

Sand – Whole life cycle and use in Construction



Summary

A brief look into the whole life cycle of sand and its versatility within the construction industry, that is fast becoming its downfall. Global use of sand within construction and how demand is outstripping supply. Research into the Innovative ways in which other problematic materials can replace a proportion of sand to off set the increased use of this finite material.

Sand is the second most used natural product on our planet after water.

Construction demands a specific type of sand

- Estimated 15 billion tonnes of sand used yearly for construction. A third of material used to produce concrete is sand
- 50 billion tons of sand every year is mined, that is twice the amount produced by every river in the world
- Only sand that is washed by water is used. Desert sand is too round due to being wind blown reducing its ability to bind.
- Concrete production responsible for 4-8% of world Co2
- Sand takes thousands of years to create but we can extract & use vast amounts daily
- Sand mining makes areas more prone to flooding as natural barriers and dunes are removed
- Sand mining destroys aquatic ecosystems
- Sand is never returned to its natural state through the whole life cycle.

Main uses for sand in construction and global production yearly

Concrete

2019 4.4 billion tons globally



Asphalt

1.6 trillion metric tons globally

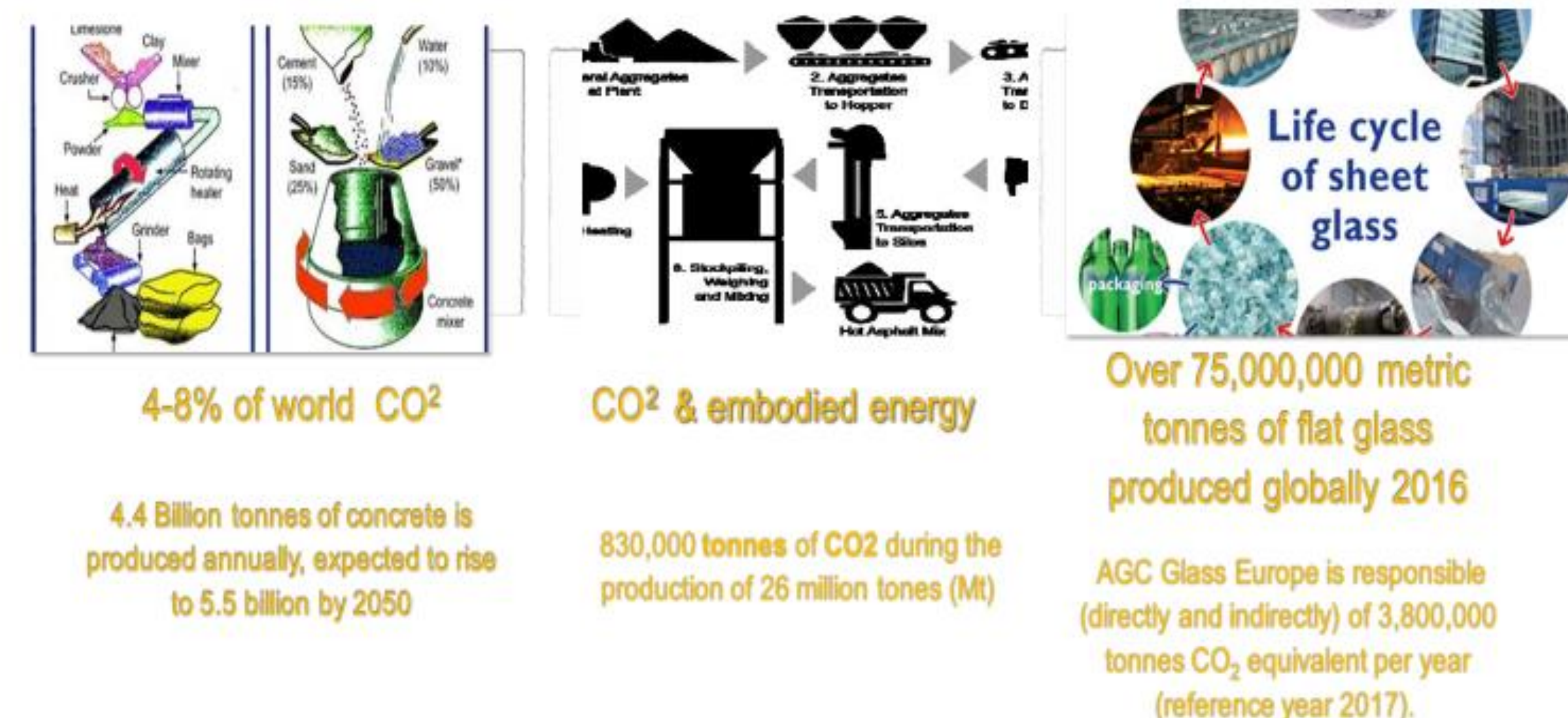


Glass

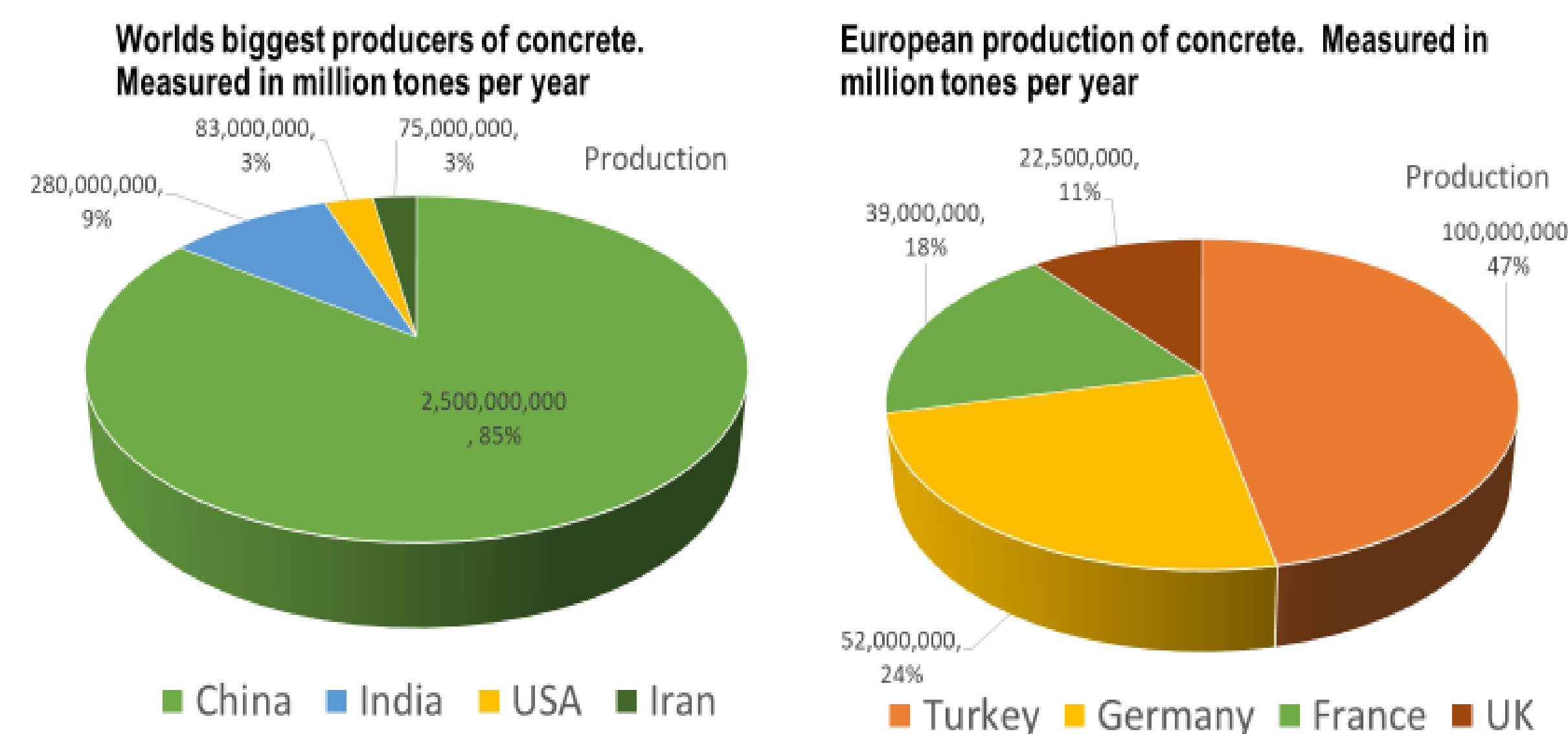
11 billion square meters globally 2021



CO₂ emissions during production



Global production of concrete, one third of materials is sand!



Question?

What if we replace at least 10% of sand used in the production of concrete with a problematic material like, plastic? Win, win?

Exciting research carried out by Bath University in conjunction with India's Goa engineering college into the use of recycled plastics in concrete!

- By replacing 10% of the sand used for concrete with a recycled plastic as much as 800 million tonnes of sand could be saved yearly.
- 15,000 tons of plastic waste is dumped every day in India
- Particles from recycled plastic bottles, polyethylene terephthalate 'PET' was found to be the best replacement material with a compressive strength of 54MPa, similar strength to that of structural concrete.
- Similar methods, using higher quantities of plastic can be used for low technology concrete products that don't require the structural element, like pavements and hard standing areas.
- By using hard to recycle plastics as a replacement for sand could prove invaluable.
- Saving a rapidly diminishing natural resource for a 21st century single use commodity has got to be a win, win.

End of life, or is it?

We cannot return sand to its natural state but it can have a second life for many more years!



Crushed waste concrete used as a new road surface

Conclusion

We cannot return sand to its natural state, however, we can slow it's use down within the construction industry and therefore the speed in which it is mined. By taking another global waste product "Plastic", to take the place of sand, we can successfully create a concrete with a comparable structural strength. By substituting with plastic, a problematic product, it will help balance natural environments allowing their sustainability whilst at the same time manage our increasing global plastic pollution. Construction materials concrete, asphalt & glass can be recycled in a number of ways to provide renewed & reused materials for many years to come.