	382286	Kg
Internally invoiced goods &services Cost (€)	120247	Kg
Sub-contracting costs	64020	Kg
Total emission from cost	**1044350**	**Kg**

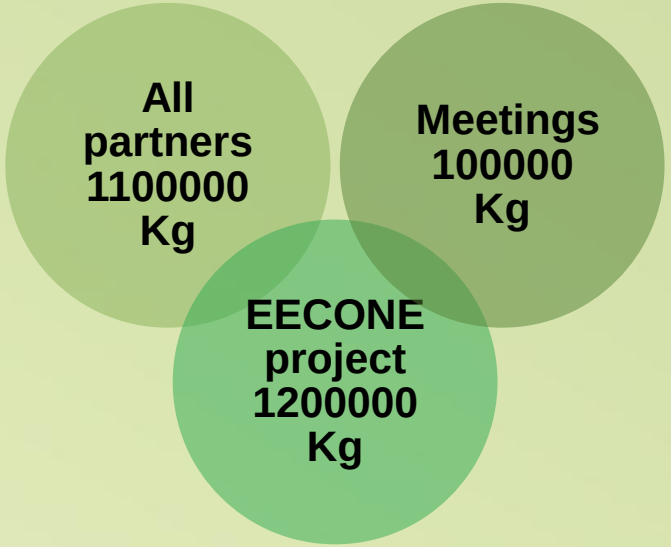
Co2 emission from the staff of all partner		
Type of Category of emission	**Total Co2 emission in kg**	
CO2 emission from heating system (CO2 Kg)	39550	Kg
CO2 emission from electricity comsumption (No heating) Kg CO2	93932	Kg
Total co2 emission from electricity consumption and heating system	**133482**	**Kg**

Total Co2 emissiom from all partner	**1177832**	**Kg**

Result analysis







Automated model

	Location city	Latitude	Longitude	Distance (km)	Number of participants	Travel distance (km)		Possibilities to choos travelling mode		
Meeting Place	Paris	48.9	2.4			above	below			
	Grenoble	45.2	5.7	481	1			Plane(%)	Train(%)	Car(%)
	Istanbul	41.0	29.0	2254	1		200	0	0.6	0.4
	Leoben	47.4	15.1	959	1	200	500	0.2	0.6	0.2
	Stuttgart	48.8	9.2	499	1	500	1000	0.25	0.75	0
	Paris	48.9	2.4	0	1	1000		0.8	0.2	0
	Louvain-la-Neuve	50.7	4.6	258	1					
	Taastrup	55.7	12.3	1012	1					
	Munich	48.1	11.6	683	1					
	Grenoble	45.2	5.7	481	1					
	Athens	38.0	23.7	2095	1					
	Sommariva del Bosco	44.8	7.8	614	1					
	Prague	50.1	14.4	881	1					
	Villach	46.6	13.8	893	1					
	Neubiberg	48.1	11.7	692	1					
	Warsaw	52.2	21.0	1366	1					
	Rome	41.9	12.5	1105	1					
	Yavne	31.9	34.7	3290	1					
	Aalborg	57.1	9.9	1041	1					
	Istanbul	41.0	29.0	2254	1					
	Linz	48.3	14.3	879	1					
	Málaga	36.7	-4.4	1457	1					
	Borås	57.7	12.9	1208	1					
	Bensheim	49.7	8.6	463	1					
	Graz	47.1	15.4	993	1					
	Leuven	50.9	4.7	280	1					
	Riga	56.9	24.1	1703	1					

Parameters to be considered

- Distance
- Travelling mode
- Number of participants
- Emission Factor

Selecting the optimal location

- Applying this model, we can estimate the total co2 emission.
- By changing the location, we compare the emission

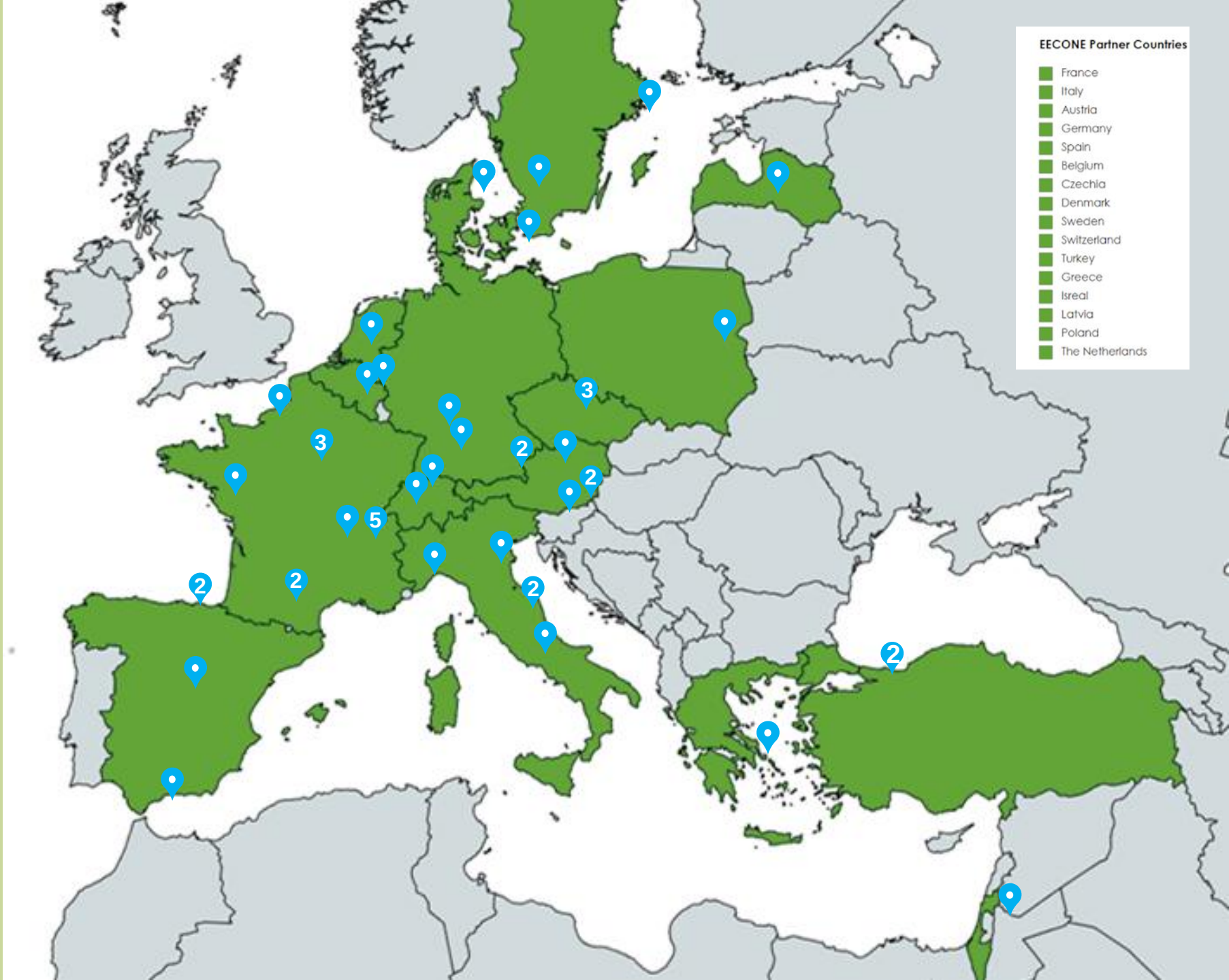
Location city	Distance (km)	Number of people joining the	Distance by Plane	Distance by Car	Distance by Train	CO2 emission Plane	CO2 emission Car	CO2 emission Train	CO2 emission applying Condition	Total CO2 emission	Travel distance (km)		Possibilities to choos travelling mode		
Madrid											above	below	Plane(%)	Train(%)	Car(%)
Grenoble	933	1	1028	1212.9	1119.6	105.6	125.4	3.7	103.0	29.2					
Istanbul	2737	1	2832	3558.1	3284.4	290.8	367.9	10.8	290.8	220.8		200	0	1	0
Leoben	1687	1	1782	2193.1	2024.4	183.0	226.8	6.7	183.0	138.9	200	500	0.2	0.6	0.2
Stuttgart	1376	1	1471	1788.8	1651.2	151.1	185.0	5.4	151.1	114.7	500	1000	0.25	0.75	0
Paris	1052	1	1147	1367.6	1262.4	117.8	141.4	4.2	117.8	89.4	1000		0.75	0.25	0
Louvain-la-Neuve	1309	1	1404	1701.7	1570.8	144.2	176.0	5.2	144.2	109.4					
Taastrup	2059	6	2154	2676.7	2470.8	1327.3	276.8	48.9	1327.3	6046.2					
Vélizy-Villacoublay	1039	1	1134	1350.7	1246.8	116.5	139.7	4.1	116.5	88.4					
Grenoble	933	1	1028	1212.9	1119.6	105.6	125.4	3.7	103.0	29.2					
Munich	1484	1	1579	1929.2	1780.8	162.2	199.5	5.9	162.2	123.1					
Tourville-les-Ifs	1082	1	1177	1406.6	1298.4	120.9	145.4	4.3	120.9	91.7					
Toulouse	553	1	648	718.9	663.6	91.8	74.3	2.2	64.9	24.6					
Santander	339	1	434	440.7	406.8	61.5	45.6	1.3	38.8	22.2					
Paris	1052	1	1147	1367.6	1262.4	117.8	141.4	4.2	117.8	89.4					
Grenoble	933	1	1028	1212.9	1119.6	105.6	125.4	3.7	103.0	29.2					
Nantes	775	1	870	1007.5	930.0	123.2	104.2	3.1	87.2	33.1					
Madrid	0	1	95	0.0	0.0	13.5	0.0	0.0	0.0	0.0					
Stockholm	2593	1	2688	3370.9	3111.6	276.1	348.6	10.3	276.1	209.6					
Saint-Quentin-Fallavier	920	1	1015	1196.0	1104.0	104.2	123.7	3.6	101.7	28.8					
									9388.5	14797.2					

result: 9389 kgCO2 initial
14797.2 kgCO3 tests

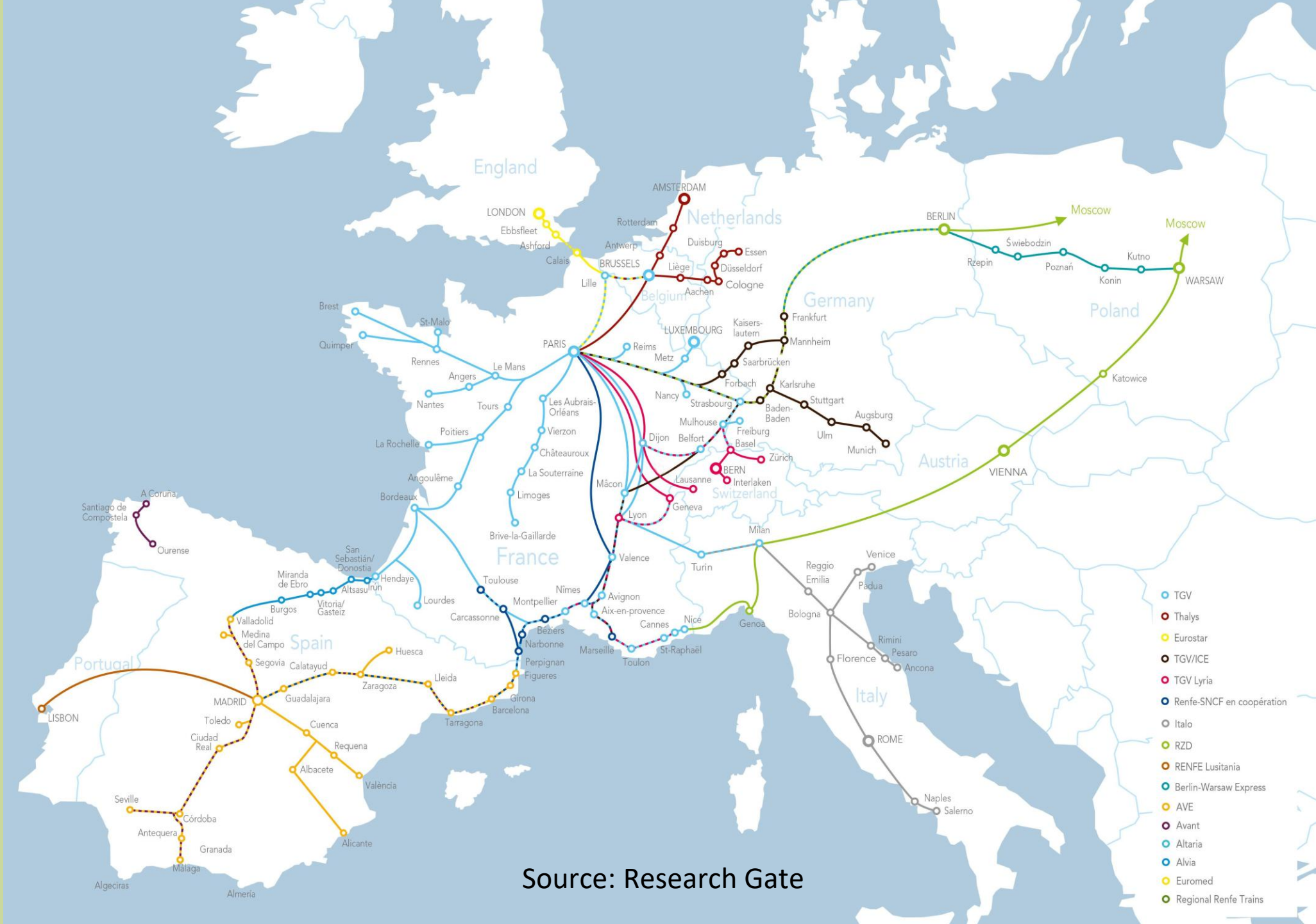
CO2 emission 9388.55 Kg One way

Total Co2 emission 18777 Kg

EECONE MAP
50 Partner location



High Speed Railroad Map of Europe



Source: Research Gate

Tools and Methodology

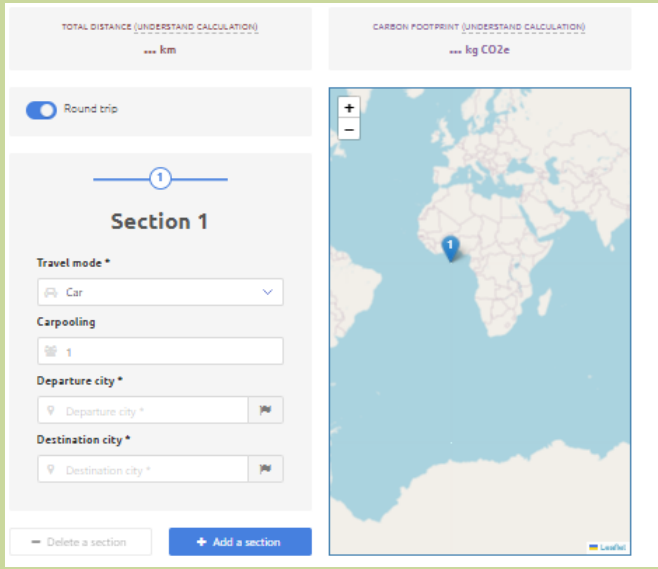
Calculator used for the transportation:

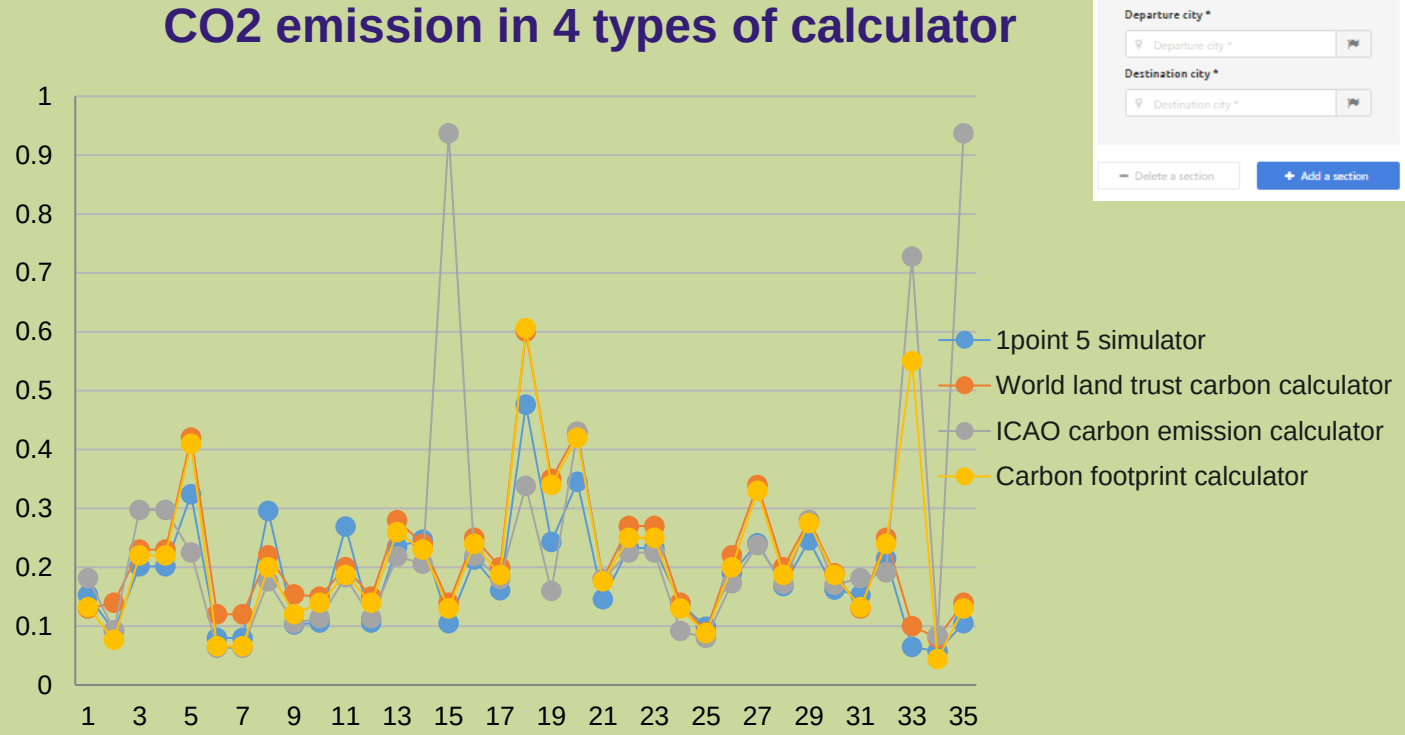
- 1point 5 simulator
- Hotel Stay CO2 Emission Calculator
- Zoom Emission Calculator
- Email carbon footprint calculator

1point 5 simulator

Methodology:

- Distance
- Emission Factor
- Multiplying Factor Correlation

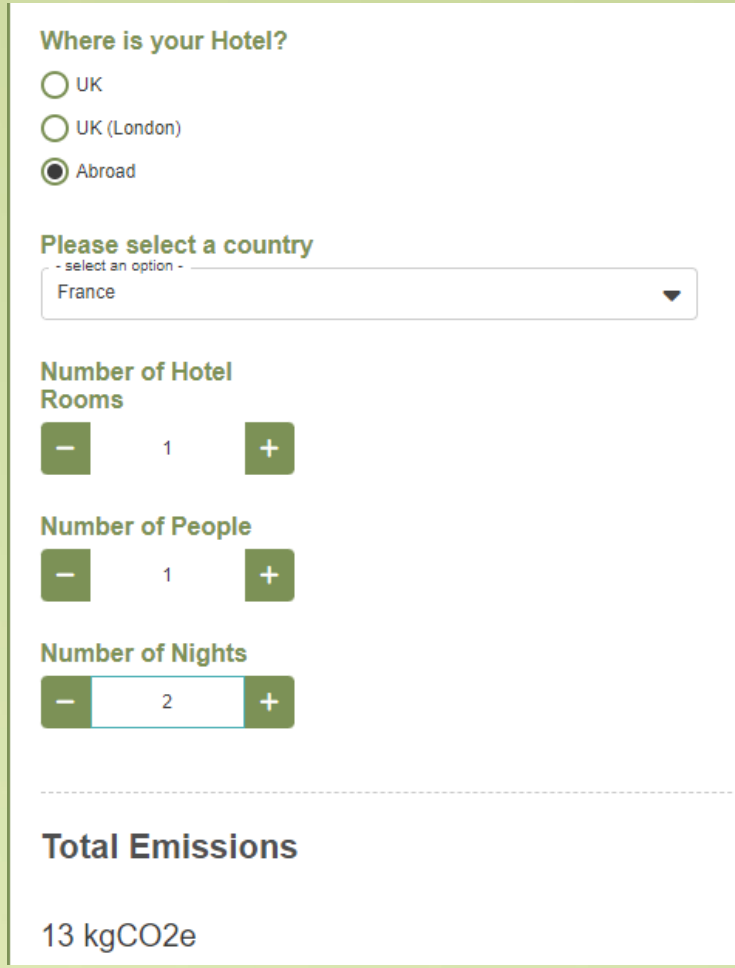




Hotel Stay CO2 Emission Calculator

Methodology:

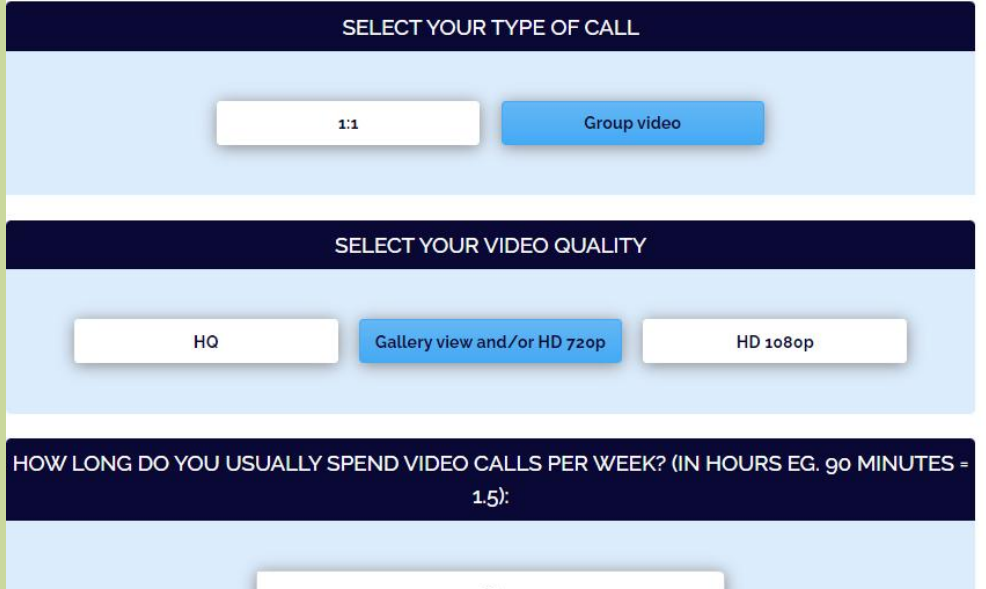
- Specific country
- Average class of hotel
- Conversion Factors Correlation



Zoom Emission Calculator

Methodology:

- ❑ Type of call
- ❑ Duration
- ❑ Video quality
- ❑ Number of participants Correlation



Methodological Innovations

- Applied precise multipliers for accurate distances.
- Used diverse CO2 calculators for reliability.
- Crafted targeted survey questions for effective data collection.
- Employed Excel for accessible modeling and partner engagement.

Perspective

- Optimize CO2 emissions
- Develop best practices
- Increase public awareness
- Aim towards zero waste in the electronics industry

Limitations

- Uncomplete data
- Access in Excel
- Specification of data

Conclusion

- EECONE project vital for e-waste and sustainability.
- Collaboration is essential for zero-waste electronics.
- Milestones set the path for better CO2 management.
- Environmental integration ensures a sustainable future.