LANXESS' "Green Tires" truck test in cooperation with TALKE and TÜV Rheinland

November 7, 2013

LANXESS
Energizing Chemistry

Christoph Kalla

Head of Marketing and R&D

Performance Butadiene Rubbers business unit

LANXESS AG

November 7, 2013

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LANXESS – a global specialty chemicals player

LANXESS
Energizing Chemistry

Specialty chemicals company

- Spun-off from Bayer in 2004, listed on the DAX index since 2012
- Focused on: plastics, synthetic rubber, specialty chemicals, intermediates

Global success story

- Roughly 17,500 employees in 31 countries
- 52 production sites worldwide
- 2012 sales of EUR 9.1 billion

Tire expert and technology leader

- World's leading producer of synthetic high-performance rubber
- Development partner for the tire industry

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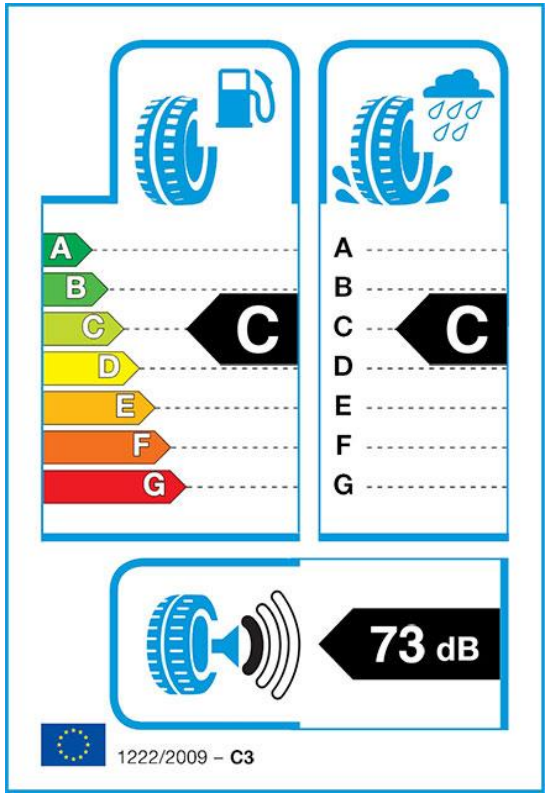
“Green Tires” offer high saving potential for trucks

- Better fuel efficiency
  (label class “C” and better)
- Reduction of CO_2-emissions in road traffic
- Optimum safety and driving properties
  (label class “C” and better)

EU-tire label



Market study on decision criteria and attitudes towards the purchase of new truck tires

Secondary analysis

- Truck tires available in the market (including tire size and EU-tire label)

Qualitative interview*

- Information on willingness to purchase rolling-resistance-optimized tires, on purchase decision criteria of tires and on the EU-tire label

Quantitative interview**

- Identification of trends and attitudes towards rolling-resistance-optimized and retreaded truck tires

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* Representatives of associations, tire manufacturers, tire distributors; ** Executives of 50 companies of freight and transportation industry

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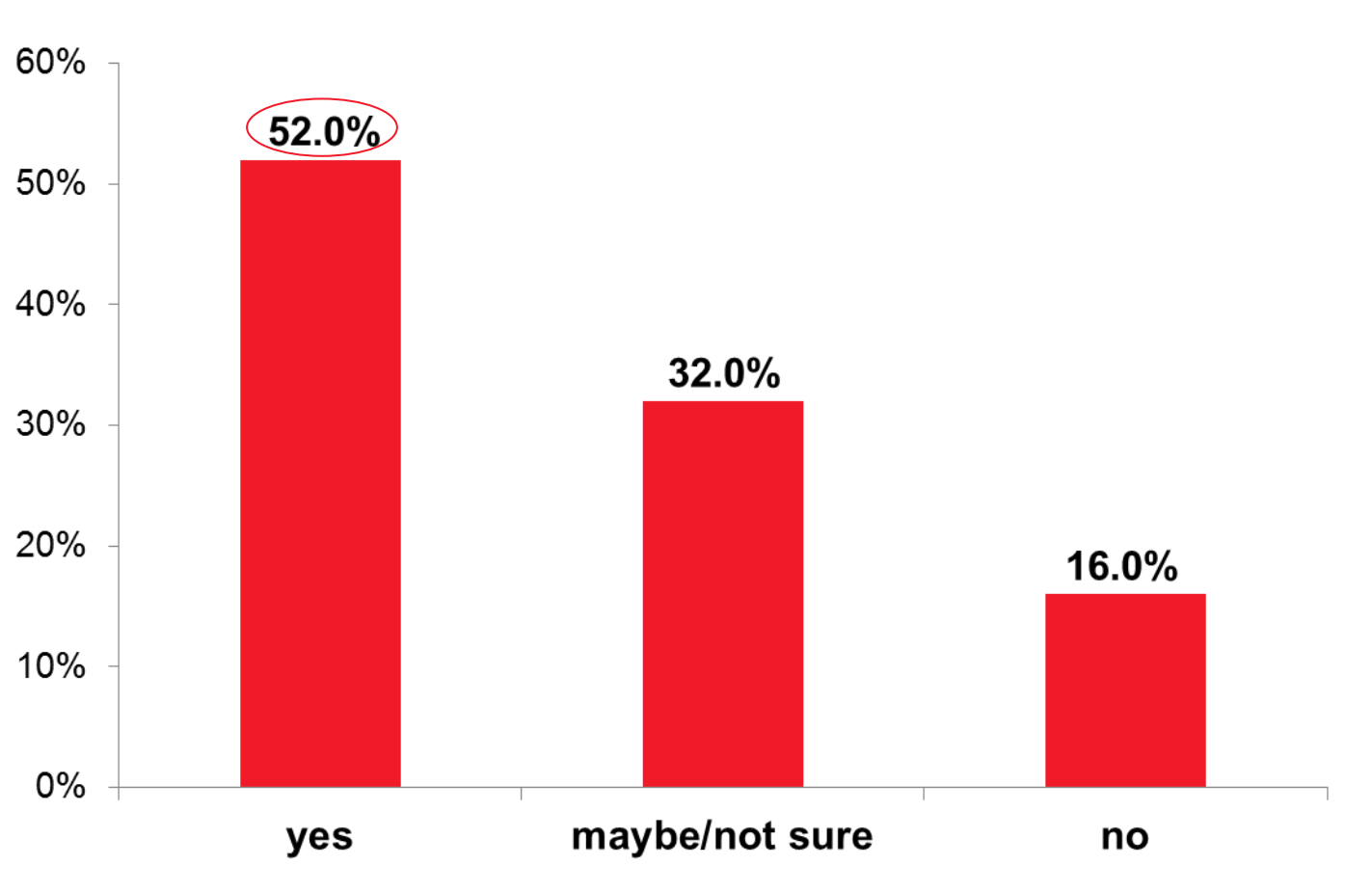
Purchase decision criteria of new truck tires

Criteria	# Mentions
1. Mileage, durability	27
2. Costs, cost-benefit ratio	25
3. Rolling resistance, fuel consumption	17
4. Quality of the tires	5
5. Traction	3
6. Safety for the driver	3
7. Noises	2
8. Other	9

Rolling resistance is the third most important criterion for the freight and transportation industry for the purchase of new truck tires

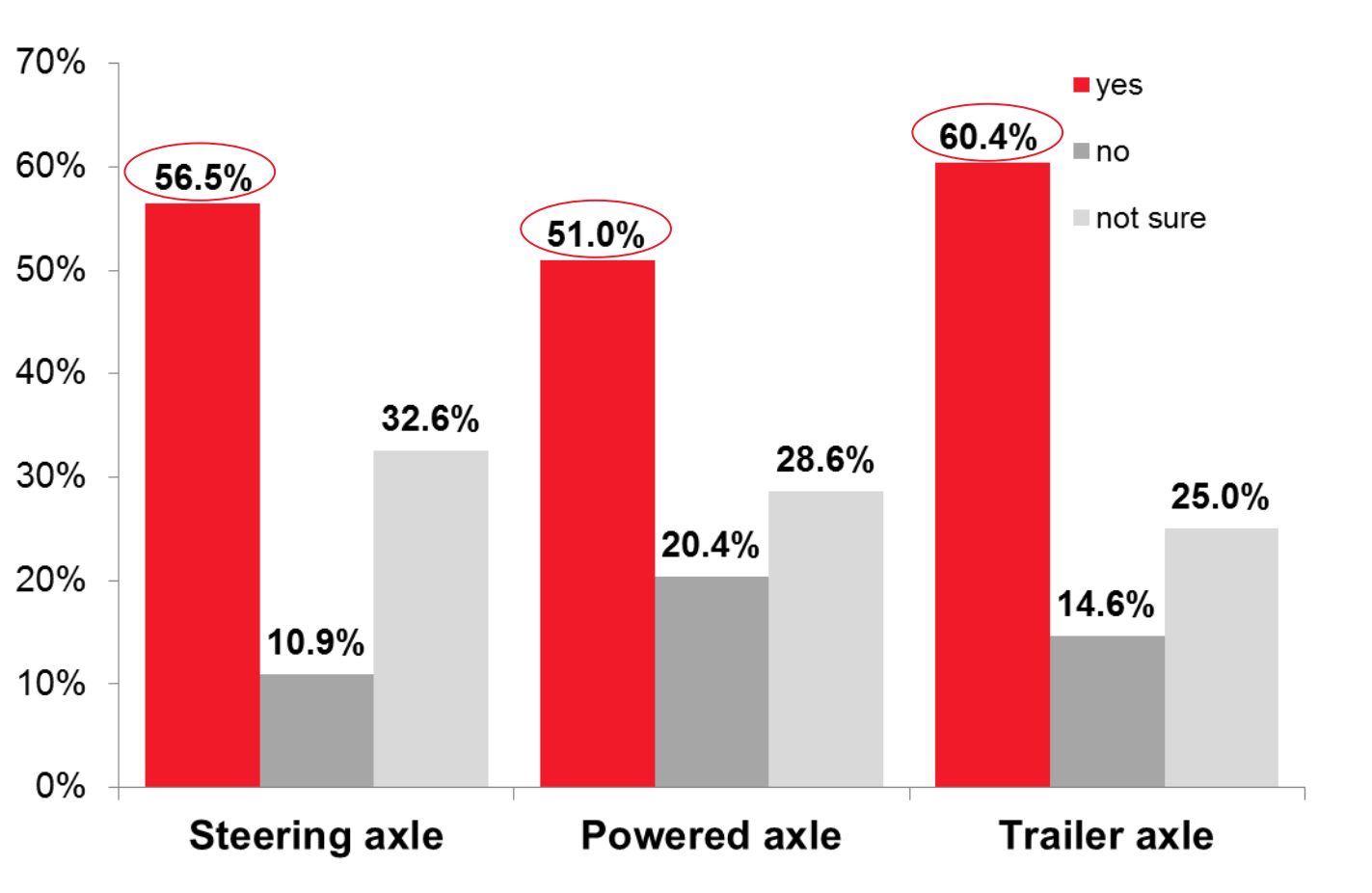
Do rolling-resistance-optimized tires lead to noticeable fuel savings?



More than half of the respondents are convinced that rolling-resistance-optimized tires lead to noticeable cost savings

n=50

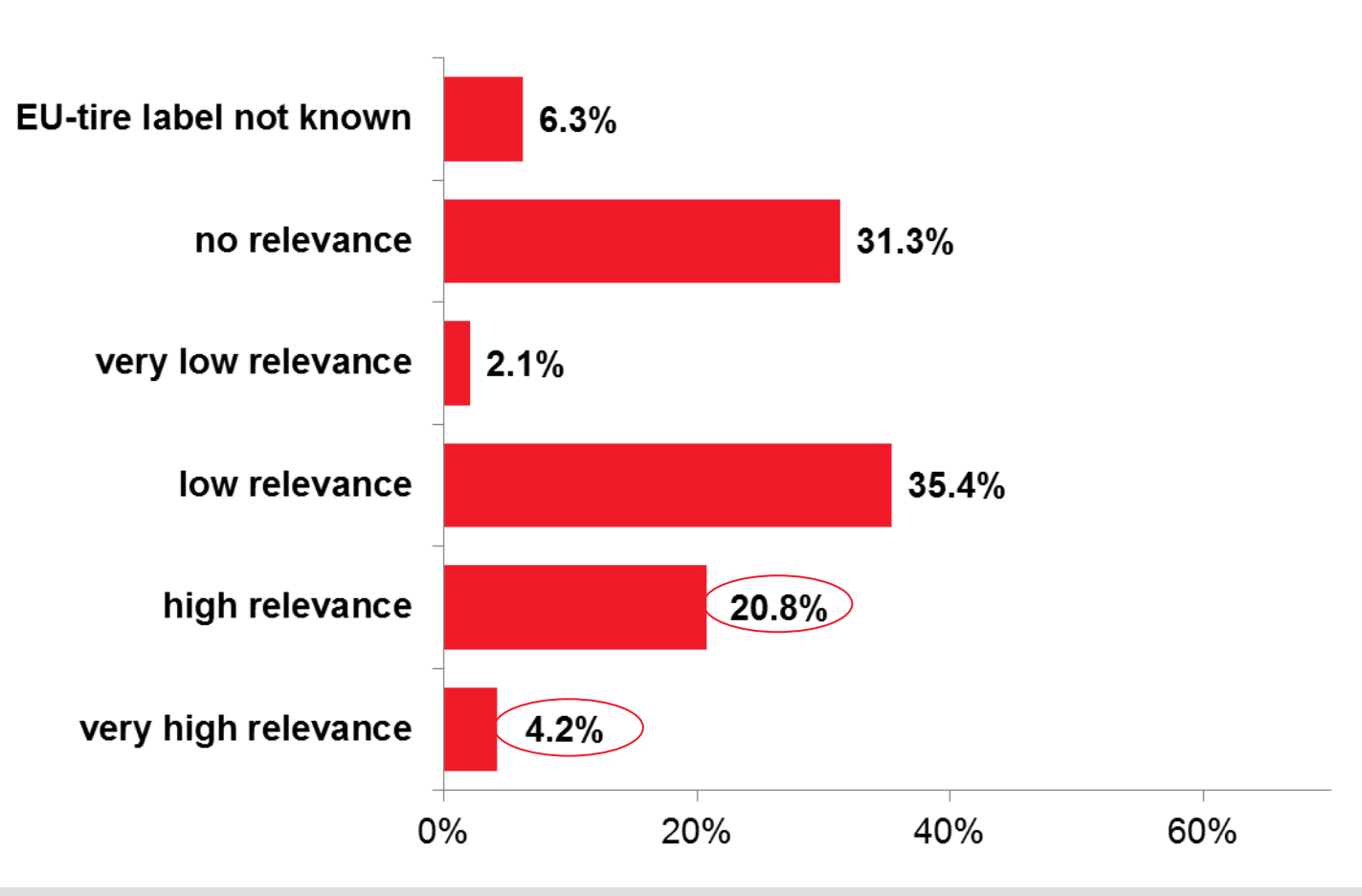
Purchase decision for rolling-resistance-optimized tires



More than half of the respondents intend to purchase rolling-resistance-optimized tires in the future

n=46 (Steering axle); n=49 (Powered axle); n=48 (Trailer axle)

Importance of the EU-tire label for the purchase of new tires



For only 25% of the respondents the EU-tire label has a very high/high relevance for the purchase of new tires

n=48

Axel Vaßen
Head of Public Affairs and Strategic Initiatives
Corporate Communications
LANXESS AG

November 7, 2013

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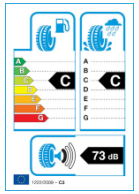
LANXESS' unique truck tire test in cooperation with logistic company TALKE and TÜV Rheinland

"Green Tires" truck test for the determination of saving potential (fuel consumption & CO_2-emissions)

- Test in real road traffic

- Based on EU tire label



- TÜV-certified

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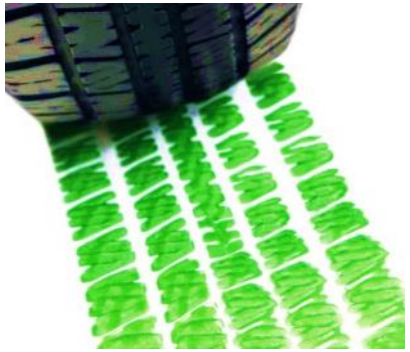
Long-term test with “Green Tires” under real conditions

- Test period
  - August 8, 2013 – October 8, 2013
  - Two-phase test
    (Phase 1: Validation; Phase 2: Differentiation)
- Test conditions for the entire test period
  - Common tire sizes as of the EU-tire label*
  - Same daily route
  - Same vehicles and drivers
  - Same refueling processes
- Additional theoretical plausibility check conducted by TÜV Rheinland

“Green Tires”



VS.

Standard tires

* Source: Market study on common truck tires, TÜV Rheinland

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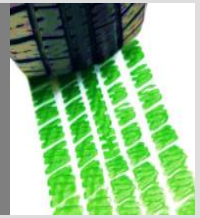
Two-phase test design

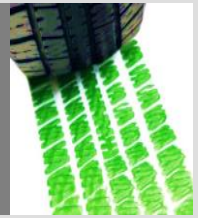
Phase 1 – Validation

- Vehicle 1 and 2 on “Green Tires”

Vehicle 1



Vehicle 2

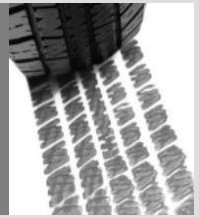


Determination of the deviation of vehicle/driver 1 to vehicle/driver 2

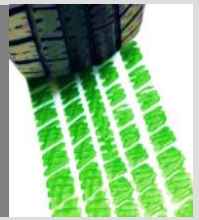
Phase 2 – Differentiation

- Vehicle 1: Change to standard tires
- Vehicle 2: Remains on “Green Tires”

Vehicle 1



Vehicle 2



Determination of saving potential (fuel consumption & CO_2-emissions) through the use of “Green Tires”

Total distance of 40,000 km

Hürth (D) – Loos (F) – Hürth (D)

Route details

- ~ 650 km route distance a day
  - Highway: 635 km
  - Town/city: 10 km
  - Rural road: 5 km
- ~ 40,000 km distance in total
  - Phase 1: 31 trips, 20,200 km
  - Phase 2: 30 trips, 19,600 km
- Average load
  - Outward journey: ~ 39,500 kg (loaded)
  - Backward journey: ~ 12,300 kg (empty)

TALKE test vehicles

2 road tractors

Semi trailer

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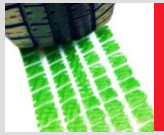
Test tires – “Green Tires” versus standard tires

	Road tractor		Semi trailer
Axle	**FA**	**RA**	**RA**
Tire			
Efficiency class*	**B**	**C**	**B**
CR (kg/t)**	**4.5**	**5.5**	**4.5**

	Road tractor		Semi trailer
Axle	**FA**	**RA**	**RA**
Tire			
Efficiency class*	**D**	**D**	**D**
CR* (kg/t)	**6.5**	**6.5**	**6.5**



“Green Tires” **VS.** **Standard tires**

* For the tested tire size no A tire available yet – further improvement potential expected; **CR= average rolling-resistance-coefficient

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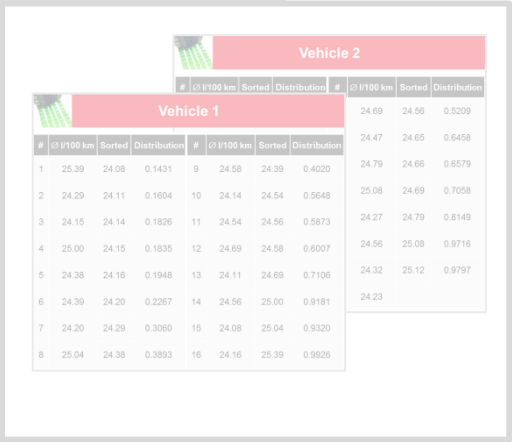
Test results phase 1 – “Green Tires”



Vehicle 1

#	∅ l/100 km	Sorted	Distribution	#	∅ l/100 km	Sorted	Distribution
1	25.39	24.08	0.1431	9	24.58	24.39	0.4020
2	24.29	24.11	0.1604	10	24.14	24.54	0.5648
3	24.15	24.14	0.1826	11	24.54	24.56	0.5873
4	25.00	24.15	0.1835	12	24.69	24.58	0.6007
5	24.38	24.16	0.1948	13	24.11	24.69	0.7106
6	24.39	24.20	0.2267	14	24.56	25.00	0.9181
7	24.20	24.29	0.3060	15	24.08	25.04	0.9320
8	25.04	24.38	0.3893	16	24.16	25.39	0.9926

Vehicle 2

#	∅ l/100 km	Sorted	Distribution	#	∅ l/100 km	Sorted	Distribution
					24.69	24.56	0.5209
					24.47	24.65	0.6458
					24.79	24.66	0.6579
					25.08	24.69	0.7058
					24.27	24.79	0.8149
					24.56	25.08	0.9716
					24.32	25.12	0.9797
					24.23		

	Vehicle 1			Vehicle 2		
Efficiency class	B	C	B	B	C	B
Avg. fuel consumption*	24.48 l/100km			24.54 l/100km		

0.06 l/100km (0.25%)

Only very low deviation of av. fuel consumption of “Green Tires”

* Vehicle 1 = Min:24.08 l/100km; Max:25.39 l/100km
Vehicle 2 = Min:24.23 l/100km; Max:25.12 l/100km

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Test results phase 2 – Standard tires versus “Green Tires”

Vehicle 2

#	∅ l/100 km	Sorted	Distribution	#	∅ l/100 km	Sorted	Distribution
					27.36	27.62	0.4455
					27.62	27.64	0.4546
					26.37	27.80	0.5196
					27.15	27.89	0.5556
					26.79	29.20	0.9328
					26.98	29.41	0.9570
					27.10	29.92	0.9873

Vehicle 1

#	∅ l/100 km	Sorted	Distribution	#	∅ l/100 km	Sorted	Distribution
1	27.64	26.37	0.0771	9	27.36	27.62	0.4455
2	27.89	26.79	0.1611	10	27.62	27.64	0.4546
3	29.92	26.98	0.2121	11	26.37	27.80	0.5196
4	27.80	27.10	0.2501	12	27.15	27.89	0.5556
5	27.51	27.15	0.2682	13	26.79	29.20	0.9328
6	29.20	27.36	0.3418	14	26.98	29.41	0.9570
7	27.54	27.51	0.4002	15	27.10	29.92	0.9873
8	29.41	27.54	0.4131	16			

	Vehicle 1 			Vehicle 2 		
Efficiency class	D	D	D	B	C	B
Avg. fuel consumption	27.75 l/100km			25.39 l/100km		

2.36 l/100km (- 8,5%)

Significantly lower fuel consumption with “Green Tires” compared to standard tires

Further improvement potential with A tires expected
(no A tires for tested tire size available yet)

* Vehicle 1 = Min:27.51 l/100km; Max:29.92 l/100km
Vehicle 2 = Min:25.04 l/100km; Max:26.87 l/100km

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“Green Tires” offer high saving potential – fuel consumption

Trucks with “Green Tires”

save 8.5% (2.36 l/100)

fuel compared to trucks

with standard tires

Comparison of only two label classes (D/D/D versus B/C/B)

“Green Tires” offer high saving potential – CO_2 foot-print

~ 700 kg/10,000 km

less CO_2e-emissions due to “Green Tires”

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What does this mean for a sample fleet of 300 trucks?

Calculation basis*:

- Annual mileage per vehicle = 150,000 km
- Change from D/D/D to B/C/B tires

	Incl. value added tax	Without value added tax
Gross-savings	~ 1.5 m EUR – per year	~ 1.3 m EUR – per year
Additional costs**	~ 55,000 EUR	~ 47,000 EUR
Net - savings	~ 1.45 m EUR – per year	~ 1.25 m EUR – per year
CO_2e-savings	~ 3,150 t – per year	~ 3,150 t – per year

* Calculation based on test conditions: Average fuel consumption= 25.39 l/100 km, fuel price = 1.43 €/l (Source: Shell; In the commercial sector the fuel price is reduced by the deduction of VAT, favorable purchasing conditions or other deductions); **Source tire prices: Reifen Göggel (12 tires per vehicle)

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Which economic and ecologic consequences arise for the German road traffic?

Calculation basis*:

- 14,261 40-metric ton trucks (number of all German 40-metric ton trucks)*
- Annual mileage per vehicle = 150,000 km
- Change from D/D/D to B/C/B tires

	Incl. value added tax	Without value added tax
Gross-savings	~ 72 m EUR – per year	~ 61 m EUR – per year
Additional costs***	~ 2.5 m EUR	~ 2.2 m EUR
Net - savings	~ 69.5 m EUR – per year	~ 58.8 m EUR – per year
CO_2e-savings	~ 150,000 t – per year	~ 150,000 t – per year

* Calculation based on test conditions: Average fuel consumption= 25.39 l/100 km, fuel price = 1.43 €/l (Source: Shell; In the commercial sector the fuel price is reduced by the deduction of VAT, favourable purchasing conditions or other deductions); ** Kraftfahrt-Bundesamt 2012: calculation refers to the vehicle classes of trucks and road tractors with a total mass of 30,001-40,000 kg (total stock of all admissible masses: trucks=2,528,656, road tractors= 2,028,071) ***Source tire prices: Reifen Göggel (12 tires per vehicle)

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Prof. Dr.-Ing. Jürgen Brauckmann

TÜV Rheinland

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Mehr Erfahrung. Mehr Dynamik. Mehr Wert.

LANXESS' „Grüne Reifen"-Test für Nutzfahrzeuge in Kooperation mit TALKE und TÜV Rheinland

Erfahrungen aus der Praxis

Köln, 7. November 2013

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Logistic Services

TALKE – Das Unternehmen

- Qualitätsanbieter von Transport-, Logistik- und Beratungsdienstleistungen für die chemische und die petrochemische Industrie
- Höchste Standards für Arbeits- und Produktsicherheit, Qualität und Umwelt-Management
- Familienunternehmen in dritter Generation
- Jahresumsatz > € 200 Mio.

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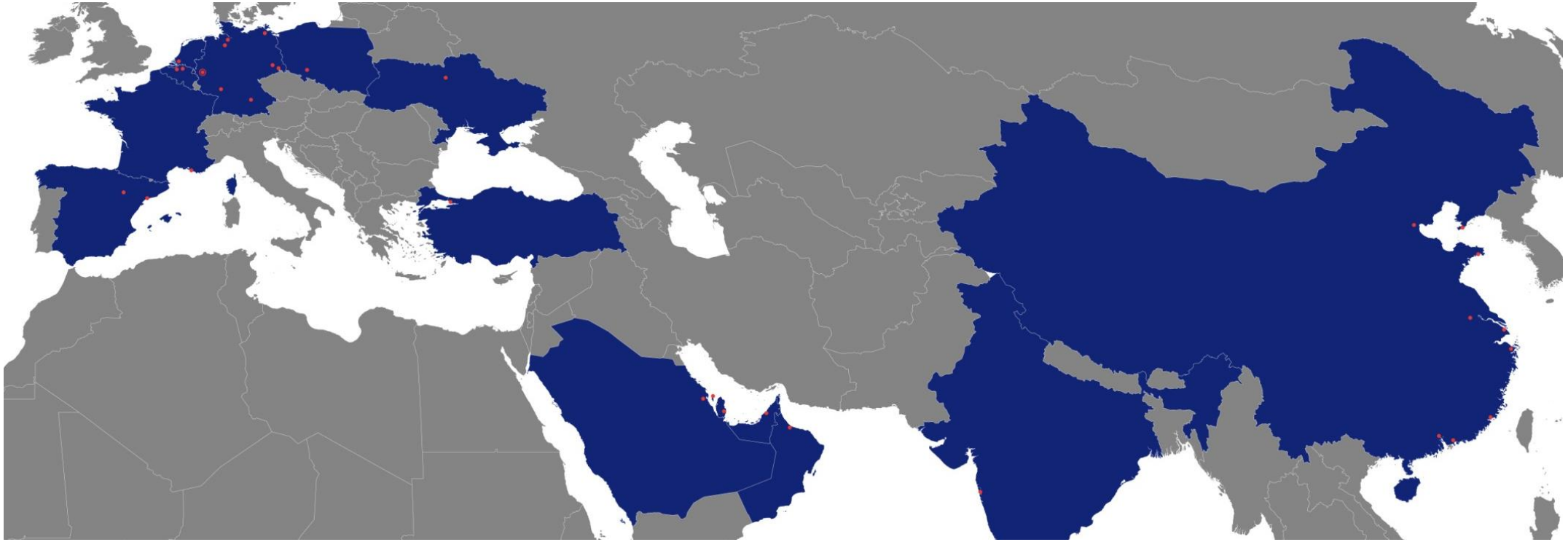
Logistic Services

TALKE in Europa, dem Mittleren Osten, Indien und China



- Mehr als 2.000 Mitarbeiter an 39 Standorten in 16 Ländern Europas, des Mittleren Ostens, Indiens und Chinas
- Full-Service-Spektrum von Transport-, Lager-, Mehrwert- und Beratungsdienstleistungen

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TALKE Service Portfolio

Transport

- Liquid Bulk: 1.200 Transporteinheiten (Auflieger und Container)
- Dry Bulk: 1.100 Transporteinheiten
- 300 eigene Fahrzeuge in Europa
- Gesamtfahrleistung 2012: rund 40 Mio. Kilometer (eigene und Sub)

Logistics

- On-site-Logistik
- Multi-user-Warehousing
- Gefahrstofflagerung
- Mehrwertdienste

Logistic Solutions

- Beratung
- Ingenieursleistungen
- Projektmanagement
- Bau schlüsselfertiger Logistikanlagen

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Fuhrparkmanagement

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Fuhrparkmanagement bei TALKE

- Konsequentes Fuhrpark-Management traditionell von hohem Stellenwert
- Gewährleistung von
  - Sicherheit
  - Wirtschaftlichkeit
  - Umweltverträglichkeit
- Zentrale Abteilung definiert technische Standards und Spezifikationen
- Fahrerbetreuung
- Fahrertraining: Konzeption, Durchführung und Dokumentation von Trainings
- Einsatz von Fernanalysesystemen
  - Fahrzeugwartung
  - Benchmarks und Bonussysteme

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Fuhrparkmanagement – Dimensionen

Technische Dimensionen

Zugmaschine		Auflieger	
Aerodynamik	🟡	Aerodynamik	🔴
Motor	🔴	Gewicht	🟡
Gewicht	🟡	Bereifung	🟢

Operative Dimensionen

Terrain und Routenplanung	🟡
Verkehr	🔴
Fahrer	🟢

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Fuhrparkmanagement – Fazit

- Der Einsatz „grüner“ Reifen im Logistikfuhrpark ermöglicht signifikante Steigerungen der Wirtschaftlichkeit und der Umweltverträglichkeit…
- …die durch hervorragend geschulte Fahrer unterstützt werden.
- Durch einen gut abgestimmten, integrierten Einsatz von „grünen“ Reifen und trainiertem Fahrpersonal können Fuhrparkbetreiber sich diese Einsparpotenziale erschließen und damit Wettbewerbsvorteile sichern.

„Zu einem professionellen Fuhrparkmanagement gehört für uns seit langem auch der Einsatz rollwiderstandsoptimierter Reifen für einen effizienteren, wirtschaftlicheren und umweltschonenderen Fuhrparkbetrieb. Der in Kooperation mit LANXESS durchgeführte Reifentest hat uns noch einmal sehr eindrucksvoll die Einsparungen gezeigt, die wir in den vergangenen Jahren bereits realisiert haben. Wir würden uns wünschen, dass dieses Beispiel weitere Verbreitung in unserer Branche findet.“

Alfred Talke, Group Managing Director TALKE Gruppe

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LANXESS' „Grüne Reifen"-Test für Nutzfahrzeuge
in Kooperation mit TALKE und TÜV Rheinland

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Vielen Dank für Ihre Aufmerksamkeit!

Axel Vaßen
Head of Public Affairs and Strategic Initiatives
Corporate Communications
LANXESS AG

November 7, 2013

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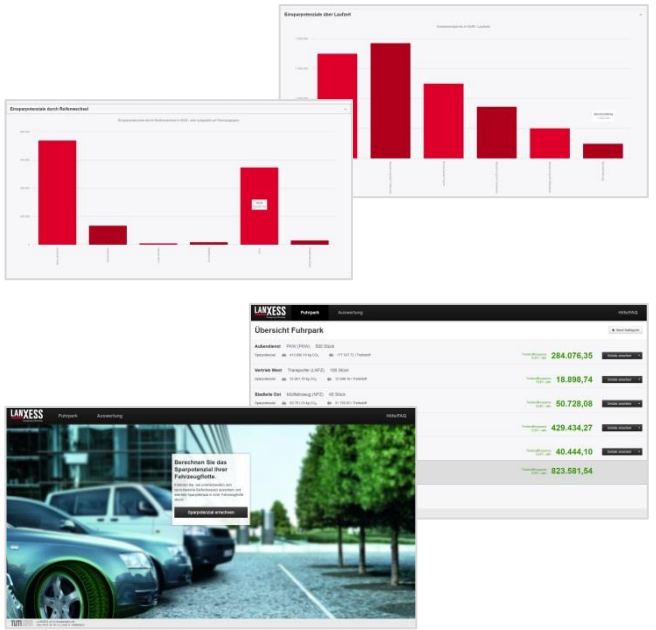
Calculate the saving potential of your individual vehicle fleet with the LANXESS fleet fuel saving calculator

The first tire manufacturer independent and comprehensive tool for the fleet industry

- Advantages for fleet managers
  - Calculation of saving potentials (fuel and CO_2-emissions) for individual fleet
  - Extensive parameters (label classes, number of axles, average load, driver trainins etc.)
  - Independent of vehicle model, tire brand etc.
- Available in German, English and French
- http://flotte.green-mobility.de



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“Green Tires” – enabler of efficient fleets

Test results show high saving potential for trucks with “Green Tires”

Still great potential for further improvement with the use of A tires

(No A tires available for tested tire size)

LANXESS’ fleet fuel saving calculator enables detemination of saving potential for individual fleets

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Marketable tire sizes of trucks

	Dimension	Performance	Share
1	385/65 R 22.5	Trailer – Street	16.0%
2	315/80 R 22.5	Steering – Street	4.5%
3	315/80 R 22.5	Power – Street	3.8%
4	315/70 R 22.5	Power – Street	3.7%
5	215/75 R 17.5	Steering – Street	3.6%
6	275/70 R 22.5	Steering – Bus	3.5%
7	235/75 R 17.5	Trailer – Street	3.3%
8	315/70 R 22.5	Steering – Street	3.2%
9	385/65 R 22.5	Trailer – Long distance	2.8%
10	215/75 R 17.5	Power – Street	2.5%
11	385/65 R 22.5	Steering – Street	1.9%

Source: Bundesverband Reifenhandel und Vulkaniseur-Handwerk e.V.

Marketable truck tires regarding EU-tire label

Trailer axle

Label	Fuel efficiency		Wet grip	
A	1	1.0%	4	3.8%
B	7	6.7%	45	42.9%
C	59	56.2%	32	30.5%
D	15	14.3%	3	2.9%
E	2	1.9%	0	0.0%
F	0	0.0%	0	0.0%
without	21	20.0%	21	20.0%
total	*105*	*100.0%*	*105*	*100.0%*

Steering axle and powered axle

Label	Fuel efficiency		Wet grip	
A	0	0.0%	8	5.8%
B	6	4.3%	38	27.3%
C	34	24.5%	72	51.8%
D	53	38.1%	3	2.2%
E	24	17.3%	0	0.0%
F	4	2.9%	0	0.0%
without	18	12.9%	18	12.9%
total	*139*	*100.0%*	*139*	*100.0%*

Source: TÜV Rheinland, tire manufacturers and tire distributors

Distribution of rolling resistance on the axles of a semi trailer

Steering axle
17%

Powered axle
33%

Trailer axle
50%

Quellen: TÜV Rheinland; Michelin

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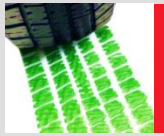
Test vehicles – Road tractor

Vehicle details	Vehicle 2 BM – AT 714 / BM – AT 884
Manufacturer	Mercedez-Benz
Type	1843 LS Axor – C 3
Description	944.03
Gear	12 – Gear Power Shift
Motor	R6 – Zyl / 12.0 ltr / 315 kW / 428 PS, 1900 U/min / max. torque 2100 Nm, 1900 U/min
Kilometers	At test beginning on August 8, 2013 = 235918 km
License plate	BM – AT 714
Number of chassis	WDB9440321L606928
Seize	FD: 315/70R 22.5 154/150L / RD: 315/70R 22.5 154/150L
Air pressure at axles	FD: 8.5 bar / RD: 8.5 bar
Tread depth	FD: FL 14mm, FR 14mm / RD: RL 18mm/18mm, RR 18mm/18mm
Fifth wheel	540 mm
Empty weight	Car documents: 6640 kg / measured full tanked driver induced 6740kg

Test vehicles – Semi trailer

Trailer	
Manufacturer	Vocol (NL) Sanh Chemietankfahrzeug
Type	DT 25.5
License plate	BM – AT 884
Number of chassis	XL905052200084522
Seize	385/65R 22.5 160K/158L
Air pressure at axles	All 9.0 bar
Tread depth	6
Empty weight	Car documents: 5420 kg / referring to weighting slip 5460 kg

Test tires – Details



“Green Tires” VS. Standard tires

	Road tractor		Semi trailer
Axle	**FA**	**RA**	**RA**
DOT	2513	1613	2513
Size	315/70 R 22.5	315/70 R 22.5	315/65 R 22.5
LI	154/150	154/150	160
Speed	L	L	K
Efficiency class	**B**	**C**	**B**
Speed (km/h)	120	120	110
Load capacity (kg)	3750	3750	4500
Load capacity (kg)	3350	3350	
Load capacity (kg)	7500	13400	27000
Permissible axle load (kg)	7100	11500	27000
Tire class	C3	C3	C3
CR (kg/t)	4.1<=CR<=5.0	5.1<=CR<=6.0	4.1<=CR<=5.0
CR* (kg/t)	**4.5**	**5.5**	**4.5**

	Road tractor		Semi trailer
Axle	**FA**	**RA**	**RA**
DOT	0713	1213	4411
Size	315/70 R 22.5	315/70 R 22.5	315/65 R 22.5
LI	**154/150**	**154/150**	**160**
Speed	L	L	K
Efficiency class	**D**	**D**	**D**
Speed (km/h)	120	120	110
Load capacity (kg)	3750	3750	4500
Load capacity (kg)	3350	3350	
Load capacity (kg)	7500	13400	27000
Permissible axle load (kg)	7100	11500	27000
Tire class	C3	C3	C3
CR (kg/t)	6.1<=CR<=7.0	6.1<=CR<=7.0	6.1<=CR<=7.0
CR* (kg/t)	**6.5**	**6.5**	**6.5**

* CR= average rolling-resistance-coefficient

Average fuel consumption – Phase 1

Vehicle 1

#	∅ l/100 km	Sorted	Distribution	#	∅ l/100 km	Sorted	Distribution
1	25.39	24.08	0.1431	9	24.58	24.39	0.4020
2	24.29	24.11	0.1604	10	24.14	24.54	0.5648
3	24.15	24.14	0.1826	11	24.54	24.56	0.5873
4	25.00	24.15	0.1835	12	24.69	24.58	0.6007
5	24.38	24.16	0.1948	13	24.11	24.69	0.7106
6	24.39	24.20	0.2267	14	24.56	25.00	0.9181
7	24.20	24.29	0.3060	15	24.08	25.04	0.9320
8	25.04	24.38	0.3893	16	24.16	25.39	0.9926

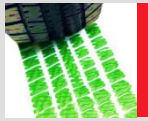
Vehicle 2

#	∅ l/100 km	Sorted	Distribution	#	∅ l/100 km	Sorted	Distribution
1	25.12	24.23	0.1348	9	24.69	24.56	0.5209
2	24.65	24.24	0.1435	10	24.47	24.65	0.6458
3	24.32	24.25	0.1460	11	24.79	24.66	0.6579
4	24.66	24.27	0.1669	12	25.08	24.69	0.7058
5	24.25	25.32	0.2094	13	24.27	24.79	0.8149
6	24.24	25.32	0.2141	14	24.56	25.08	0.9716
7		24.47	0.3981	15	24.32	25.12	0.9797
8	24.49	24.49	0.4310	16	24.23		

Average fuel consumption – Phase 2

Vehicle 1

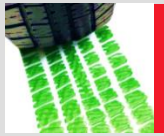
#	∅ l/100 km	Sorted	Distribution	#	∅ l/100 km	Sorted	Distribution
1	27.64	26.37	0.0771	9	27.36	27.62	0.4455
2	27.89	26.79	0.1611	10	27.62	27.64	0.4546
3	29.92	26.98	0.2121	11	26.37	27.80	0.5196
4	27.80	27.10	0.2501	12	27.15	27.89	0.5556
5	27.51	27.15	0.2682	13	26.79	29.20	0.9328
6	29.20	27.36	0.3418	14	26.98	29.41	0.9570
7	27.54	27.51	0.4002	15	27.10	29.92	0.9873
8	29.41	27.54	0.4131	16			



Vehicle 2

#	∅ l/100 km	Sorted	Distribution	#	∅ l/100 km	Sorted	Distribution
1	25.30	24.24	0.0527	9	27.36	27.62	0.4455
2	25.55	24.72	0.1728	10	27.62	27.64	0.4546
3	26.19	24.82	0.2103	11	26.37	27.80	0.5196
4	25.04	24.89	0.2371	12	27.15	27.89	0.5556
5	25.31	25.04	0.3082	13	26.79	29.20	0.9328
6	26.87	25.10	0.3374	14	26.98	29.41	0.9570
7	25.53	25.25	0.4206	15	27.10	29.92	0.9873
8	26.84	25.26	0.4231	16			

Phase 2 – Plausibility check



“Green Tires” **VS.** **Standard tires**

Phase 1	Road tractor		Semi trailer
Axle	**FA**	**RA**	**RA**
Efficiency class	**B**	**C**	**B**
M_{empty} (kg)	4213	3923	3633
$F_R=C_R * F_N$ (N)	186.0	211.7	160.4
F_R Axle portion (%)	33	38	29
Tension weight	11770	kg	
Rolling resistance F_R	**558**	**(N)**	
M_{loaded} (kg)	6500	11000	22500
$F_R=C_R * F_N$ (N)	286.9	593.5	993.3
F_R Axle portion (%)	15	32	53
Tension weight	40000	kg	
Rolling resistance F_R	**1874**	**(N)**	

Phase 2	Road tractor		Semi trailer
Axle	**FA**	**RA**	**RA**
Efficiency class	**D**	**D**	**D**
M_{empty} (kg)	4213	3923	3633
$F_R=C_R * F_N$ (N)	268.7	250.2	231.7
F_R Axle portion (%)	36	33	31
Tension weight	11770	Kg	
Rolling resistance F_R	**751**	**(N)**	
M_{loaded} (kg)	6500	11000	22500
$F_R=C_R * F_N$ (N)	414.5	701.4	1434.7
F_R Axle portion (%)	16	28	56
Tension weight	40000	Kg	
Rolling resistance F_R	**2551**	**(N)**	

FR / FR Empty = 0.74	
FR / FR Loaded = 0.73	
FR / FR Average = 0.74	

Reduction of rolling resistance:	26.1%		
Assumption: Share of route consumption:	40%	30%	20%
Theoretical reduction of route consumption:	**10.4%**	**7.8%**	**5.2%**

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