CARBON RISK AND PERFORMANCE ATTRIBUTION

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TAILORED FOR SUCCESS - READY FOR THE FUTURE

THE CHALLENGE IS TO MEET GROWING NEEDS WITH LESS CARBON & RESOURCES

40%
of CO_2 emissions due to **buildings**

x 2
Raw material use **by 2060**

+12%
in Energy demand **by 2030**

x 3
Passenger transport 2015-2050
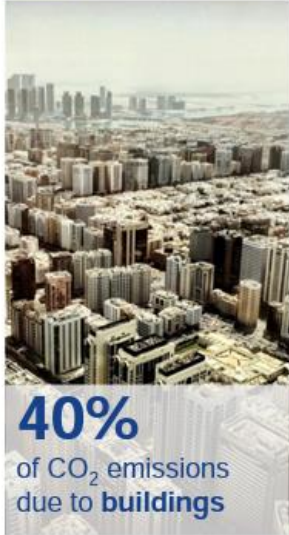
Sources: , Saint-Gobain, IEA, World Bank, OCDE, BCC research

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Transition Risk – Climate Risk

- Every company has an uncovered "Carbon Short" position based on their emissions, and it needs to recognize this hidden liability today
- This short position arises from the carbon emissions produced by their own operations (Scope 1 and 2), and their products and services (Scope 3)
- This short position is priced at 0/ton
- In 2020 ExxonMobil released 112 million metric tons of CO_2 "equivalent". At \$100/ton, they would owe \$11B annually on their own emissions. Since the company has earned only \$8 billion on average over the past five years, this means they would rapidly be bankrupt

Portfolio Carbon Risk Assessment

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CARBON RISK ASSESSMENT METHODOLOGY

1. Measure the position in carbon terms – Carbon Footprint
2. Model future Carbon Footprint
3. Determine a carbon forward price curve
4. Price the forward Carbon Footprint
5. Discount the "Carbon Footprint Cash Flows" = Carbon Liability Cost
6. Calculate the Carbon Liability Cost for each position within the portfolio = fraction of ownership hold times Carbon Cost Liability
7. Calculate the impact on return and contribution to return
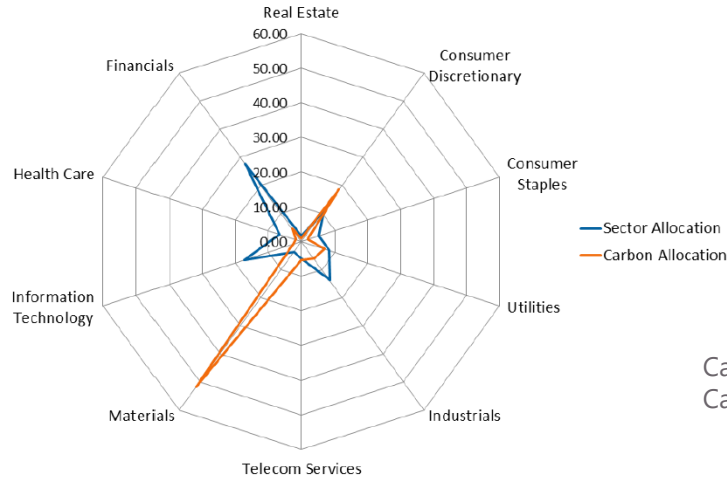
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- Total Carbon Footprint : 11,175,470 tons
- Saint Gobain 2030 goal : 9 million tons ➔ – 19.5% or – 2.7% / year
- Forward Price Curve : 50 – 50 – 100 – 100 – 150
- Future Carbon Footprint, 2030 onward 20% decrease

2022	2023	2024	2025	2026	2027	2028	2029	2030
11,175,470	10,877,094	10,586,685	10,304,029	10,028,920	9,761,156	9,500,541	9,246,884	9,000,000

- Carbon Liability Cost = – 8,550 million
- Saint Gobain Market Cap = 28,784 billion
- Portfolio holdings = 5,756,800 ➔ 0.02% fraction of ownership
- Impact = – 8,550,000 x 0.02% /5,756 = – 30%

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Allocation

Radar chart with axes: Real Estate, Consumer Discretionary, Consumer Staples, Utilities, Industrials, Telecom Services, Materials, Information Technology, Health Care, Financials. Scale 0.00 to 60.00. Series: Sector Allocation, Carbon Allocation.

Carbon Allocation = % of Carbon Footprint
Carbon Footprint = fraction of ownership times company absolute footprint

Top 5 – Absolute Carbon Return

Asset	wP	Carbon Ret. (%)	Abs. Carbon Footprint
SOLVAY SA	0.79	-11.03	9,391,281
AKZO NOBEL	1.02	-10.70	3,563,454
CRH PLC	0.33	-9.84	23,692,337
SAINT GOBAIN	0.18	-9.52	11,175,469
IMERYS	1.24	-9.44	2,348,480

Top 5 – Carbon Return Contributors

Asset	wP	Carbon Ret. (%)	Contrib Carb. Ret. (%)
ACCOR SA	1.50	-8.32	-0.10
RENAULT	2.30	-5.20	-0.09
IMERYS	1.24	-9.44	-0.09
Valeo SA	1.44	-7.87	-0.09
DEUTSCHE TELEKOM	3.30	-3.32	-0.09

Sector	Absolute Carbon Footprint	wP	Mkt Value	Footprint
Materials				
SOLVAY SA	9,391,281	0.79	934,886	806.66
CRH PLC	23,692,337	0.33	386,547	297.48
LENZING AG	60,520	0.40	471,000	10.40
AKZO NOBEL	3,563,454	1.02	1,212,447	253.63
IMERYS	2,348,480	1.24	1,462,076	1,079.12
Total Materials		3.77	4,466,956	2,447.30

Sector	Absolute Carbon Footprint	wP	Mkt Value	Footprint
Consumer Discretionary				
RENAULT	905,411	2.30	2,721,642	276.70
FERRARI NV	121,515	2.67	3,166,750	10.08
TELENET GROUP HOLDING	43,817	1.31	1,547,968	18.42
HUGO BOSS	27,099	0.21	243,094	1.84
Valeo SA	872,927	1.44	1,710,546	263.20
PUBLICIS GROUPE	96,910	1.21	1,431,900	9.62
ACCOR SA	1,286,073	1.50	1,780,223	289.73
Total Consumer Discretionary		10.64	12,602,123	869.59

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Carbon Attribution Model

- Carbon emissions are costly
- Market returns are divided into a carbon free market return and a carbon return (<0)
- Carbon Effects arise from the difference between the portfolio and the benchmark Carbon esposures
- Attribution numbers explain Active Carbon Free Returns

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CARBON ATTRIBUTION MODEL

C is the cost of o 1 ton of carbon

AF^E_i l'Absolute Footprint of the company and *r* the discount rate

The carbon cost of the company for the period is **CC = AF^E_i x *C x t***

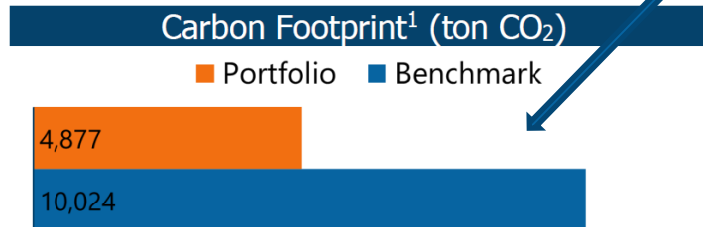**CC_i** of a position is **AF_i x *C* = V_i / V^E_i x (AF^E_i) x *C x t***

where **V^E_i** and **V_i** are market cap of the company and holdings

$$R_i = P\&L_i / V_i = (\text{Economic } P\&L_i - CC_i) / V_i$$

$$\rightarrow R_i = R^*_i - RC_i$$

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Carbon Attribution : Example

Impact of Carbon footprint on active returns

Carbon Footprint[1] (ton CO$_2$)

■ Portfolio ■ Benchmark

4,877

10,024

Top 5 Carbon Footprint

Asset	wP (%)	Contribution
IMERYS	1.24	1,214
SOLVAY SA	0.79	824
CRH PLC	0.33	300
ACCOR SA	1.50	298
RENAULT	2.30	283

Fraction of Ownership Times Absolute Footprint

$$AF_i = V_i / V^E_i \times (AF^E_i)$$

Top 5 – Carbon Saved (vs. Bench)

Asset	wP	wB	Return	Excess Carbon
IMERYS	1.24	3.93	-11.08	2,178
CRH PLC	0.33	2.37	-0.75	1,834
ENEL SPA	0.07	5.83	7.22	1,636
SAINT GOBAIN	0.18	1.71	2.05	671
AKZO NOBEL	1.02	1.66	0.00	152

Top 5 – Carbon Wasted (vs. Bench)

Asset	wP	wB	Return	Excess Carbon
SOLVAY SA	0.79	0.28	-2.07	-544
ACCOR SA	1.50	0.26	-2.72	-248
Valeo SA	1.44	0.73	-6.85	-152
RENAULT	2.30	1.18	-2.19	-143
A2A SPA	3.99	0.51	4.40	-116

Difference of Carbon Footprint Contribution

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The benchmark is replicated by a portfolio of the same value as the one analyzed : $\underline{w_i}$ ➔ $\underline{V_i} = \underline{w_i} \times V$
The absolute Footprint of a benchmark constituent is $\underline{AF_i} = \underline{V_i} / V^E_i \times (AF^E_i)$

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CARBON ATTRIBUTION : EXAMPLE

- Portfolio vs Benchmark Carbon Cost
- Goal : Attribution numbers ex Carbon Effect

Return Analysis			
	Neutral	**Carbon Cost**	**Effective**
Portfolio return	1.42	-0.18	1.24
Benchmark return	0.59	-0.33	0.26
Active return	**0.83**	**0.15**	**0.98**

Carbon Attribution			
	Neutral	**Carbon**	**Effective**
Allocation	0.22		0.36
Selection	0.61		0.62
Active return	**0.83**	**0.15**	**0.98**

Portfolio has a lower exposure to carbon emissions than its benchmark ➔ positive effect

Active return from allocation decision is partially explained by low exposure to sectors that have high carbon footprint
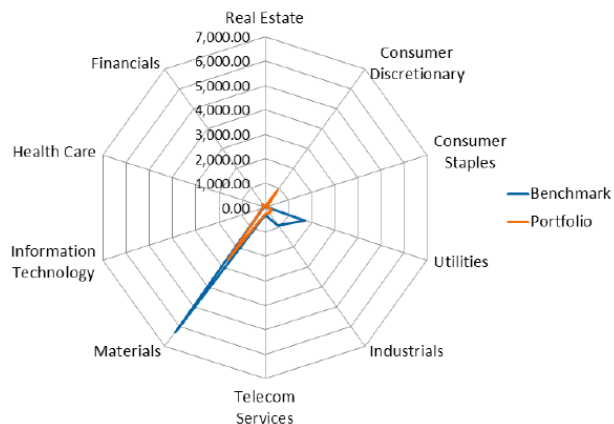Brinson allocation = 0;36
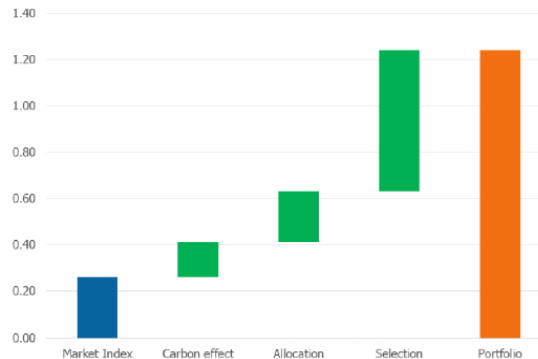Allocation adjusted to carbon emission = 0,22
Selection has no impact on potfolio carbon intensity

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Carbon Attribution Analysis

Footprint Allocation

Return Decomposition

Attribution detail - Sector

Sector	wP	wB	Rp	CFp	Rb	CFb	Carbon Effect (bps)	Allocation (bps)	Selection (bps)
Utilities	8.18	8.16	2.68	310	5.06	1,734	-0.53	0.10	-18.93
Telecom Services	4.72	4.89	2.77	251	2.54	302	0.18	-0.39	0.96
Real Estate	1.54	1.21	5.44	37	5.44	29	-0.03	1.59	0.00
Materials	4.04	11.19	-5.53	2,602	-6.92	6,287	13.38	39.10	6.84
Information Technology	17.02	17.01	3.75	126	4.36	88	-0.14	0.03	-10.27
Industrials	13.70	14.95	2.51	284	1.82	883	4.61	-2.05	5.37
Health Care	6.68	6.37	3.20	79	-3.03	74	-0.02	-1.13	41.63
Financials	28.48	25.22	-1.77	205	-2.20	192	-0.05	-9.01	12.21
Consumer Staples	4.87	4.56	6.97	81	5.55	85	0.02	1.57	6.90
Consumer Discretionary	10.78	6.43	0.01	902	-1.39	350	-2.00	-7.73	16.14
Total Global	100.00	100.00	1.24	4,877	0.26	10,024	15.43	22.10	60.84

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- Companies have short carbon position priced at 0/ton

- Methodology to measure short carbon risk

- Carbon Attribution measures the impact of active exposure to carbon emissions

- Active returns is decomposed into effects in a carbon free market

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