

Bindemedel med biogent material som förlänger vägbeläggningens livslängd

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Agenda

- ▶ The Nynas' way
- ▶ What we had to consider when developing a new material
 - The performance of biogenic polymer modified bitumen
 - Circularity
 - Health and safety
- ▶ The carbon footprint
- ▶ Conclusions



1987
Our Common Future –
"The Brundtland Report"



100% re-usable binder

Durability

Optimise maintenance

Use it!
Don't burn it!

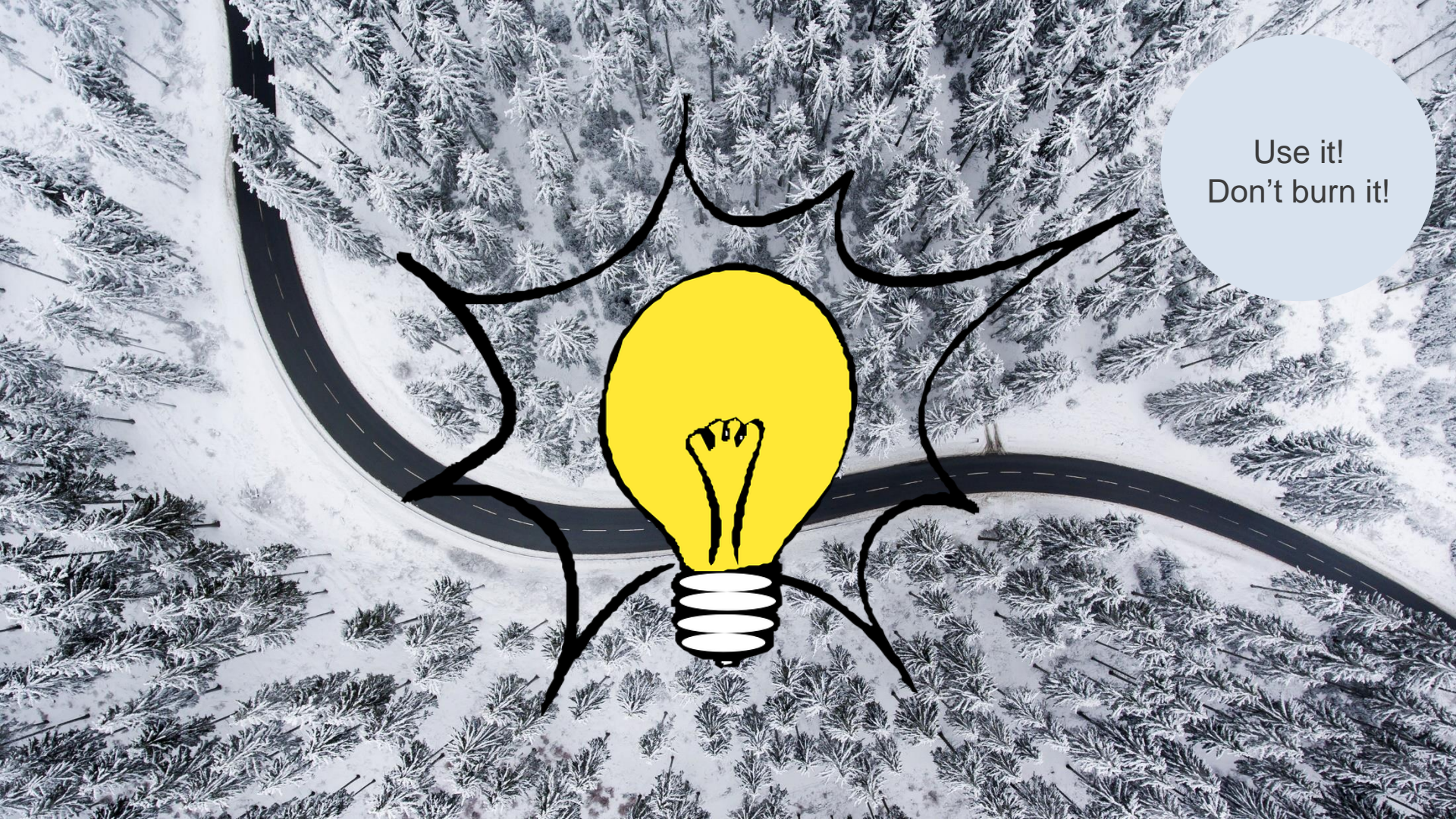
Cold-mix

Biogenic material


Towards circularity

Warm-mix

Maximise RAP usage

An aerial photograph of a dense evergreen forest covered in a thick layer of snow. A dark, winding road with a dashed white line runs through the center of the forest. In the middle of the road, a large, glowing yellow lightbulb is superimposed. The lightbulb has a black outline and a black base. Several black, wavy lines radiate outwards from the lightbulb, resembling a stylized sun or a burst of energy. In the top right corner, there is a light blue circular speech bubble containing the text "Use it! Don't burn it!".

Use it!
Don't burn it!

An aerial photograph of a dense forest of evergreen trees covered in a thick layer of snow. A dark, winding road with white dashed lines curves through the forest. Two semi-transparent circular overlays are present: a large yellow one in the center and a smaller light blue one in the top right corner.

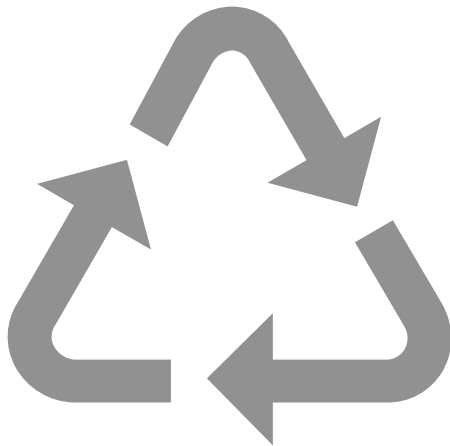
Optimise the use of
resources by developing
a durable and re-usable
binder with lowered
carbon footprint

Use it!
Don't burn it!

What to consider when developing a new material



Durability

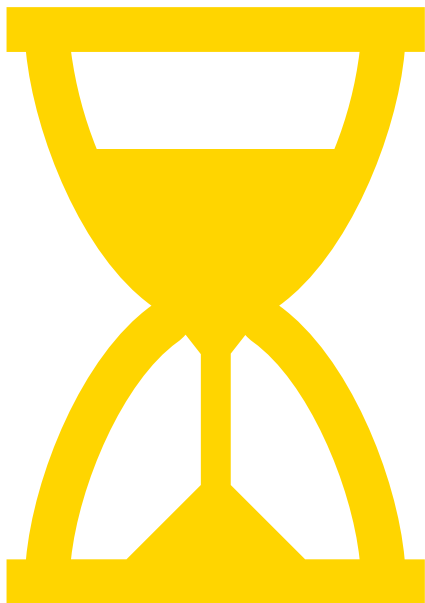


Circularity



Health and safety

What to consider when developing a new material



Durability

Binder

- Stability
- Performance
- Rheology
- Ageing

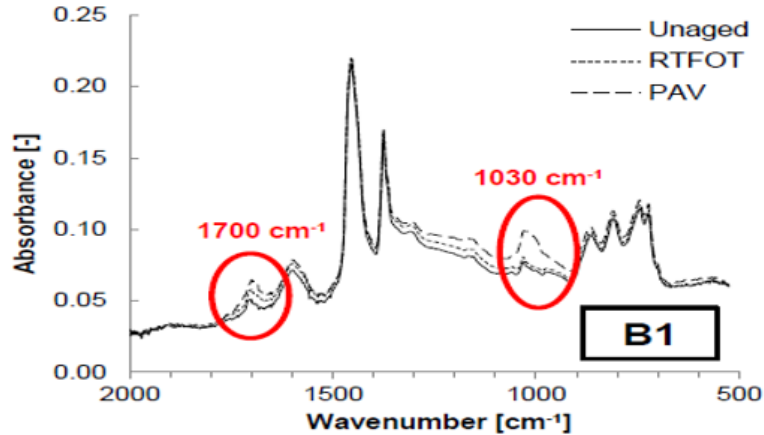
Asphalt mix

- Stiffness
- Fatigue
- Rutting
- Adhesion

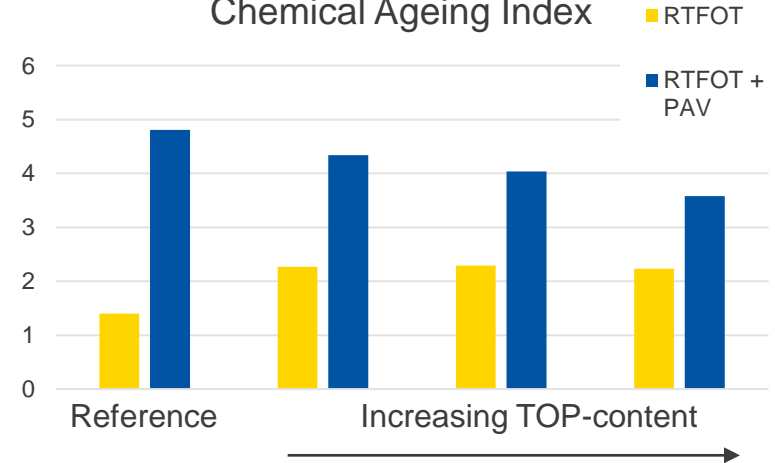
Fields trials

- Pavement performance

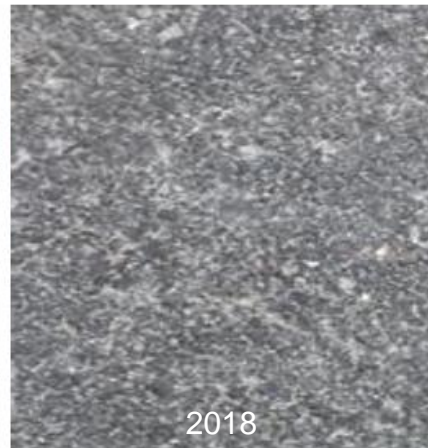
Short- and long-term ageing



Chemical Ageing Index



Asphalt mixture performance: Full scale field trials

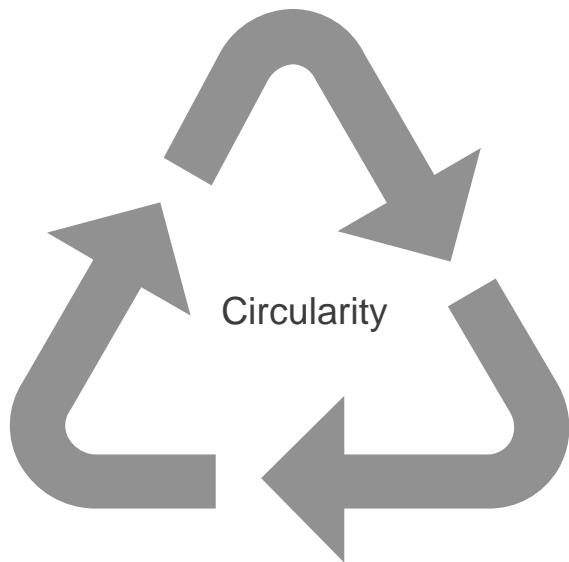


2016: Residential road, Sweden. Dense mix (ABT11), no RAP.
Inspected annually and pavement found to be in good order.

Performance testing

Sample	Wheel track test @ 60 °C		Water sensitivity		
	Rut depth, 20000 cycles (mm)	Slope, wheel track (mm/1000 cycles)	ITS wet (kPa)	ITS dry (kPa)	ITSR (%)
Reference – Nypol 73 (ABS 16)	2,6	0,04	1556	1650	94
40/100-75 containing TOP (ABS 16)	1,9	0,05	1534	1571	98

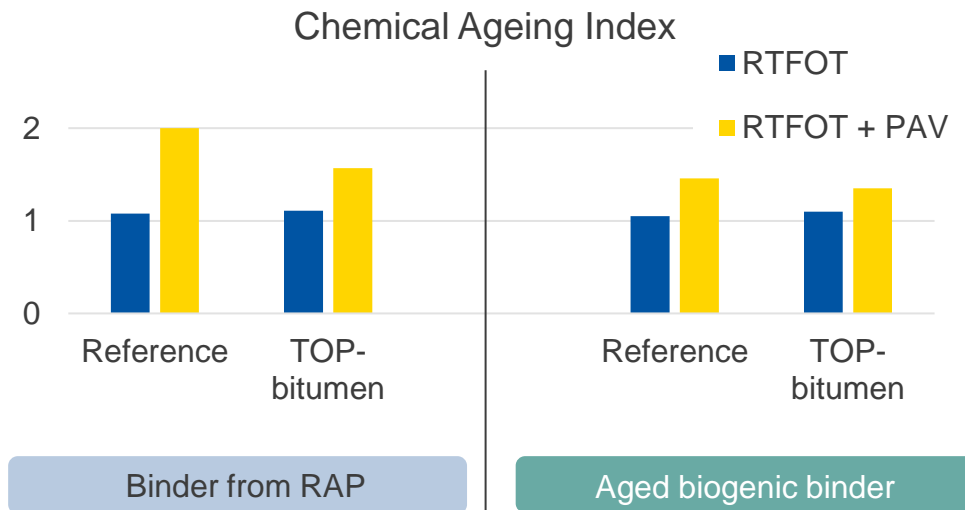
What to consider when developing a new material



Can a biogenic binder be used together with RAP?

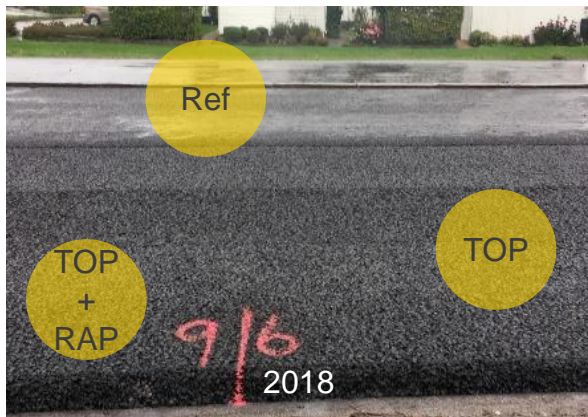
Can an asphalt containing biogenic binder be recycled?

What to consider when developing a new material



TOP extended binders are effective in the hot recycling of RAP and also completely recyclable.

Asphalt mixture performance: Full scale field trials



2018: Local road, Sweden. 40 mm asphalt layer (SMA16).

Reference sections with/without 20% RAP. Inspected annually, pavement in good order.

What to consider when developing a new material



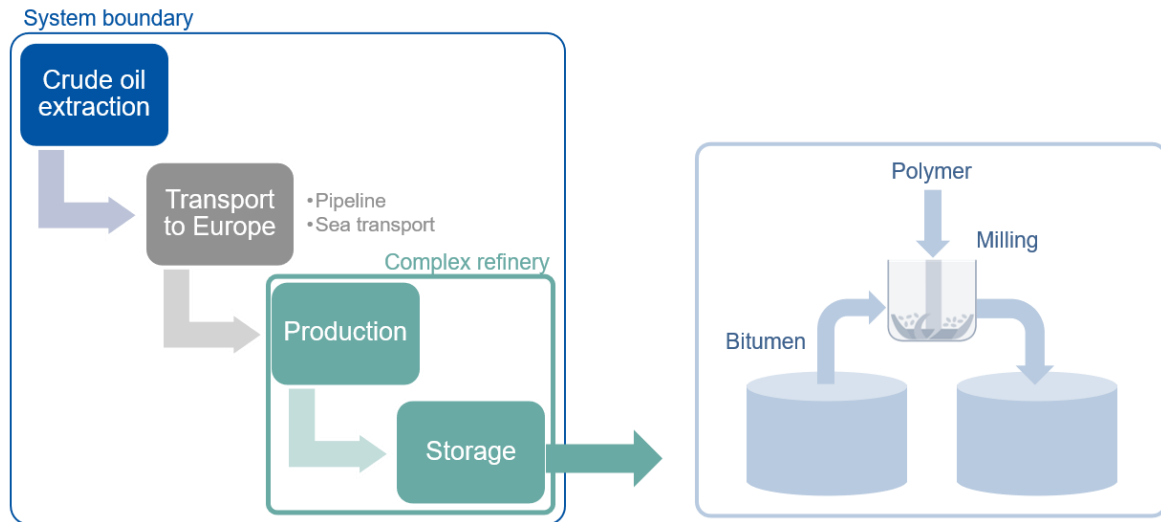
Any binder, in itself, must not be harmful

There is a need to avoid that dangerous substances
are emitted into the work environment

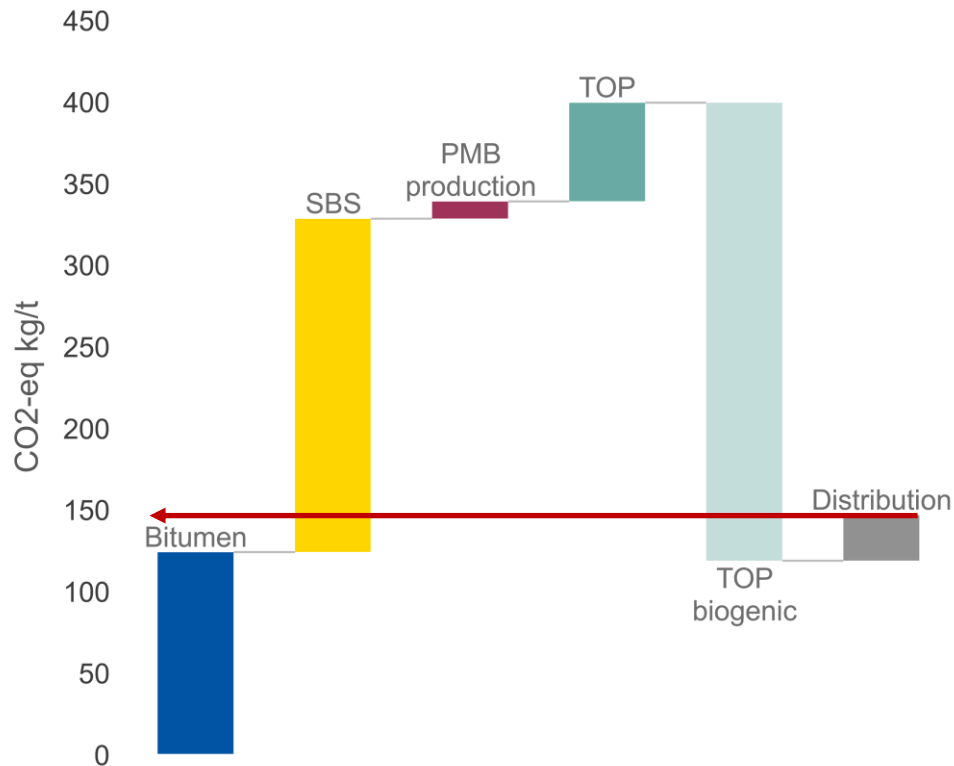
How to look upon the use of
our joint resources?

Standards used for carbon footprint calculation

- ▶ Eurobitume LCI 2012 & 2020, ISO 14040 & ISO 14044
 - Bitumen ex. gate refinery
 - Polymer and PMB production
- ▶ EN 15804:2012 and CEN TR 16970:2016
- ▶ Journal of Industrial Ecology, 2015, Volume 20 #5,
 - Greenhouse Gas and Energy Life Cycle Assessment of Pine Chemicals Derived from Crude Tall Oil and Their Substitutes, Sarah A. Cashman, Kevin M. Moran, and Anthony G. Gaglione.



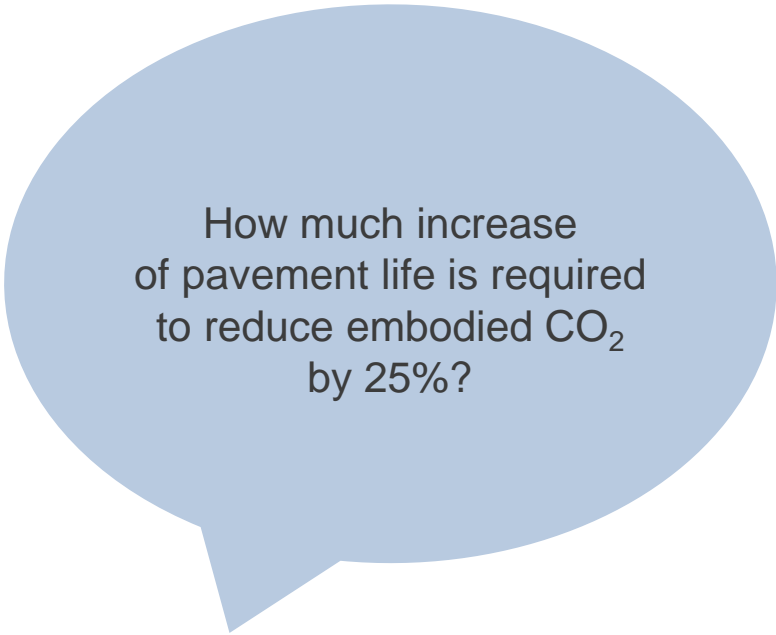
Carbon footprint for a 40/100-75 binder including TOP




- When a forest grows, CO₂ is absorbed from the atmosphere and is bound.
- When TOP is used from sustainably managed forests, it can compensate the carbon footprint of bitumen, SBS and PmB production.

- NOTE: Environmental & LCA standards and values may change in the future!

Importance of considering pavement lifetime / durability

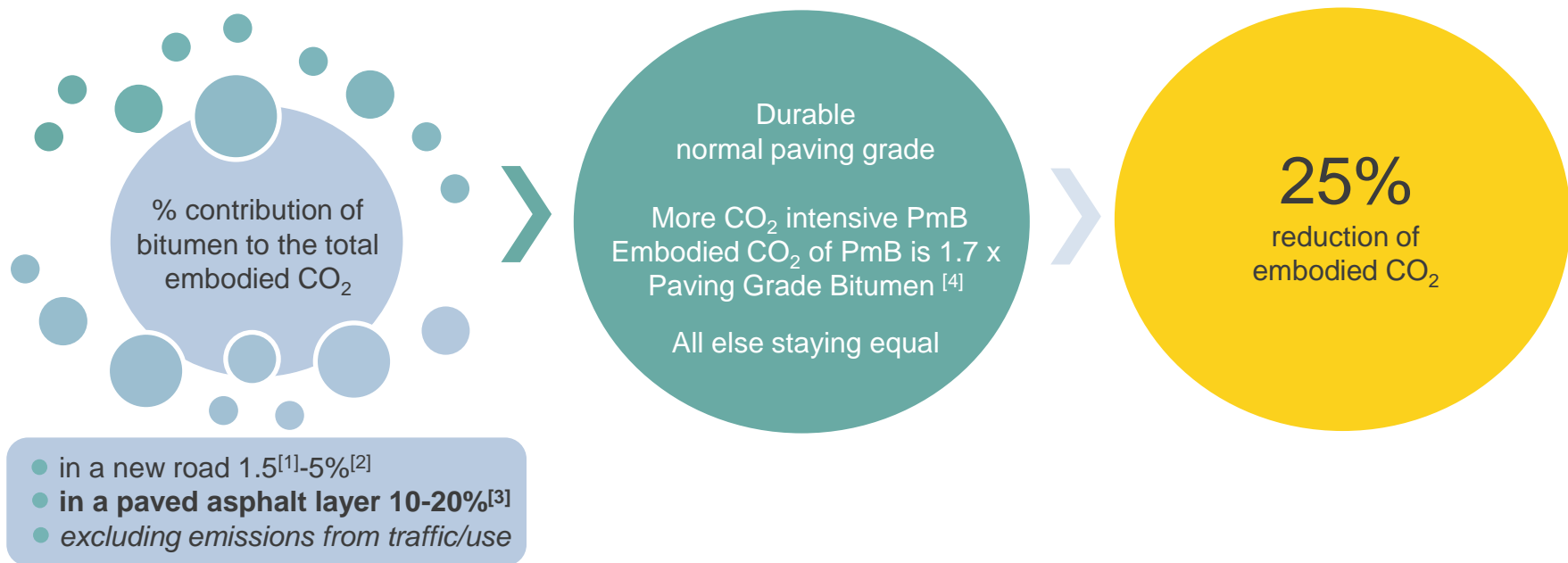
A light blue speech bubble with a tail pointing towards the bottom left.

How much increase
of pavement life is required
to reduce embodied CO₂
by 25%?

A teal speech bubble with a tail pointing towards the bottom left.

And when using a more
CO₂ intensive binder?

Importance of considering pavement lifetime / durability



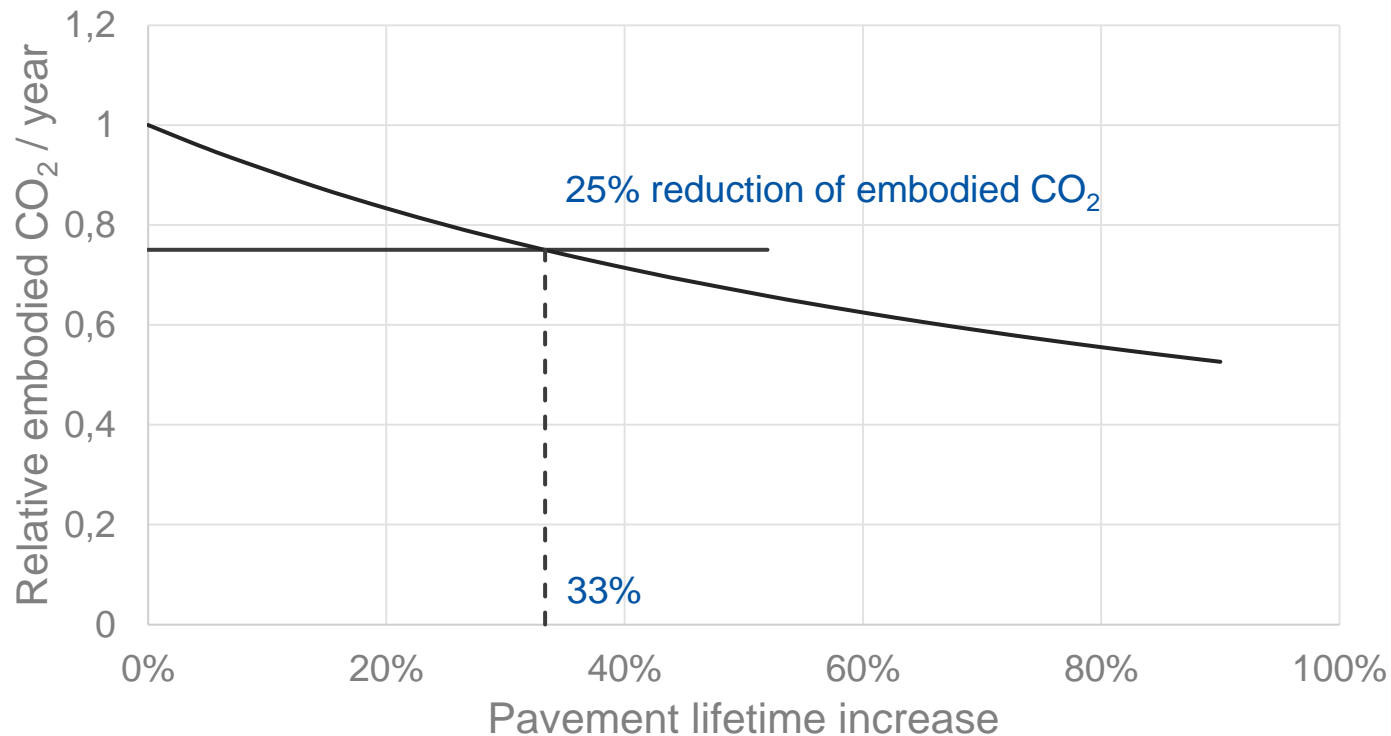
[1] Håkan Strippel: Life Cycle Assessment of road, a pilot study for inventory analysis, 2nd Revised Edition, March 2001, IVL Svenska Miljöinstitutet AB

[2] C.Milachowski, T.Stengel, C.Gehlen, TU Munich: Life Cycle Assessment for road construction and use, commissioned by European Concrete Association, 2010

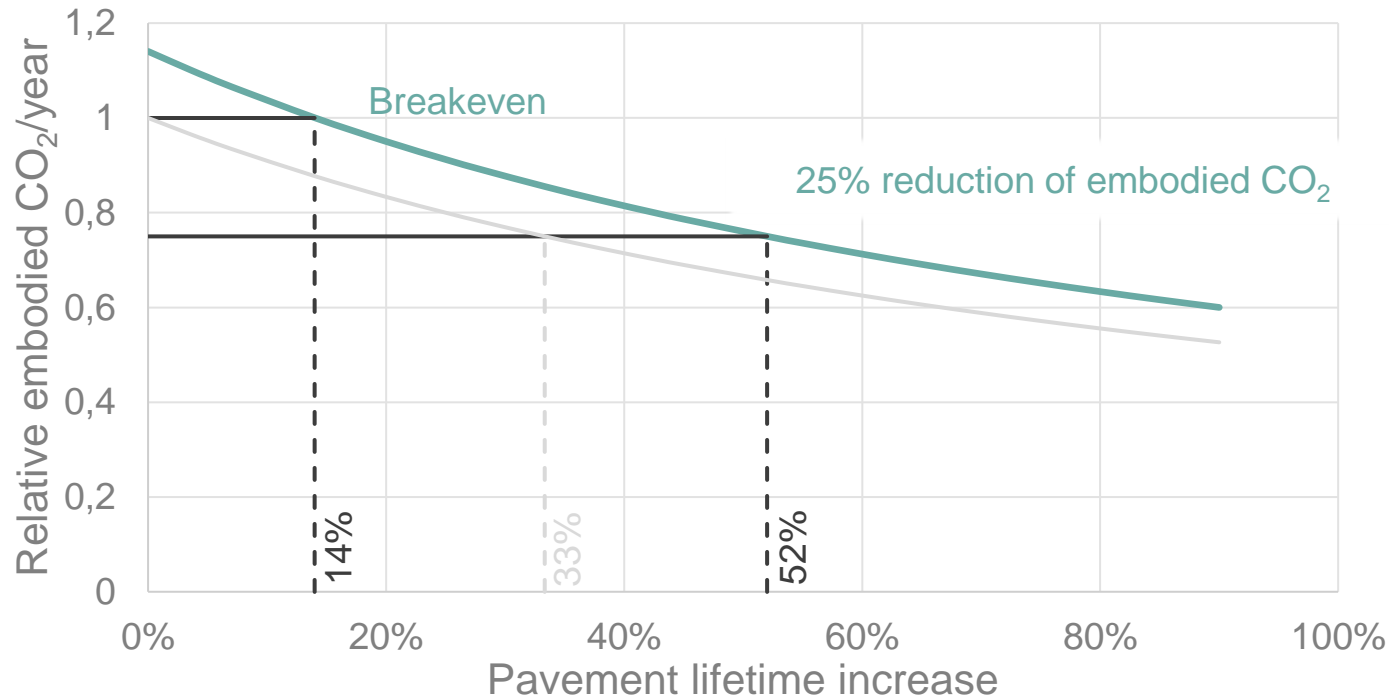
[3] Nynas Embodied Carbon Tool, 2016

[4] Eurobitume LCI, ISBN 2-930160-26-8, 2012

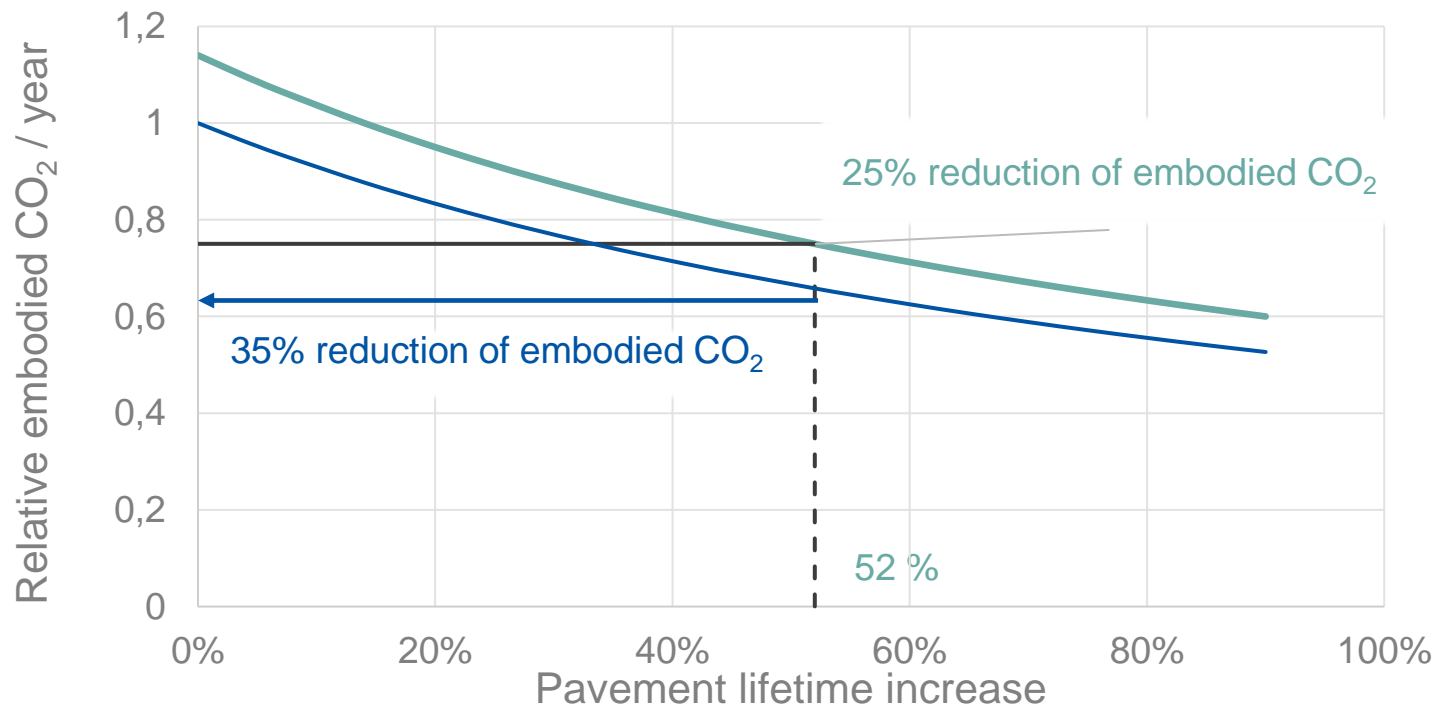
Reduction of embodied CO₂ by extending pavement life



Reduction of embodied CO₂ by extending pavement life when using a more CO₂ intensive PMB...



...and when using a less CO₂ intensive PMB



Conclusions

**Successful development of a recyclable polymer modified bitumen (PMB)
containing biogenic material**

Durability in terms of
aging resistance of
biogenic binder is
excellent

The material has a
lower carbon foot-print
than normal PMB

Fatigue and
low temperature properties
are at least as good as
reference

Rutting resistance
is slightly improved for the
biogenic binder

Improved adhesion
is seen as a reduction in
water sensitivity

Thank you for your attention!

TAKING OIL FURTHER

We take oil further to bring lasting value
to customers and the world we live in.

