REDUCING THE ENERGY CONSUMPTION FOR RECYCLING CEMENT: SHIFTING FROM A WET METHOD TO AN AIR-BLOWING METHOD

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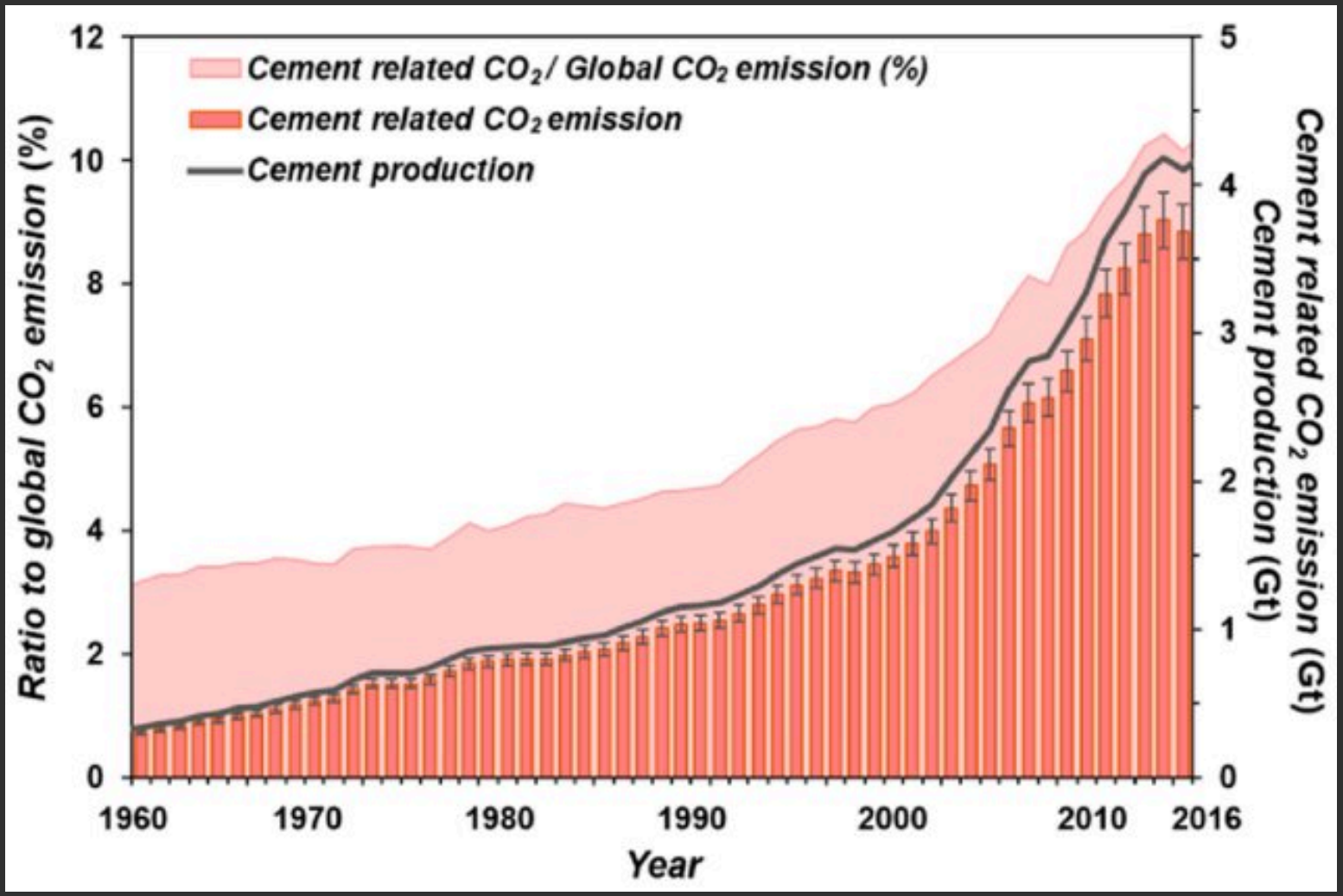
OUTLINE

1. Introduction
2. Concrete waste
3. Materials and methods
4. Results and discussion
5. Final remarks



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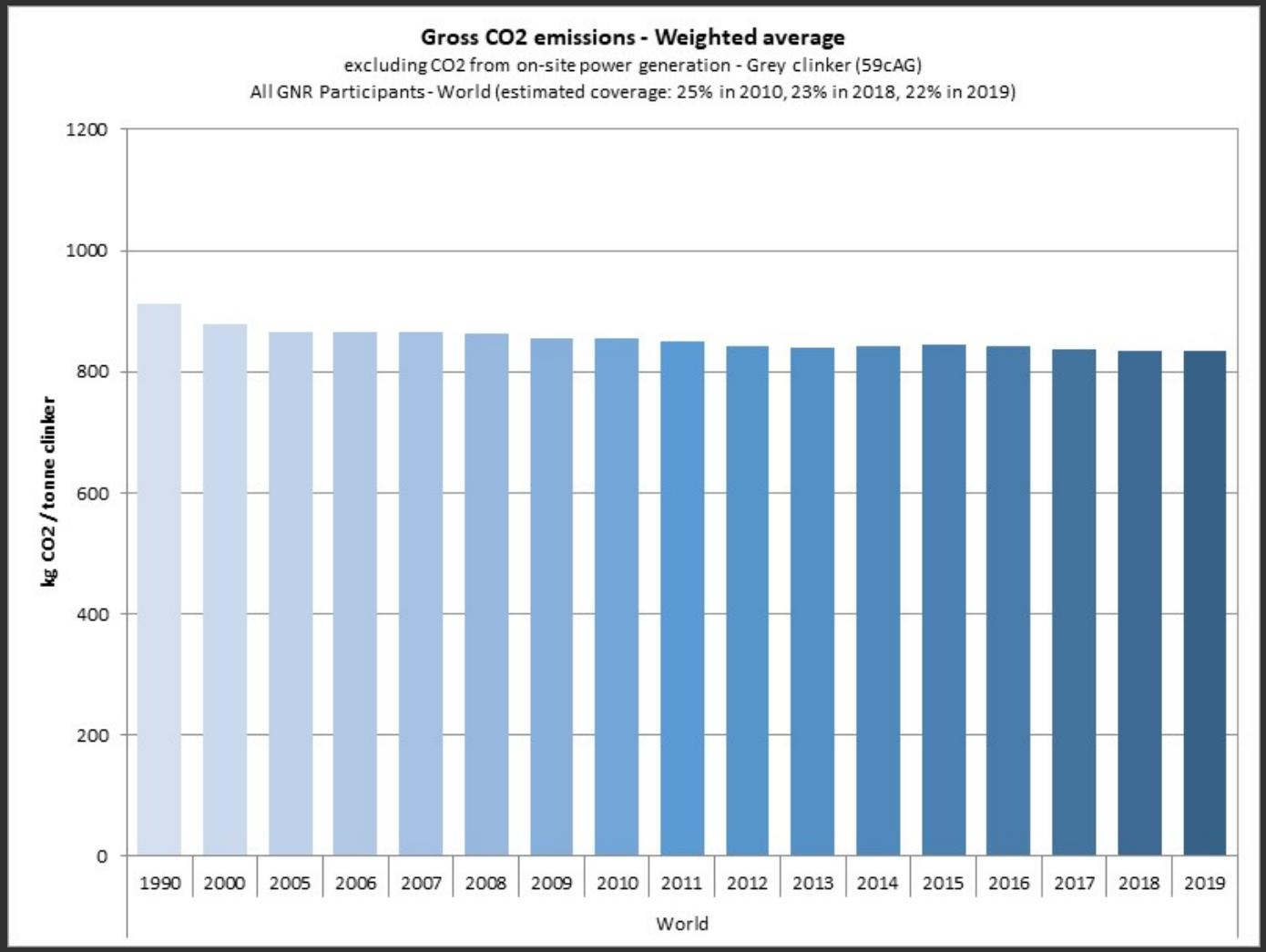
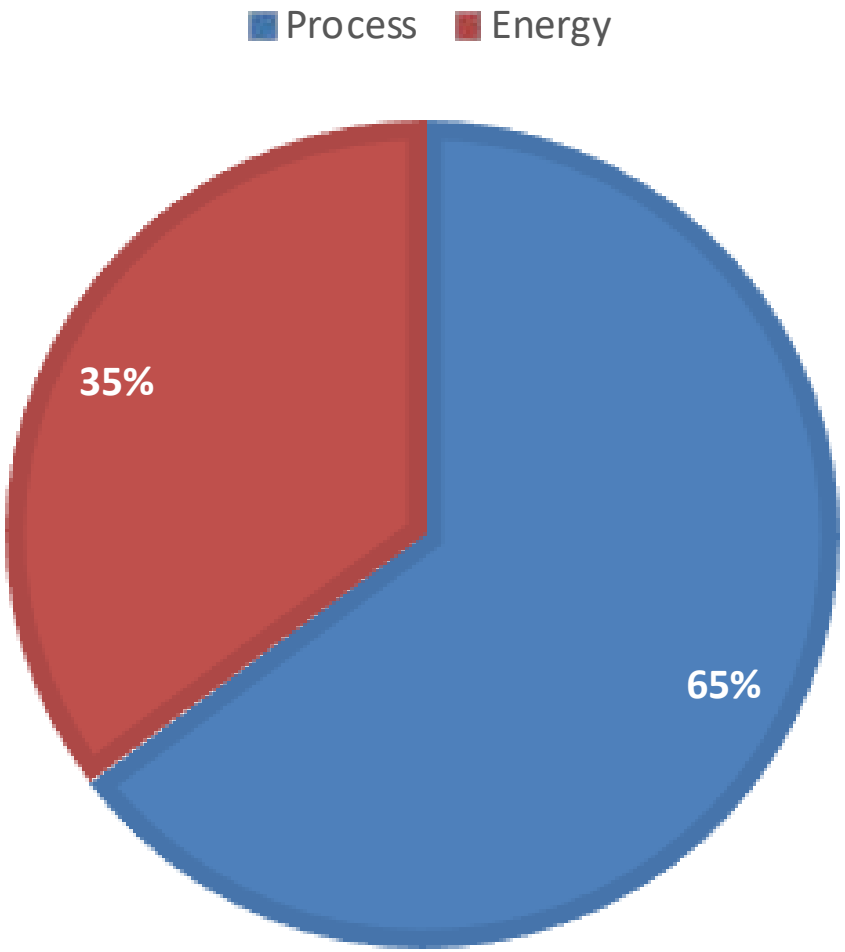
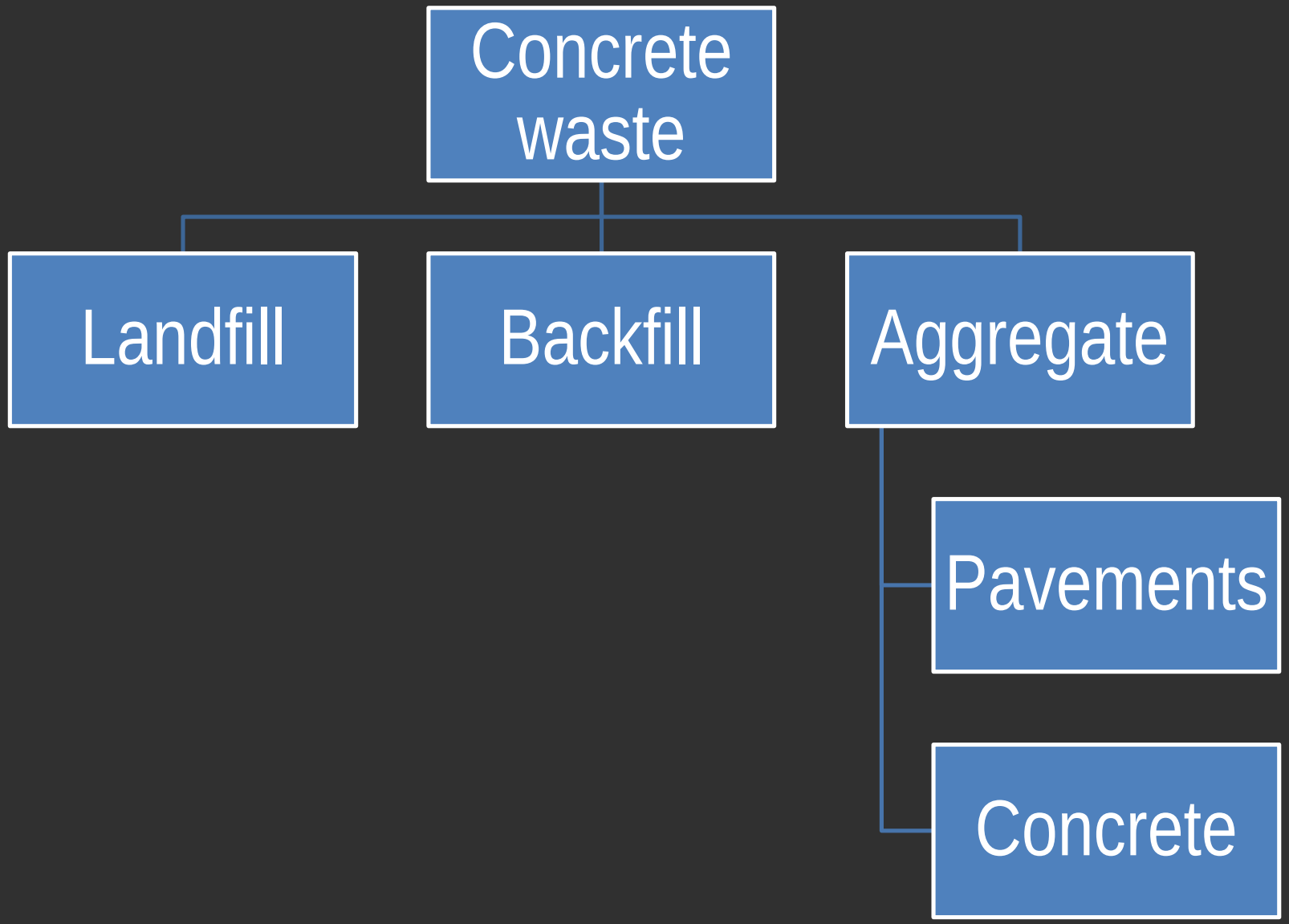
1. INTRODUCTION

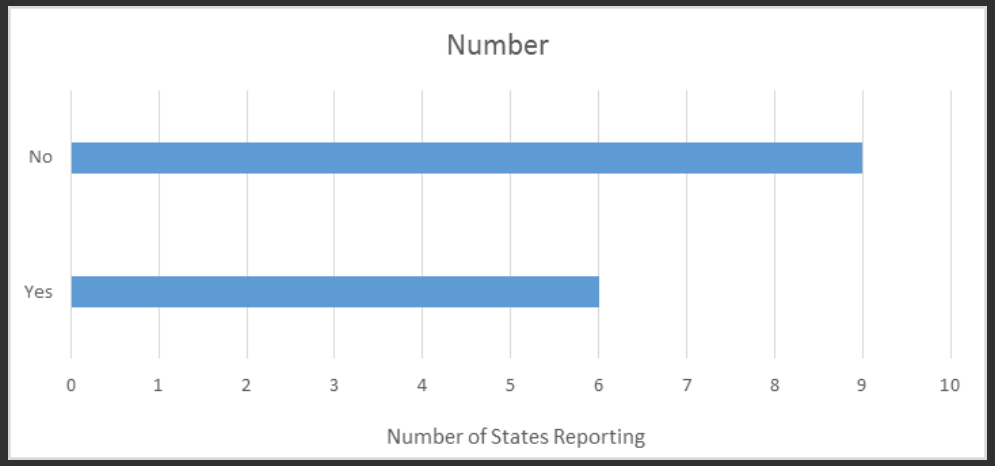


https://gccassociation.org/gnr/

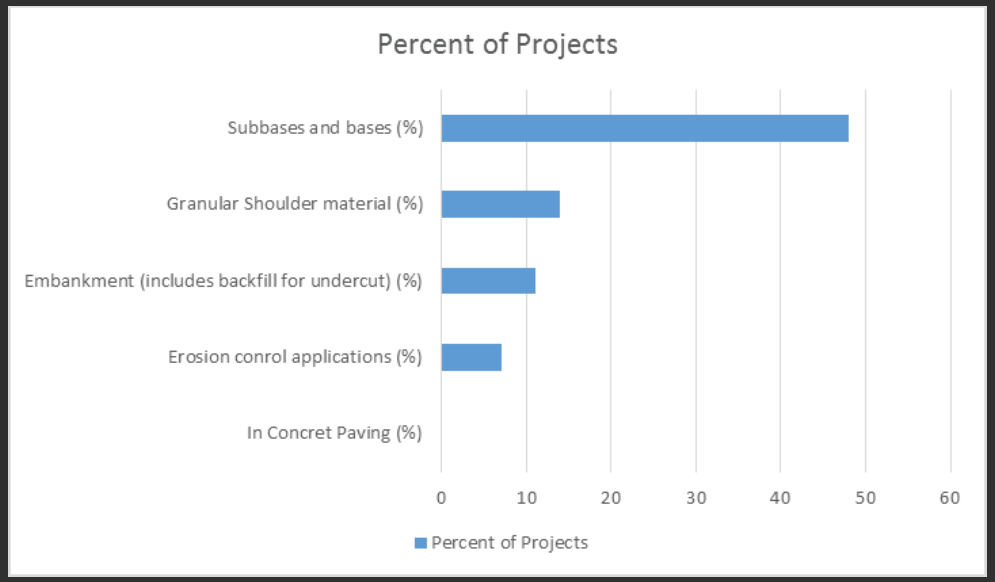

Process
Energy
35%
65%


Concrete waste
Landfill
Backfill
Aggregate
Pavements
Concrete

2. CONCRETE WASTE

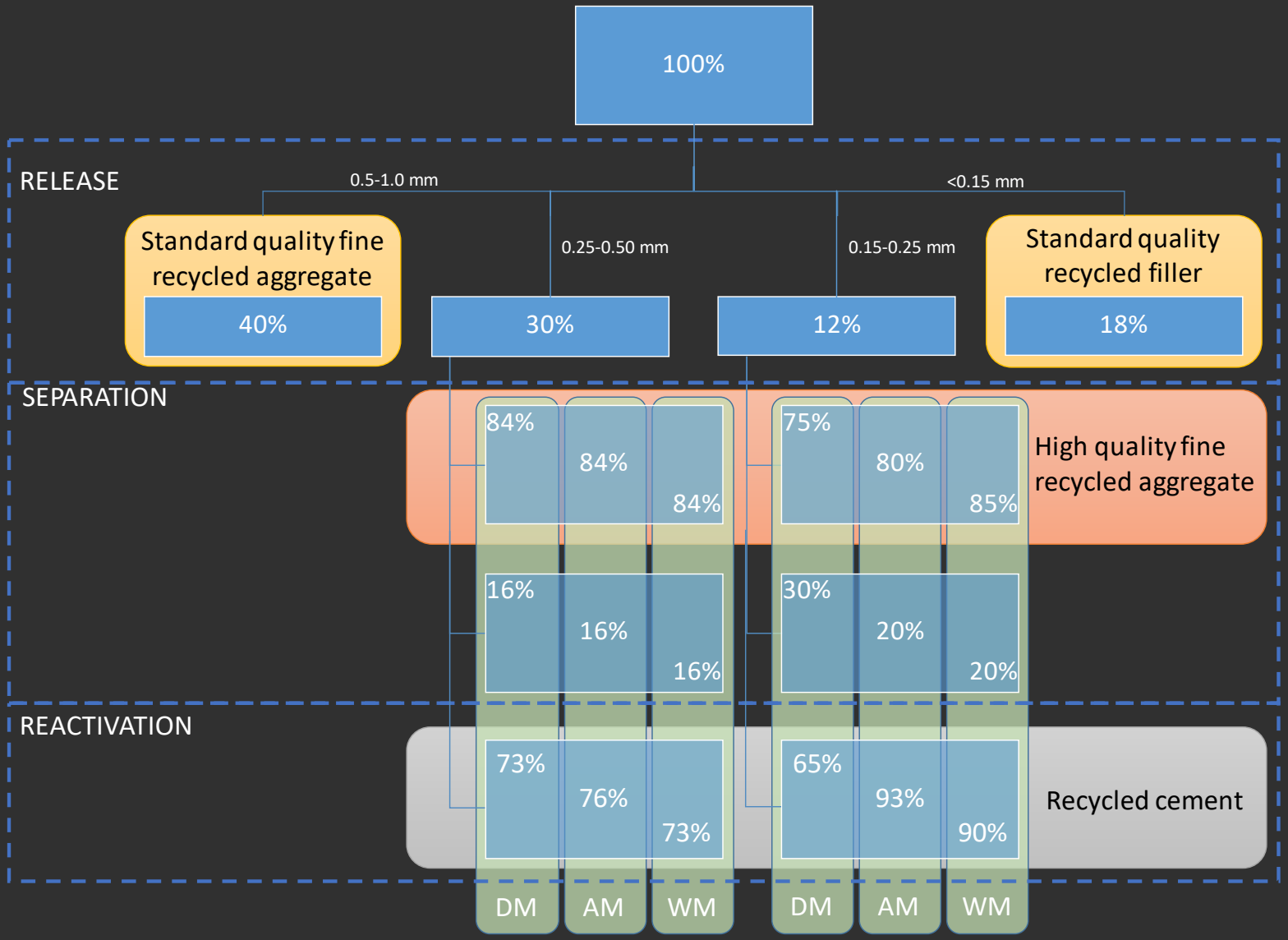


Recycled aggregates concrete allowed?



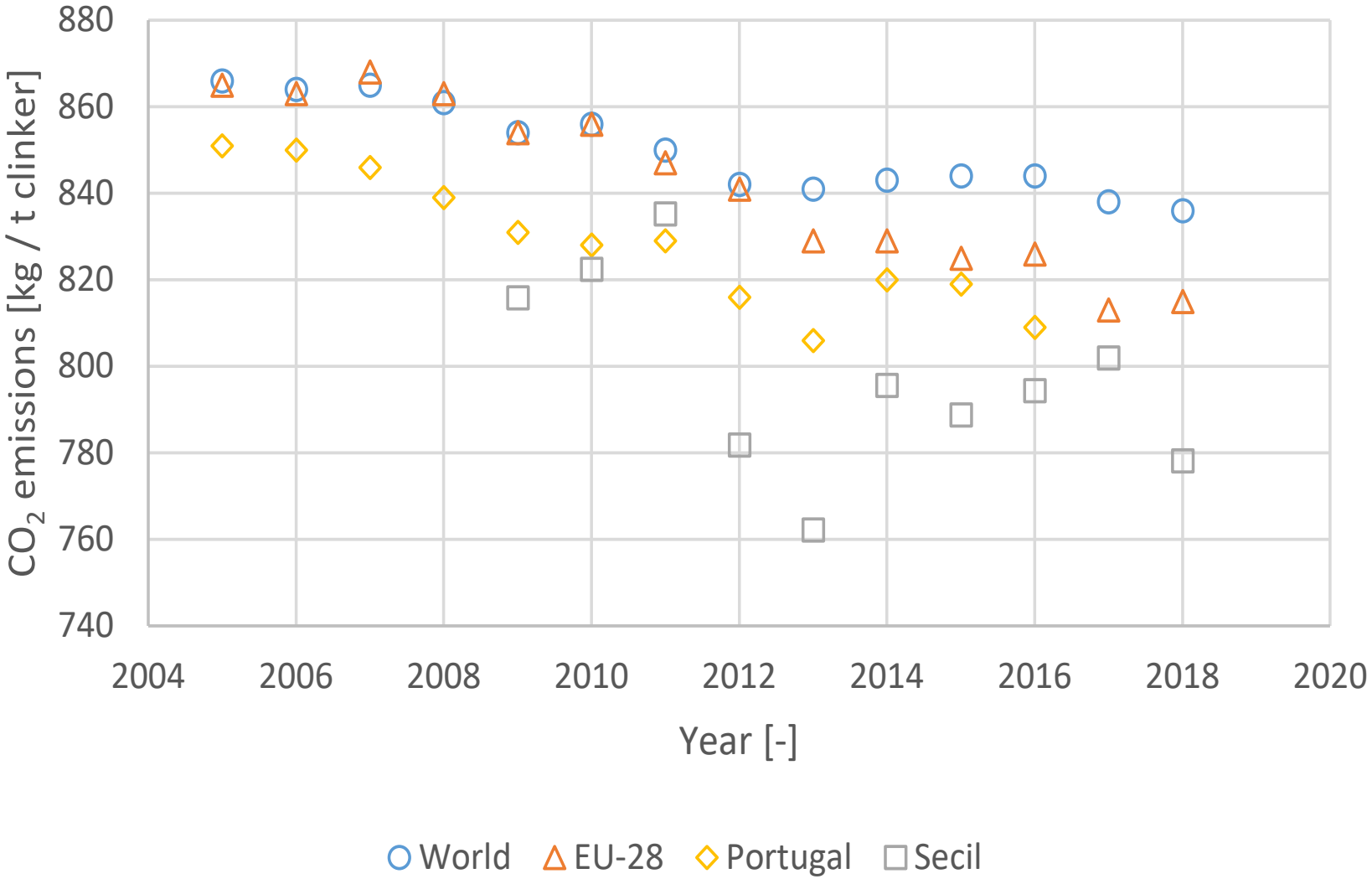
Recycled aggregates use?

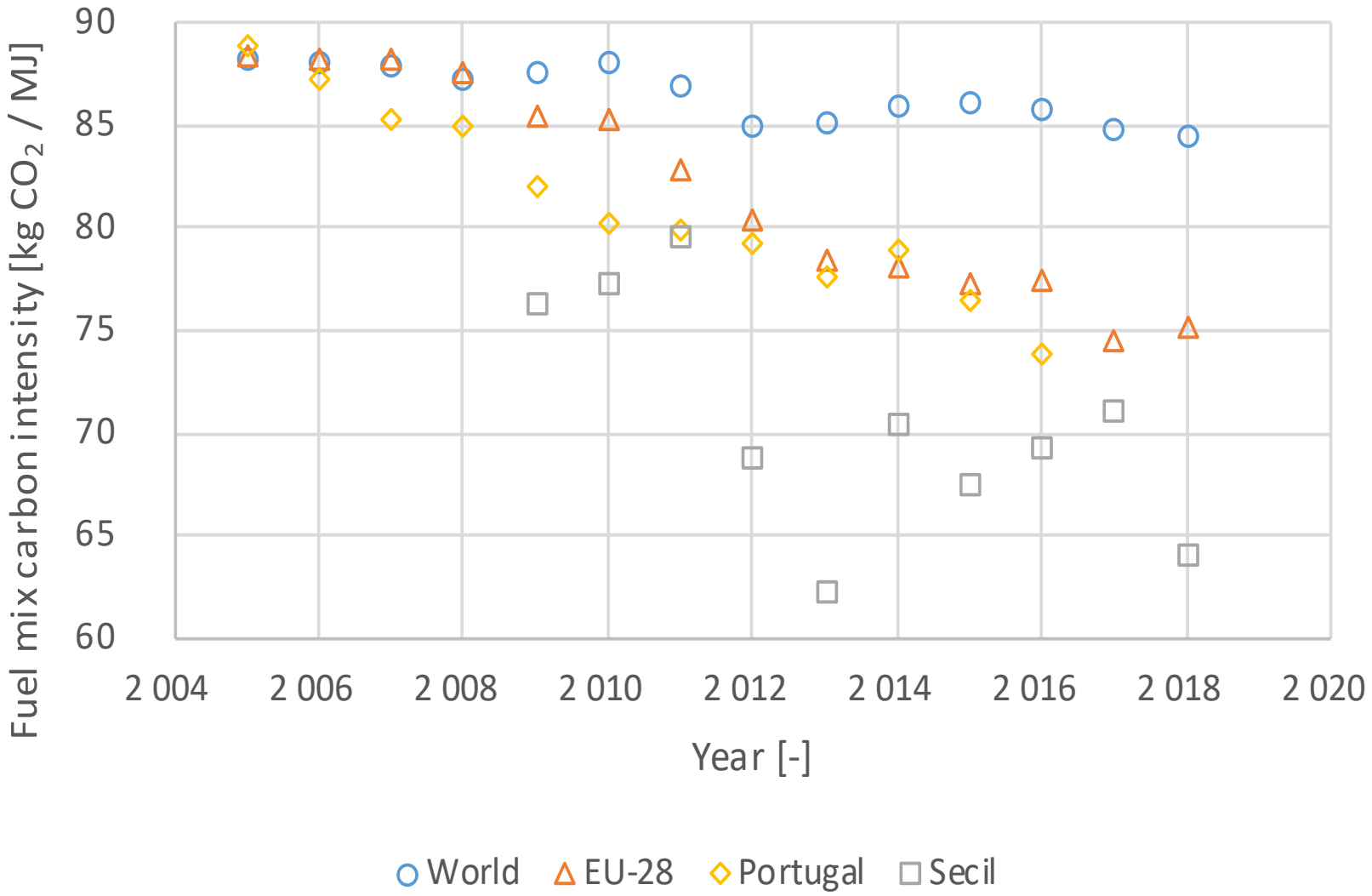
https://intrans.iastate.edu/app/uploads/2018/09/RCA_US_usage_summary_w_cvr.pdf

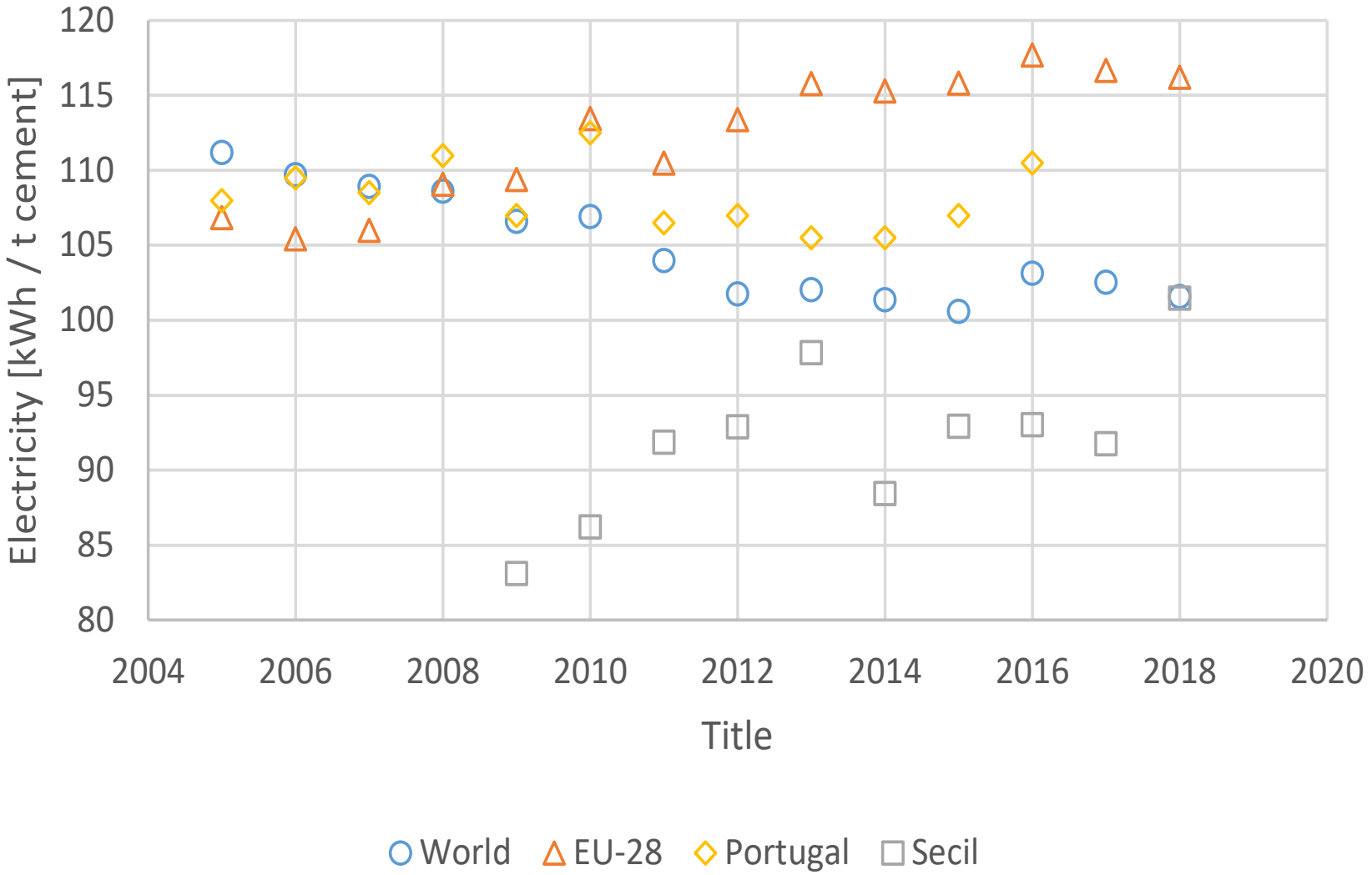

100%
RELEASE
0.5-1.0 mm
0.25-0.50 mm
0.15-0.25 mm
<0.15 mm
Standard quality fine recycled aggregate
40%
30%
12%
Standard quality recycled filler
18%
SEPARATION
84%
84%
84%
75%
80%
85%
High quality fine recycled aggregate
16%
16%
16%
30%
20%
20%
REACTIVATION
73%
76%
73%
65%
93%
90%
Recycled cement
DM
AM
WM
DM
AM
WM

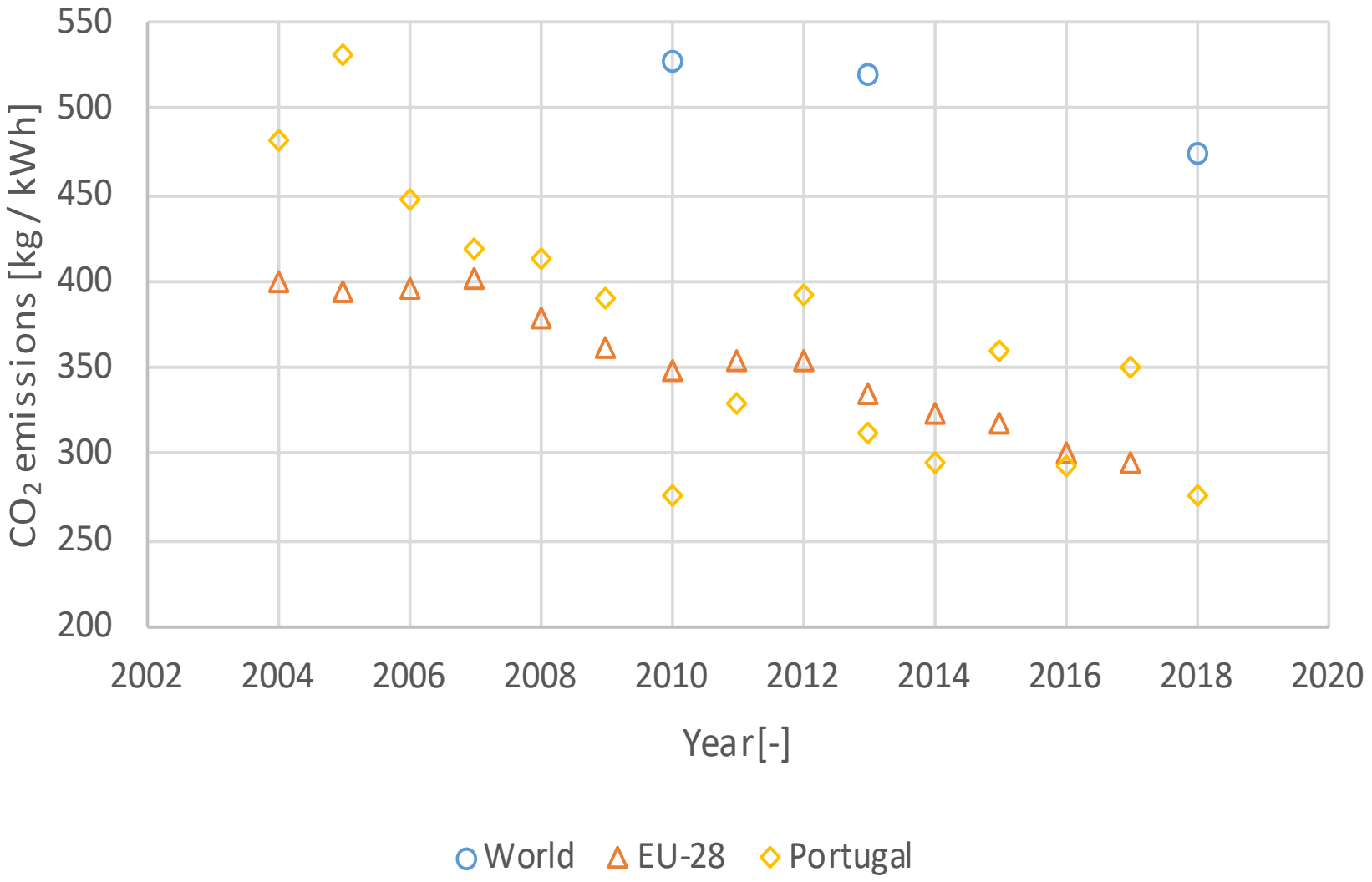
TÉCNICO LISBOA

THERMAL ENERGY	Reactivation	Analogy with the dry clinker production
	Separation	Simulation of a sand dryer use
ELECTRICITY	Release Separation Reactivation	Analogy with the clinker production + simulation of the magnetic role and air compressor
FUEL	Transportation	Simulation of trucks operating


880
860
840
820
800
780
760
740
CO_2 emissions [kg / t clinker]
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year [-]
World
EU-28
Portugal
Secil


Fuel mix carbon intensity [kg CO_2 / MJ]
90
85
80
75
70
65
60
2 004
2 006
2 008
2 010
2 012
2 014
2 016
2 018
2 020
Year [-]
World
EU-28
Portugal
Secil


120
115
110
105
100
95
90
85
80
Electricity [kWh / t cement]
2004
2006
2008
2010
2012
2014
2016
2018
2020
Title
World
EU-28
Portugal
Secil


550
500
450
400
350
300
250
200
CO_2 emissions [kg / kWh]
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Year [-]
World
EU-28
Portugal

STAGE	WORLD	EUROPE	PORTUGAL	
			AVERAGE	SECIL
ENERGY [MJ / t RC]				
Drying	6299.6			
Reactivation	1189.0	1255.3	1272.0	1147.4
Electricity	964.0	713.5	1005.8	845.1
Transportation	-	-	162.2	81.1
Total	8452.6	8268.4	8739.6	8373.2
EMISSIONS [kg CO_2/ t RC]				
Drying	574.2	501.8	491.2	425.0
Reactivation	108.4	100.3	92.7	80.2
Electricity	127.2	42.8	55.4	46.6
Transportation	-	-	34.9	17.4
Total	809.7	644.9	674.2	569.2

STAGE	WORLD	EUROPE	PORTUGAL	
			AVERAGE	SECIL
ENERGY [MJ / t RC]				
Drying	-			
Reactivation	1201.1	1268.1	1284.9	1159.1
Electricity	736.3	557.2	766.2	651.3
Transportation	-	-	163.9	82.0
Total	1937.4	1825.3	2215.0	1892.4
EMISSIONS [kg CO_2/ t RC]				
Drying	-	-	-	-
Reactivation	109.5	101.3	93.7	81.0
Electricity	97.2	33.4	42.2	35.9
Transportation	-	-	35.2	17.6
Total	206.6	134.7	171.1	134.5

Cement production is one of the largest sources of carbon emissions worldwide and the shift to green energy will not solve the problem.

A significant proportion of the concrete waste is currently recycled in many countries, but mostly as backfilling or filling material (e.g., road construction).

The use of concrete waste as aggregates for new concrete is hindered by several mechanical and durability performance limitations.

Recycling concrete for cement production is an option aligned with the circular economy goal set by the EU.

The separation of the cement paste from the aggregates of concrete waste proofs to be viable, particularly using the air-cleaning option.

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