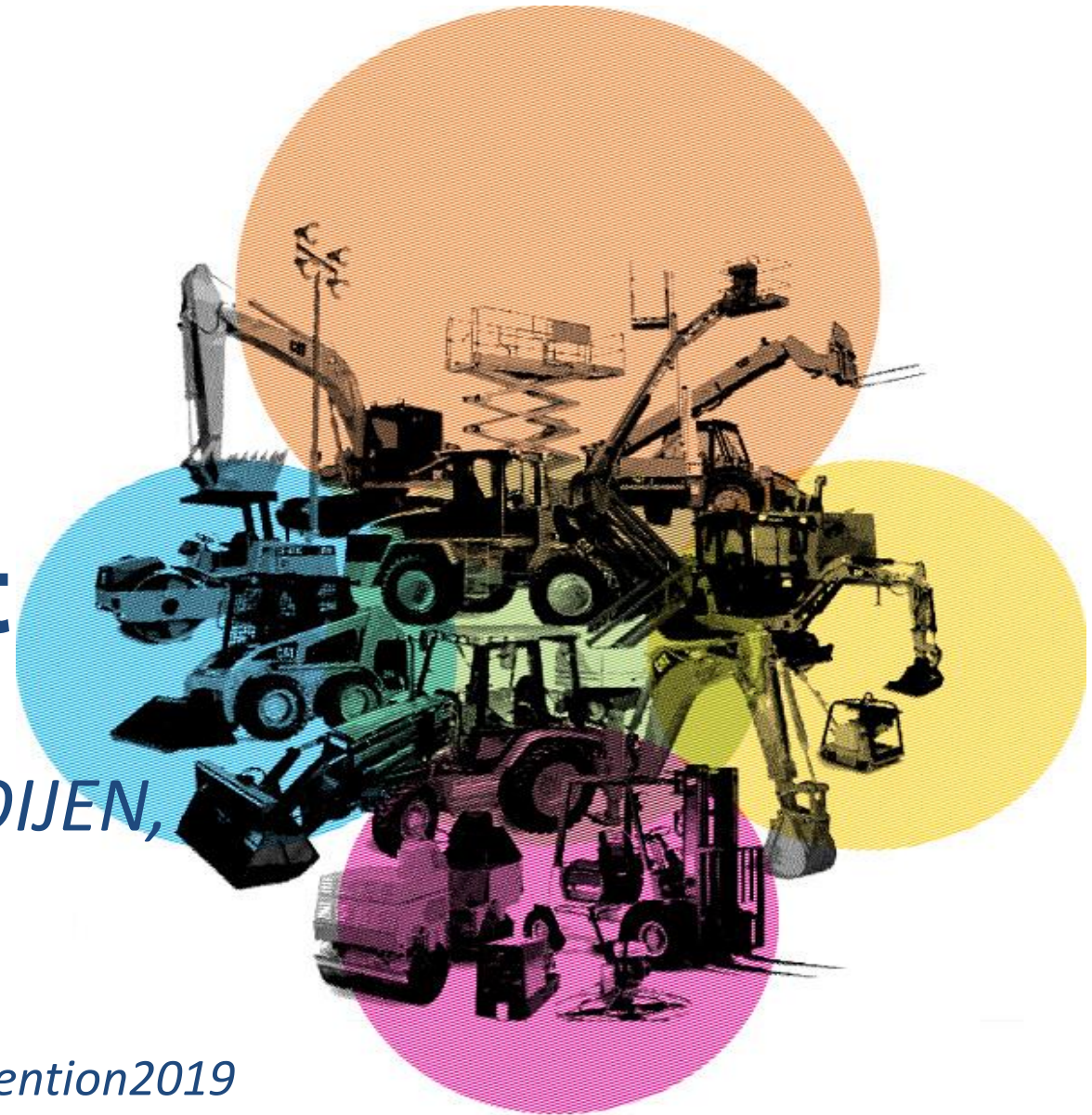# Carbon Footprint of Construction Equipment

Martijn IN'T VELD, Leonardo VERKOOIJEN,
Climate Neutral Group

Marijn BIJLEVELD, *CE Delft*

Please react on Twitter, @era_rental, #eraconvention2019

ERA Convention 2019, "RENTAL: A SHARING ECONOMY", Madrid, 15 and 16 May

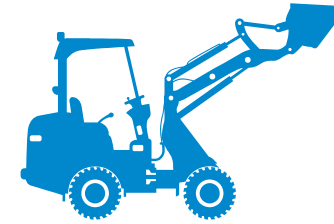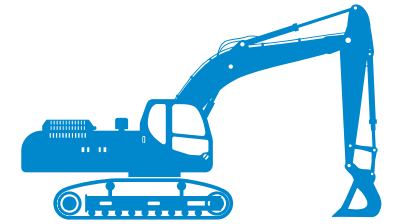# Construction equipment and its carbon footprint

Project goal

To compare efficient and inefficient use of equipment

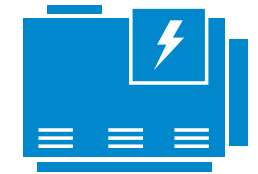To demonstrate possible reductions in CO_2-emissions.

Mini-excavator

Excavator
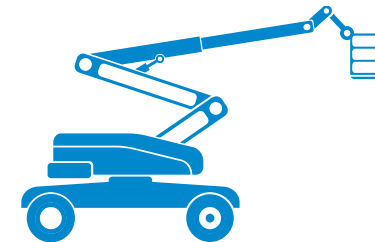
Wheel loader

Generator

Telehandler

Scissor lift

Breaker

Battery drill

Electric articulating boom lift

Mast boom lift

Team

- SGS Search – LCA

SGS | SEARCH

- CE Delft – Comparative analysis

CE Delft

- CNG – Project management and verification

Climate Neutral Group
for better business

Special thanks to:

- Volvo
- JCB
- Atlas Copco
- JLG
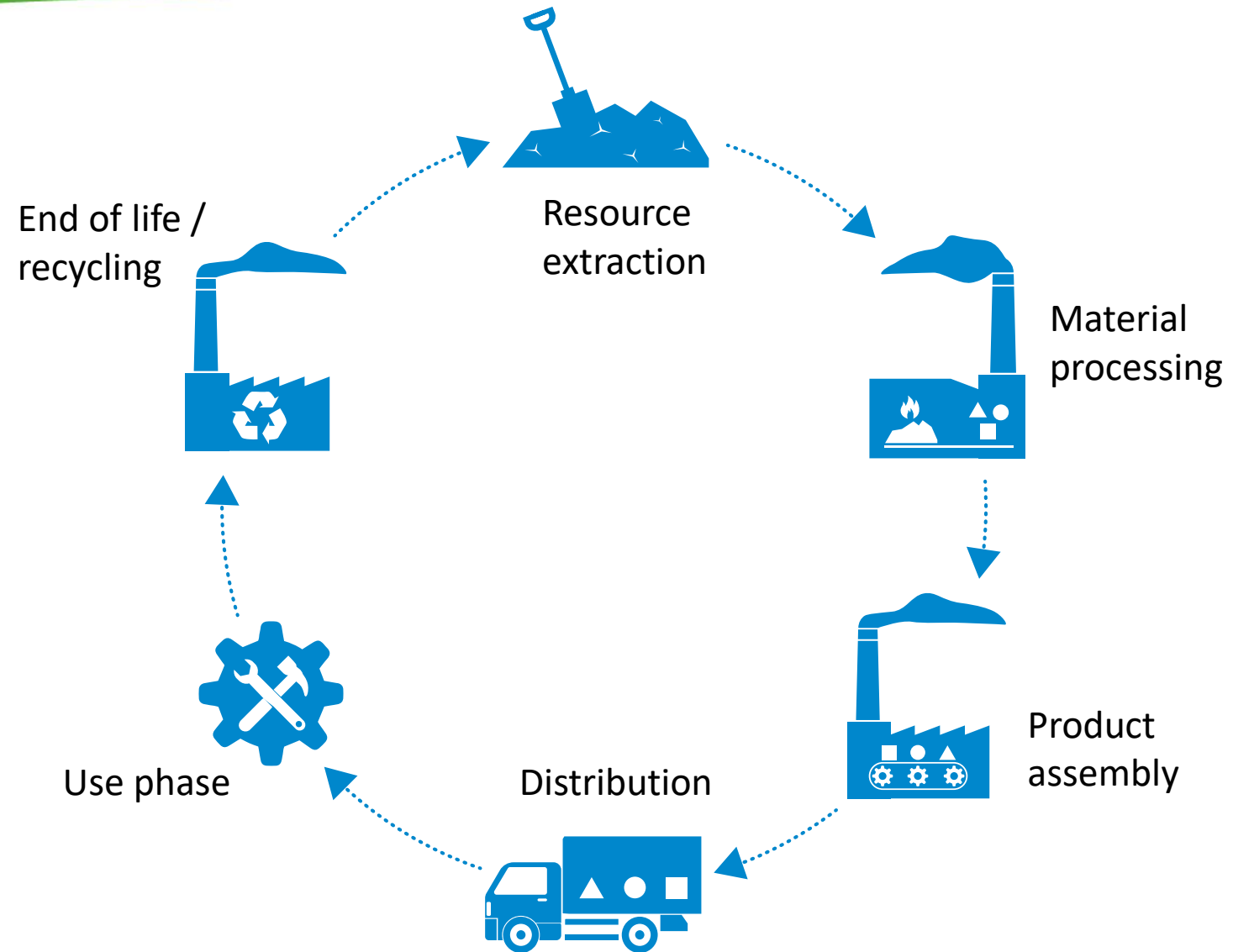- Haulotte
- Genie
- and all other contributors

Approach

Phase 1:
- Carbon Life Cycle Assessment, ISO 14040 & 14044 LCA standard

Phase 2:
- Definition of parameters
- Comparative analysis of parameters effects on selected products
- Use case scenarios and calculator

End of life / recycling

Resource extraction

Material processing

Product assembly

Distribution

Use phase

Various parameters determine the impact of use

Intensity of use

Energy consumption
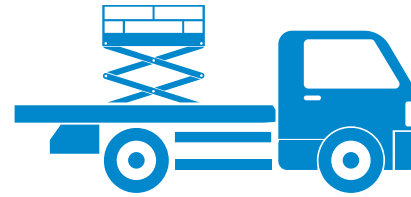
Transportation: distance, load factor, vehicle type

Recycling (yes/no)
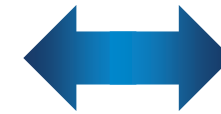
Enables innovation

A calculation tool

SCENARIO 1

500 hours
6 years
Efficient transport
Efficient energy

DIFFERENCE?

SCENARIO 2

250 hours
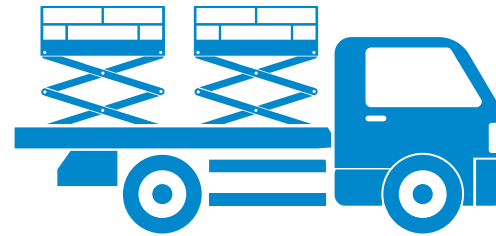8 years
Inefficient transport
Inefficient energy

CO_2

IMPACT per hour

- Transport
- Energy
- Production
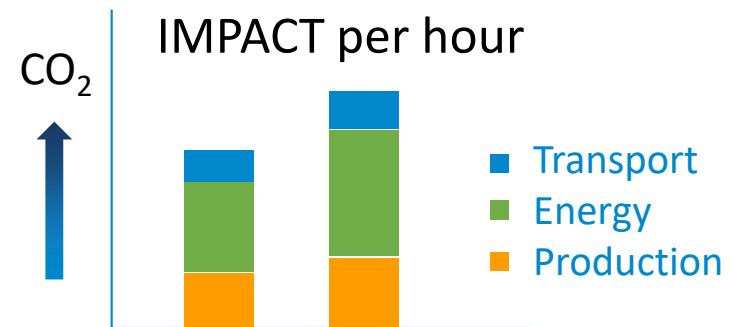
Efficient use <-> inefficient use

SCENARIO 1

SCENARIO 2

What if…

40 km

DIFFERENCE?

100 km

CO_2

?

?

S1   S2
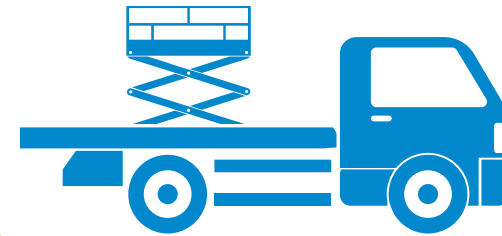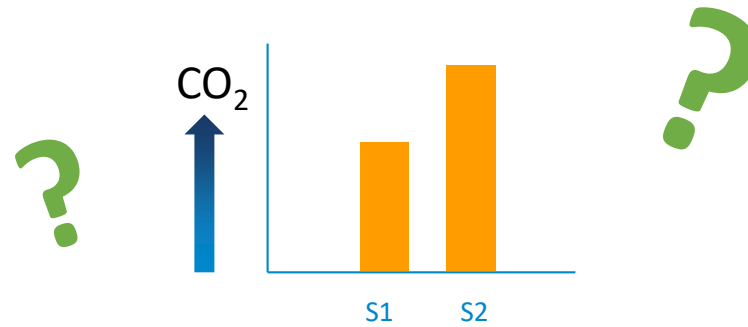
PRODUCTION of materials
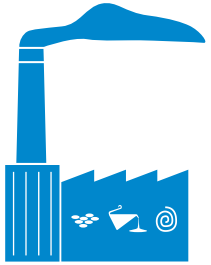
PRODUCTION of components
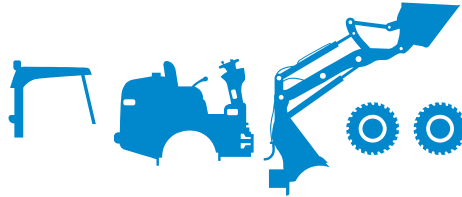
ASSEMBLY

5.000 kg $CO_{2\text{-}eq}$
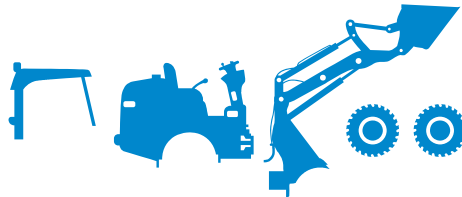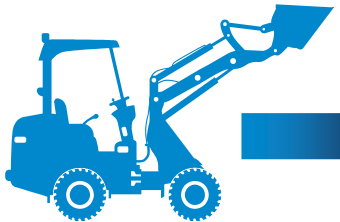
-1.800 kg $CO_{2\text{-}eq}$

DISASSEMBLY

RECYCLING (average)

3.200 kg $CO_{2\text{-}eq}$

Energy consumption

Carbon footprint of diesel consumption per hour

kg CO2-eq.

- normal: 7,5
- inefficient: 9,6
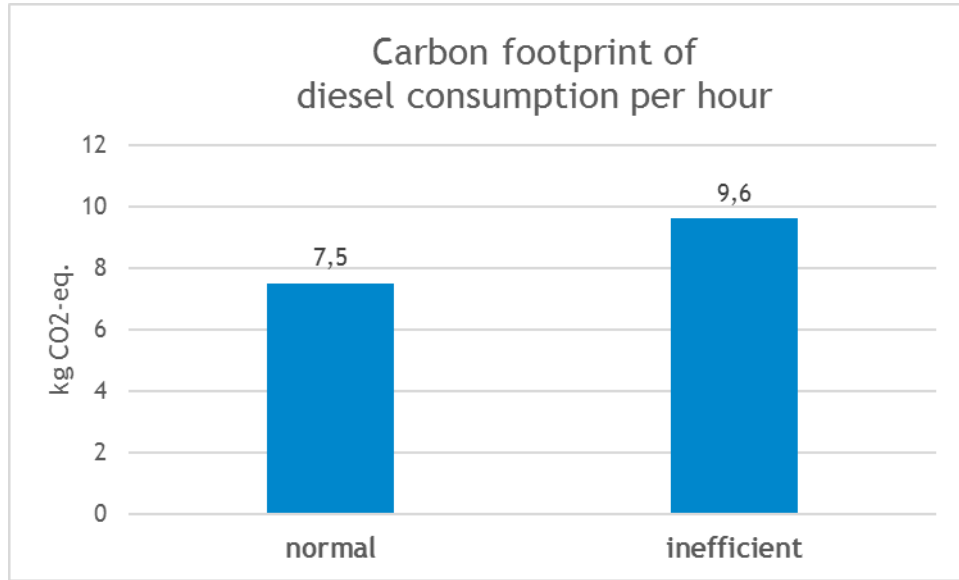
Difference:

2.1 kg CO_{2-eq}/hr

LUNCHTIME!

Energy consumption

Carbon footprint of diesel consumption per hour

	normal	inefficient
kg CO2-eq.	7,5	9,6
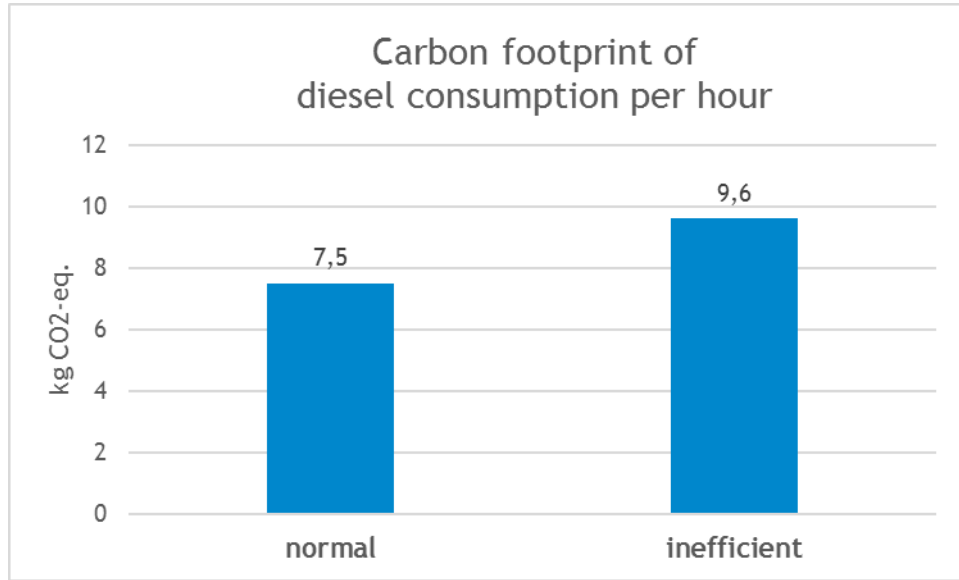
Difference:

2.1 kg $CO_{2\text{-eq}}$/hr

LUNCHTIME!

At 500 h/yr

960 kg CO_2-eq

Transport

Truck size

Load factor

Distance

DEPOT

CLIENT 1

CLIENT 3

CLIENT 2

Transport

	SCENARIO 1	SCENARIO 2	
Truck size:	28 ton	7.5 ton	
Average load factor:	80%	50%	
Average distance:	30 km	50 km	
Result per time of use	**13**	**71**	**kg CO$_2$-eq.**

Climate Neutral Group
for better business

Transport

	SCENARIO 1	SCENARIO 2	
Truck size:	28 ton	7.5 ton	
Average load factor:	80%	50%	
Average distance:	30 km	50 km	
Result per time of use	**13**	**71**	**kg CO_2-eq.**

Difference:

At 60 jobs per year: **3,500** kg $CO_{2\text{-eq}}$/hr

Hours of use

Impact of production

3,200 kg CO$_{2\text{-eq.}}$

	SCENARIO 1	SCENARIO 2	
Utilisation rate (h/yr)	500	250	
Years of (1st) use:	6	8	
Total hours of use:	3,000	2,000	
Impact of capital goods per hour	**1,1**	**1,6**	kg CO$_{2\text{-eq.}}$

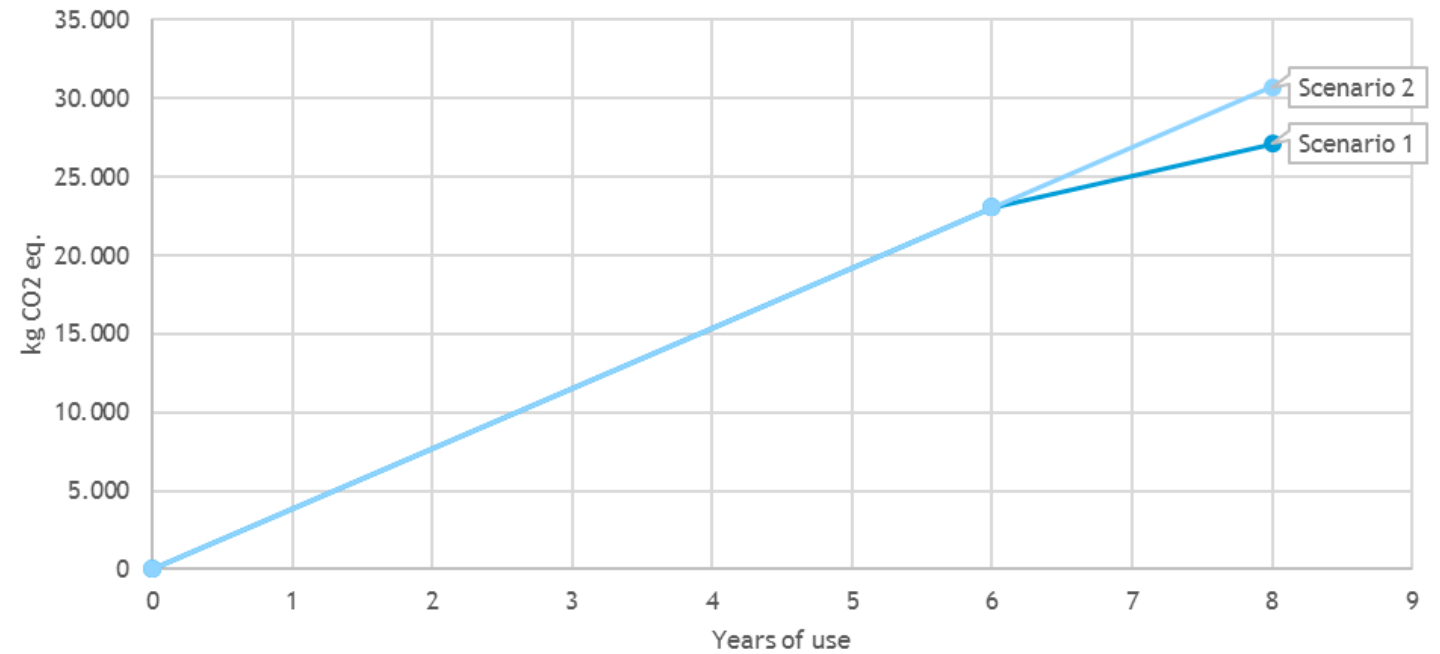Climate Neutral Group

for better business

Hours of use

Earlier replacement by a 10% more energy efficient machine

Saves **1,800** kg CO_{2-eq} per year

Life cycle impact

Saves **29,000** kg CO_{2-eq} in 6 years.

kg CO_{2-eq}

30.500

59.400

58.400

500h/yr
6 years
Efficient

500h/yr
6 years
Inefficient

250h/yr
8 years
Inefficient

■ End-of-life
■ Transport in use
■ Energy in use
■ Production
◆ Total

Climate Neutral Group ©
for better business

CLIENT

CLIENT
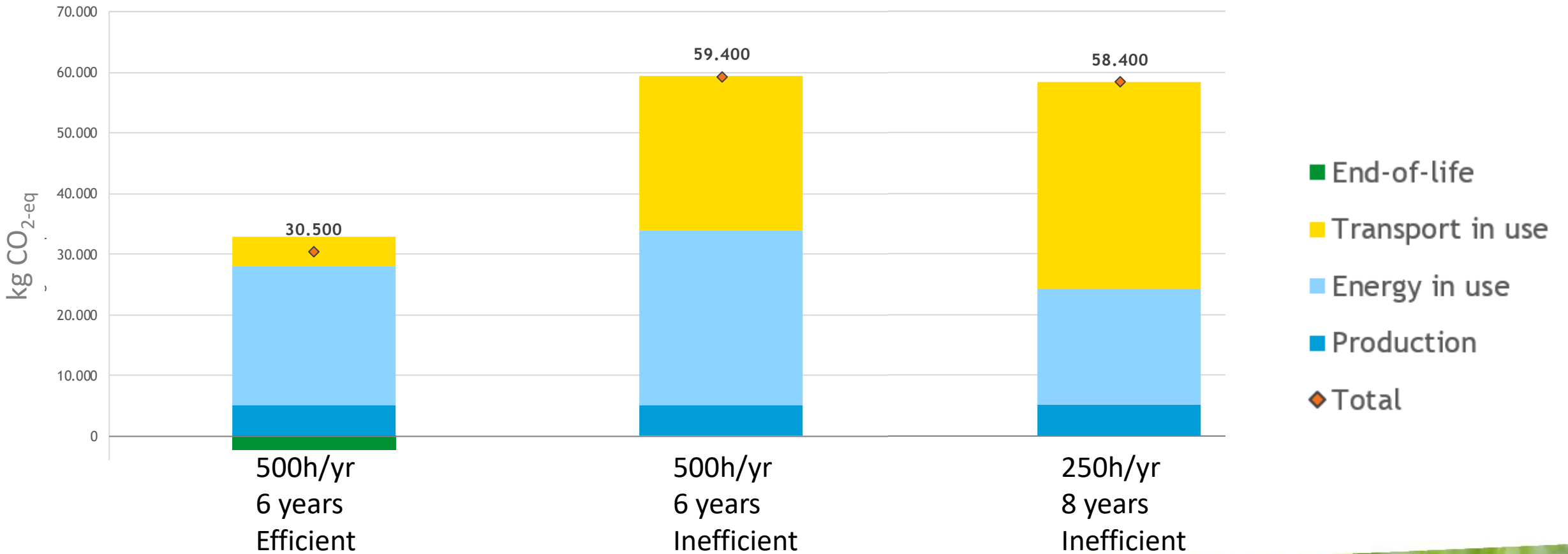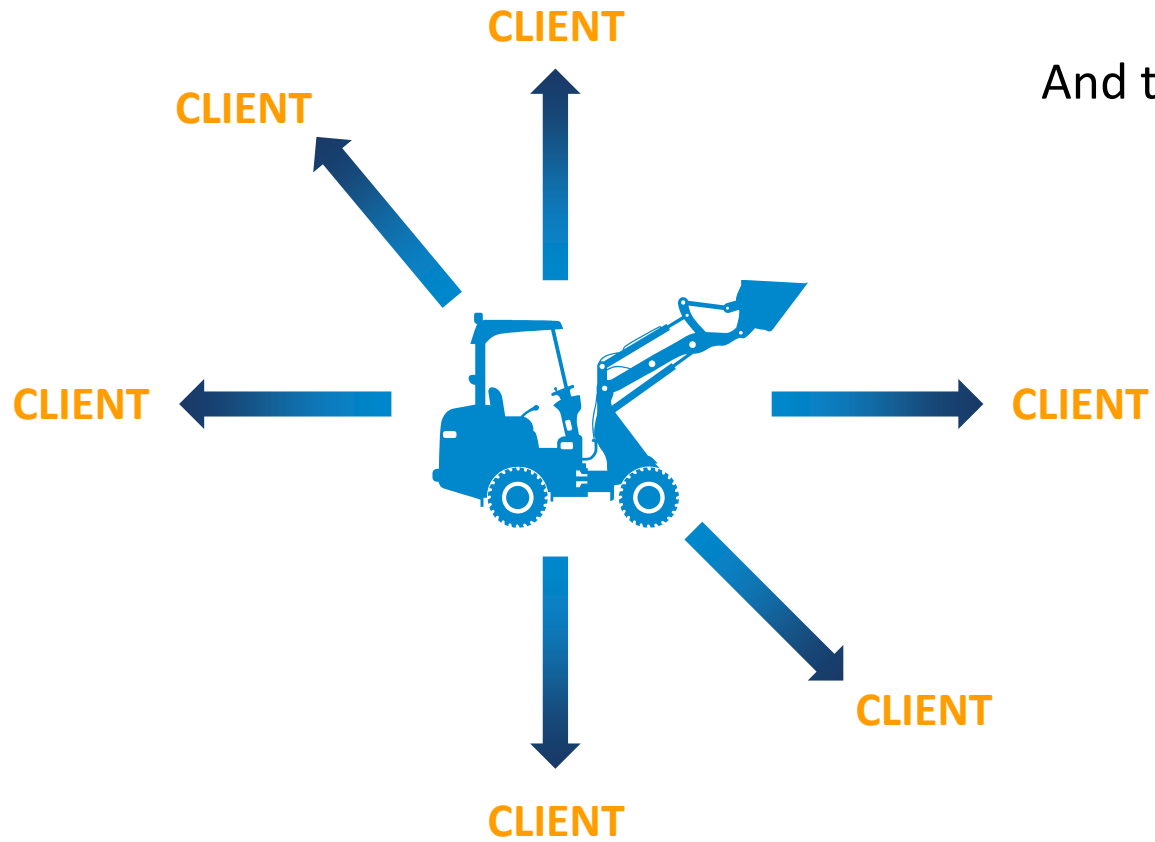
And that's just one machine. Imagine…

CLIENT

CLIENT

CLIENT

CLIENT

Conclusions

- Rental model generally increases efficient use, which can lead to large CO_2-benefits compared to inefficient use

- Shared use avoids production and can have a large CO_2-benefit

- But inefficient use can counteract these benefits.

What applies to your practice, your company?

Do you know what applies to you?

Join us in the workshops, talk with us about efficient vs inefficient use, so we can sharpen different scenario's and parameters.