

Mahmoud Khalifeh, Associate Prof.

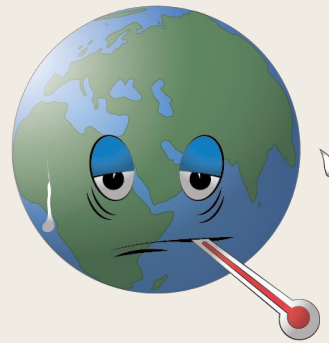
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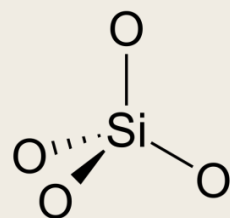
# Geopolymer Technology - Green Transition



University  
of Stavanger

SafeRock







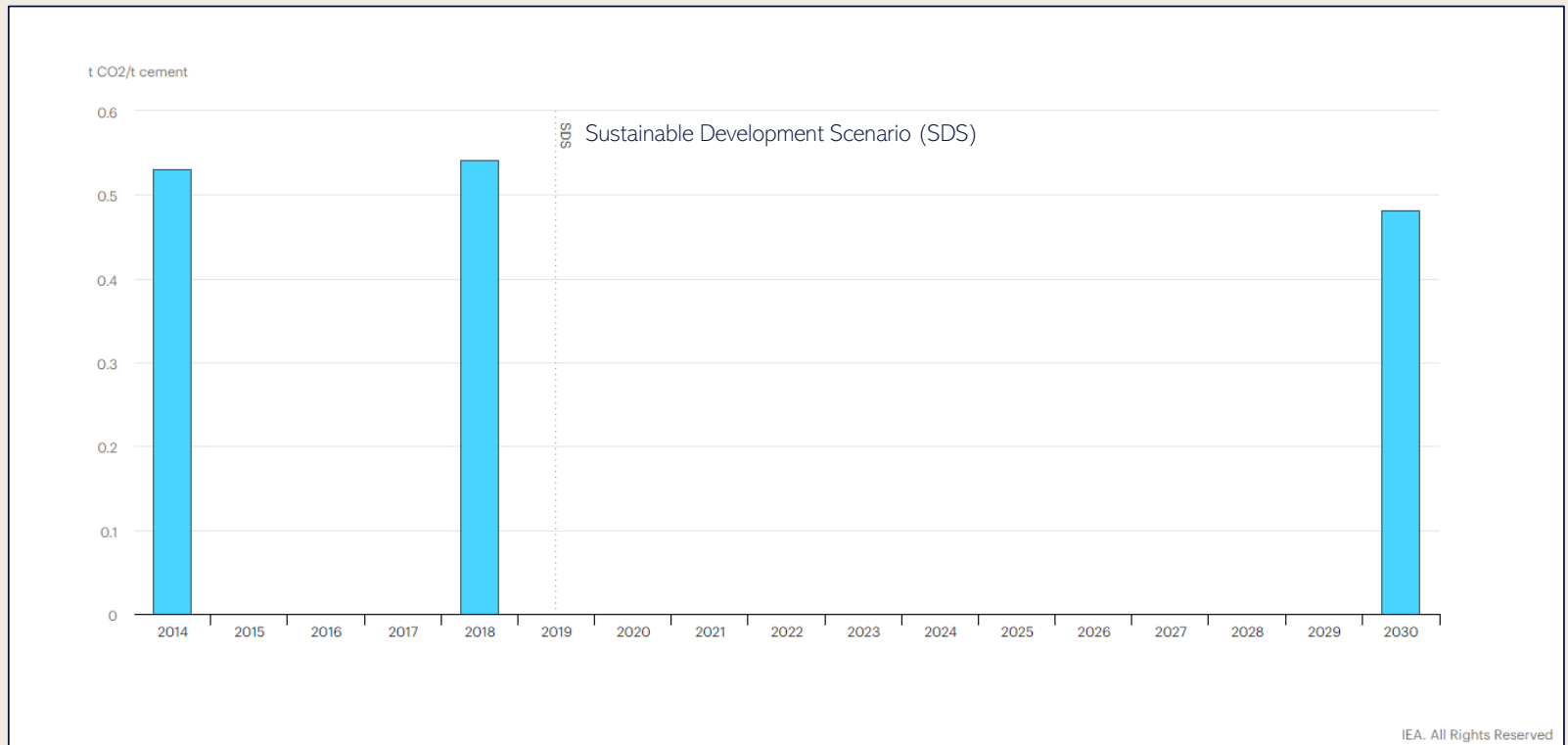




## IEA (2020), Cement

*More efforts needed*

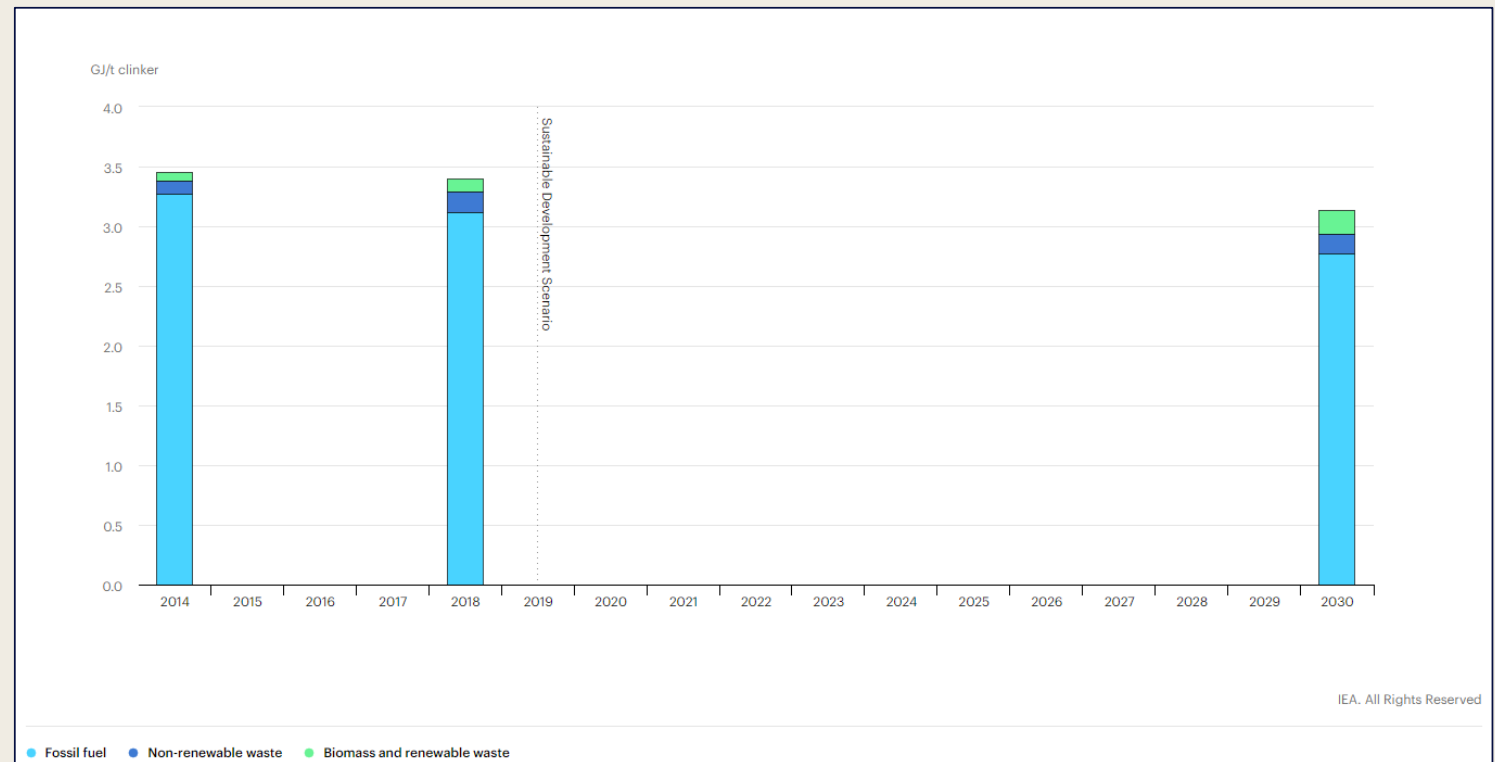
Direct CO<sub>2</sub> intensity of  
cement in the  
Sustainable  
Development Scenario,  
2014-2030



## IEA (2020), Cement

*More efforts needed*

Global thermal energy intensity and fuel consumption of clinker production, 2014-2018 and in the Sustainable Development Scenario





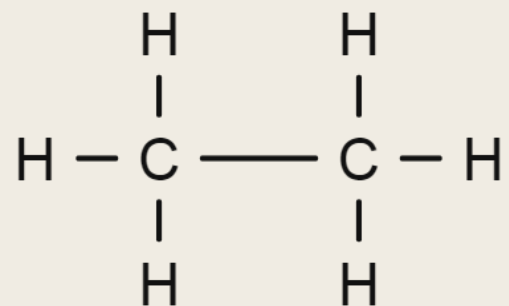
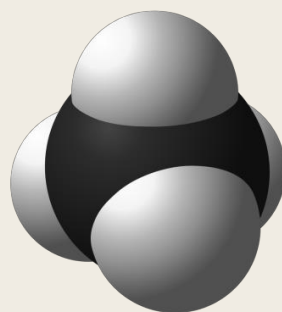
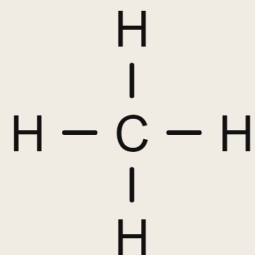
# Geopolymer Technology

## Silicon vs. Carbon

Group Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	57 La	* 72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	89 Ac	* 104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
			* 58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu		
			* 90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr		

Did you  
know?

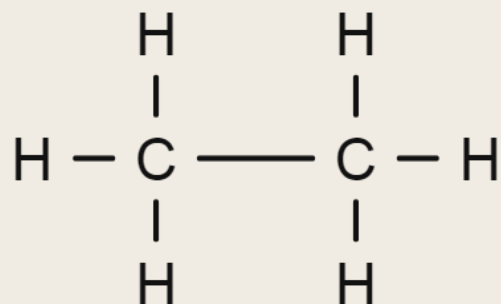
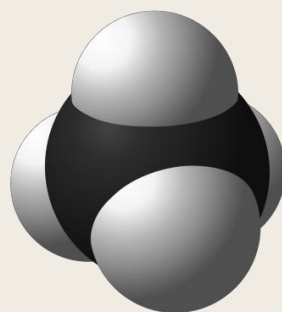
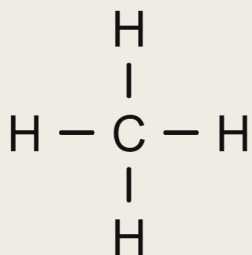
Carbon



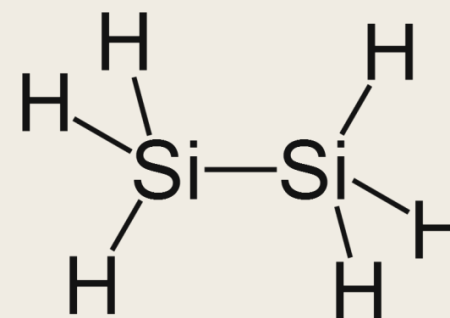
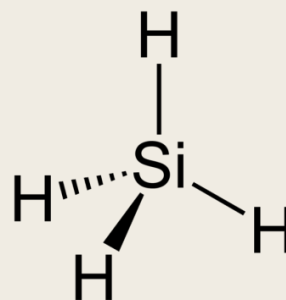
Silicon

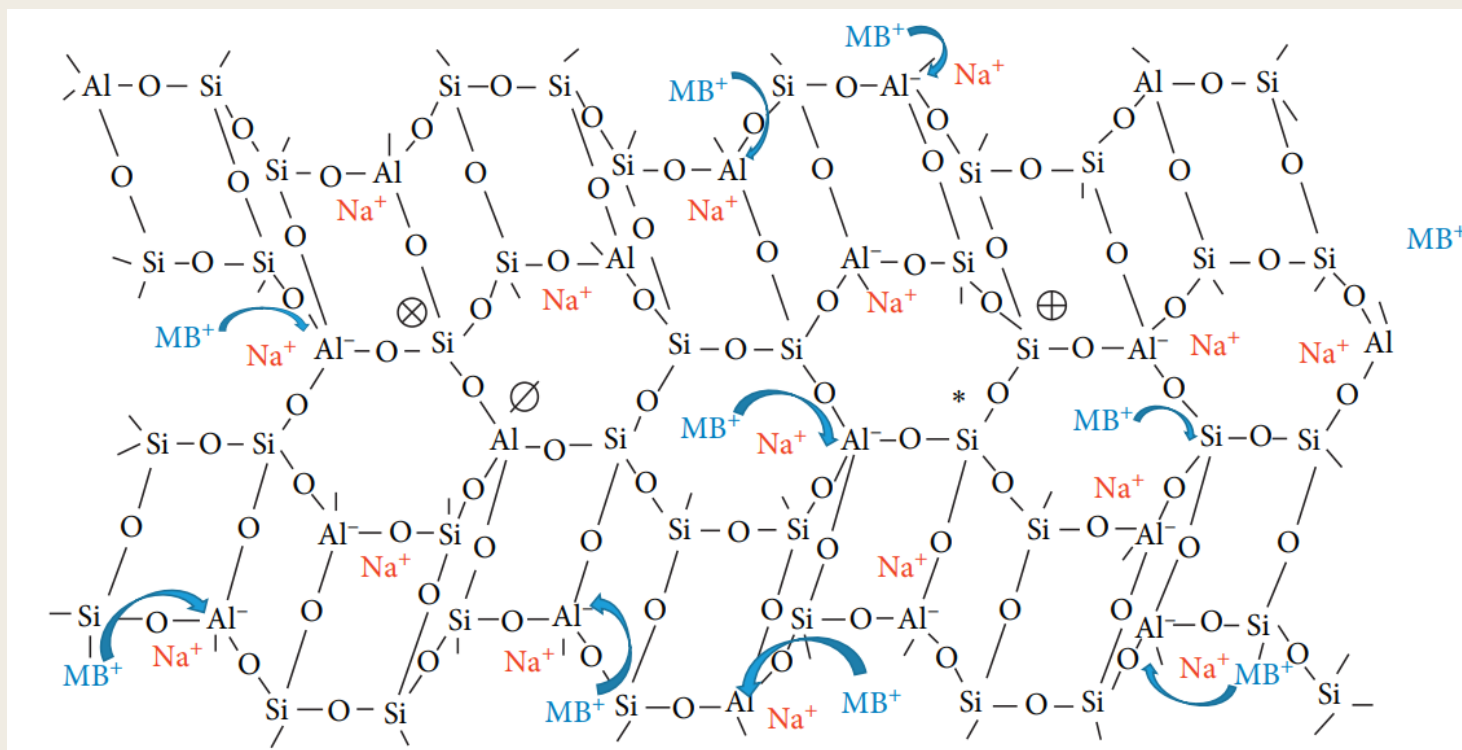
Did you  
know?

## Carbon



## Silicon





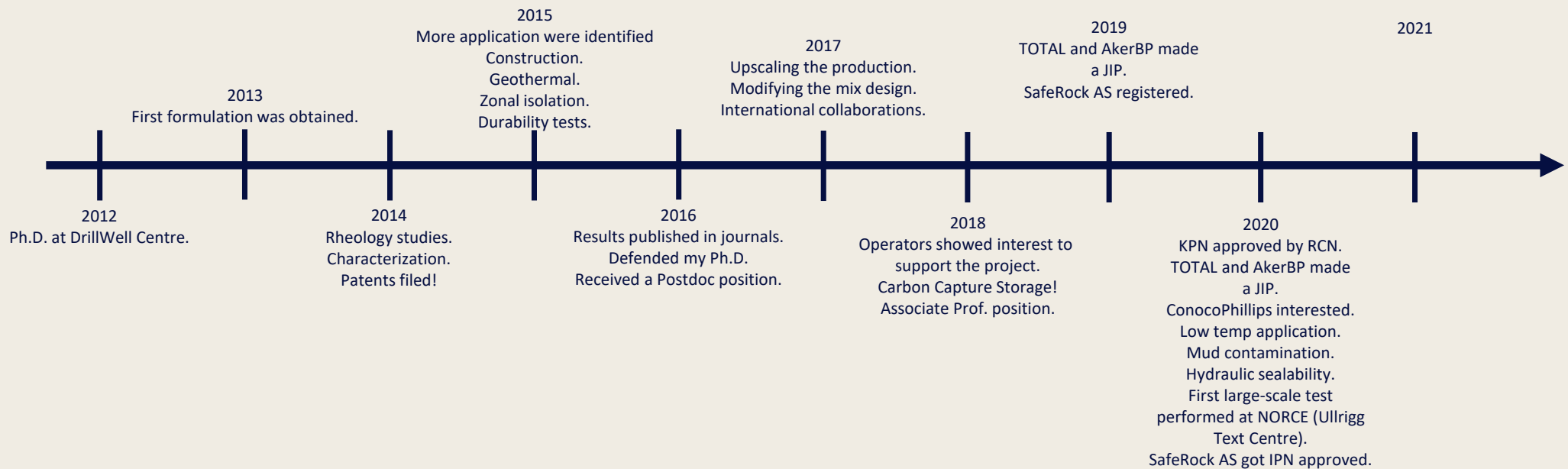
Volume 2019 | Article ID 4212901 | <https://doi.org/10.1155/2019/4212901>





# A journey began from ancient Egypt!

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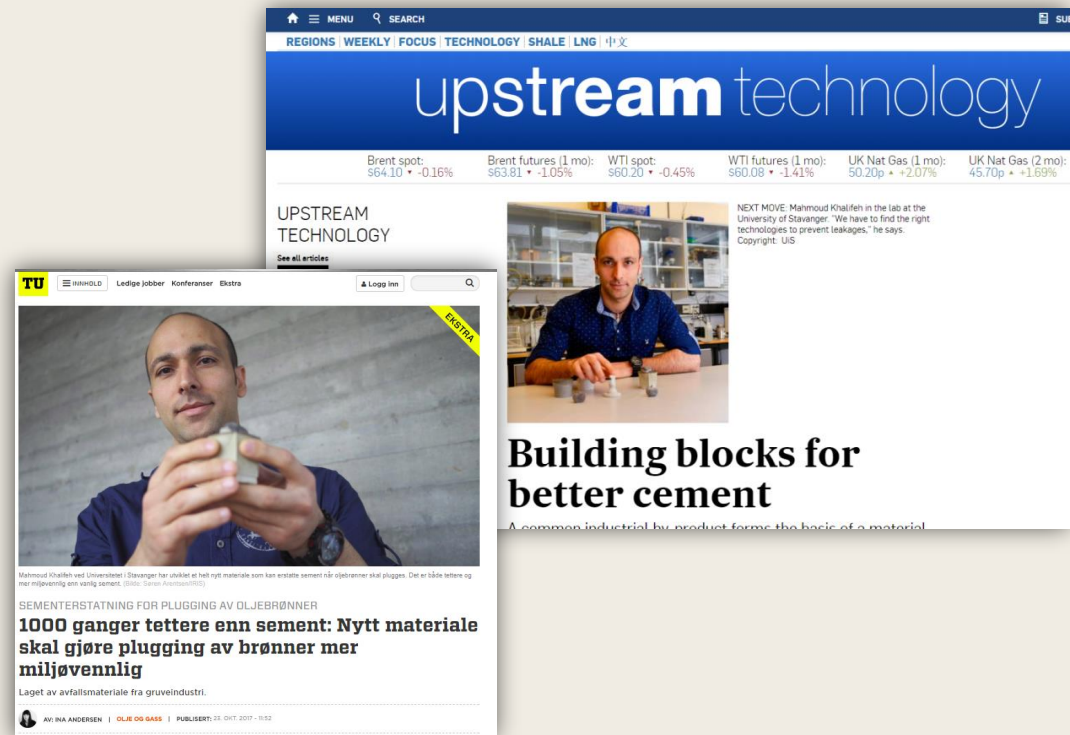




# SafeRock: 70-80 wt.% Lower CO<sub>2</sub> Emission

## Properties:

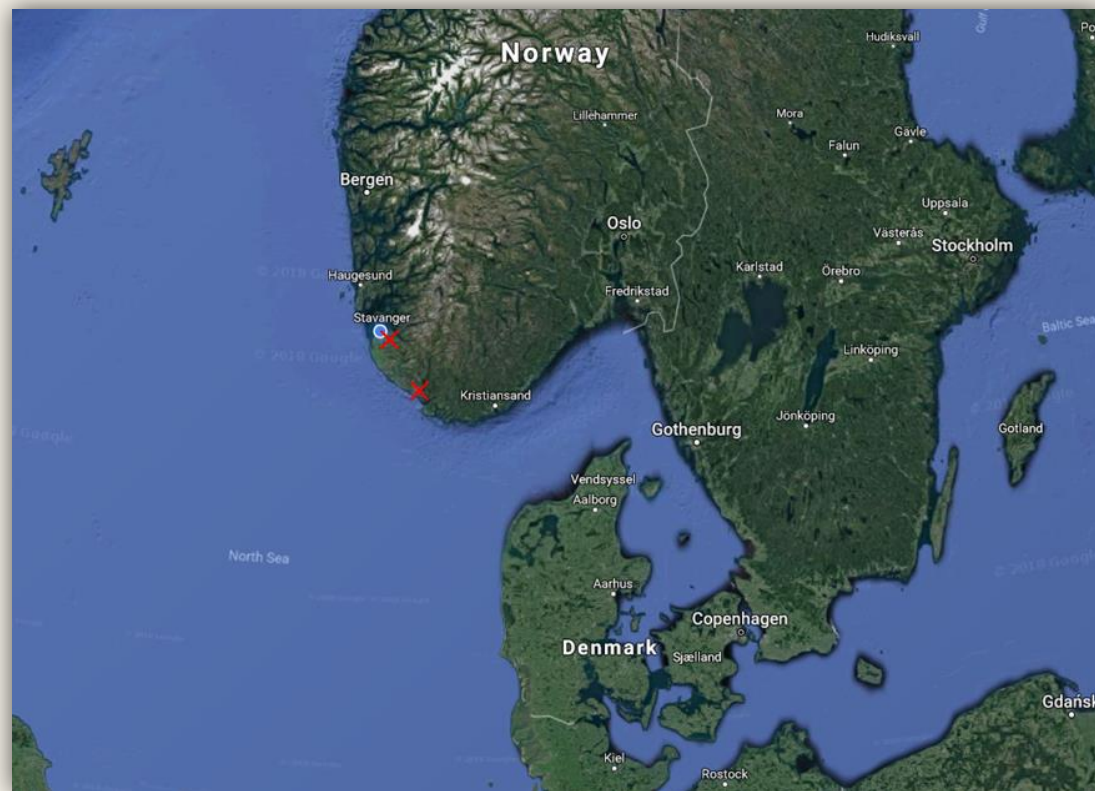
- ✓ Pumpable
- ✓ 1000 times less permeability than cement
- ✓ Less than 1% shrinkage
- ✓ Durable
- ✓ Low Young's modulus
- ✓ Environmentally friendly





# Waste or Potential!

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# Waste or Potential!

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# Preparation

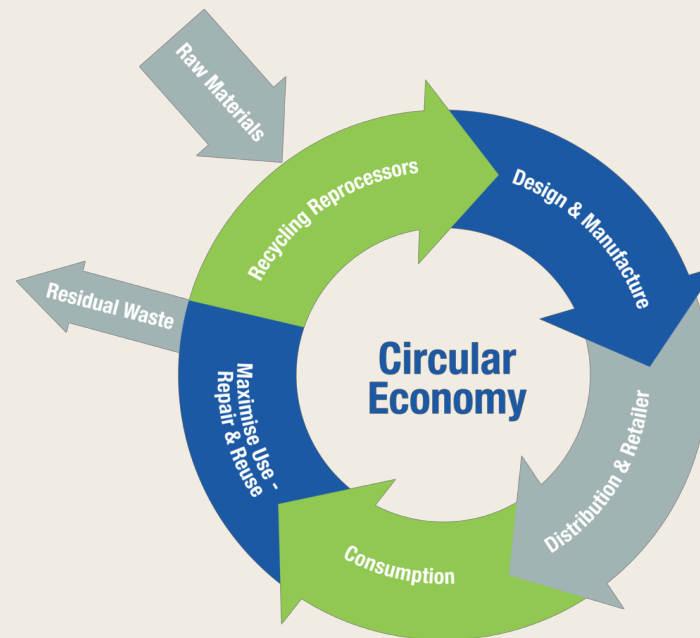
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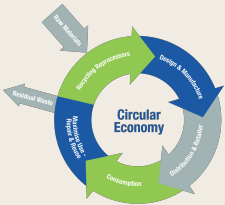
# Superiority

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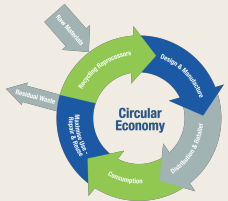
# Superiority

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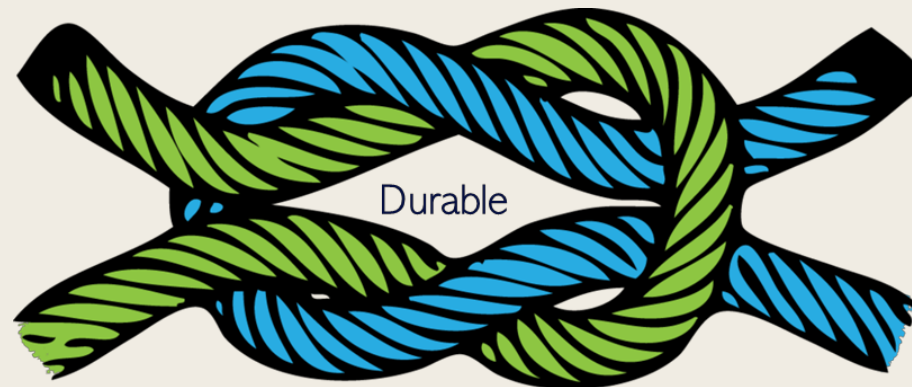
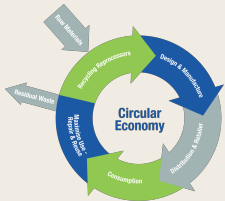
# Superiority

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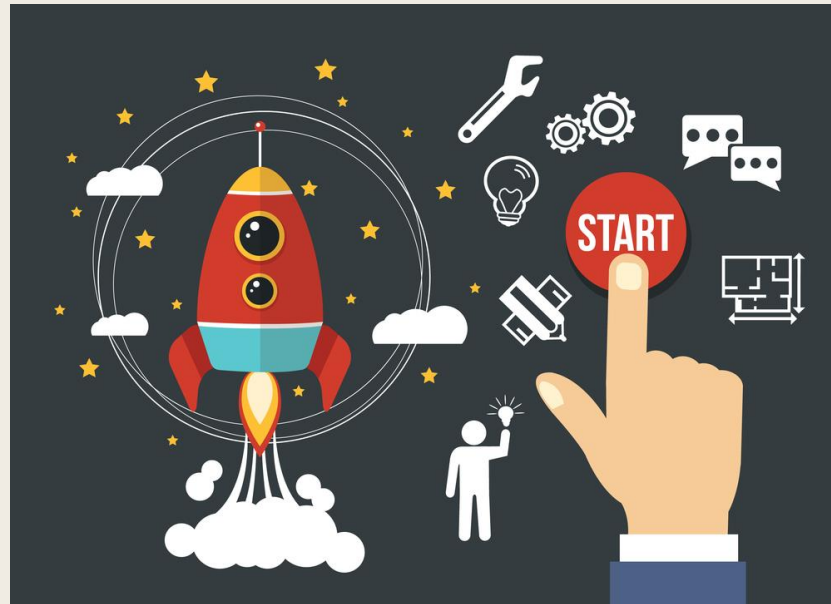
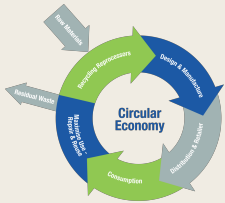
# Superiority

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# Superiority

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# Spin-off

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SafeRock



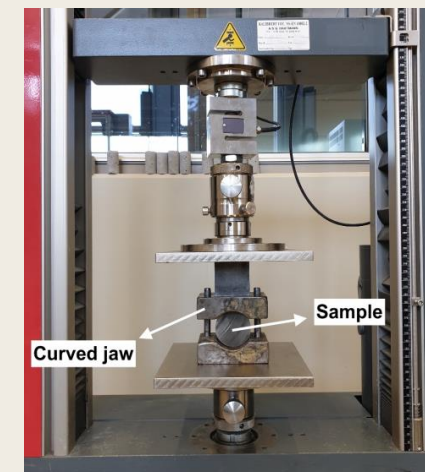
SolidRock



GeoCarb



GeoFlex





More info:  
[www.saferock.no](http://www.saferock.no)

” Thank You!



29.09.2021