DECORBONISATION
WHAT DOES IT REALLY MEAN?

26 NOVEMBER 2021

COLAS

WE OPEN THE WAY

MEETING AGENDA

1

WHY DOES DECARBONISATION MATTER?

INTRODUCTIONS

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Operations Director

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Environment Director
Colas SA

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Environment Manager

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Quarrying & Asphalt Development Director

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Technical Director
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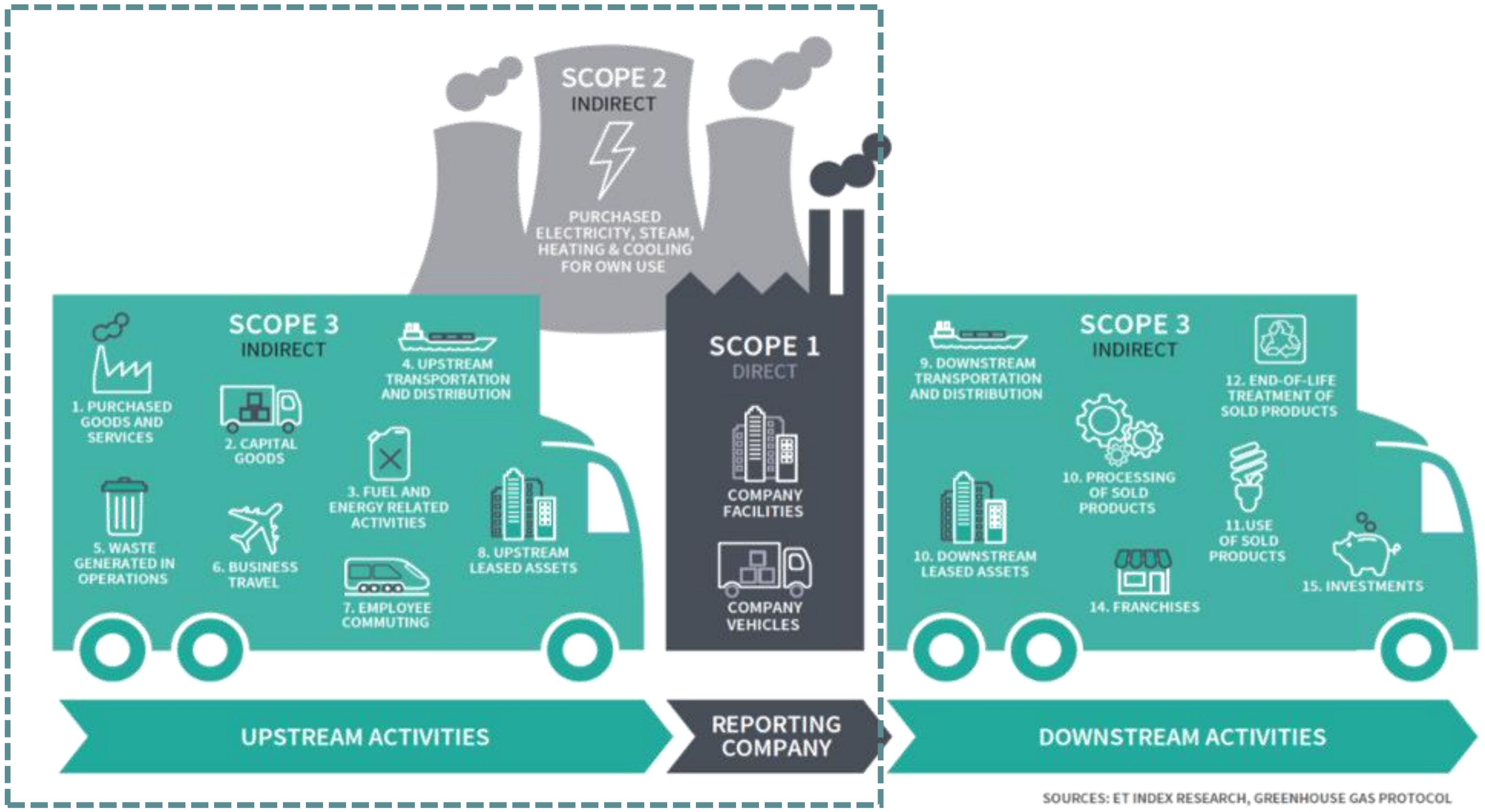
2

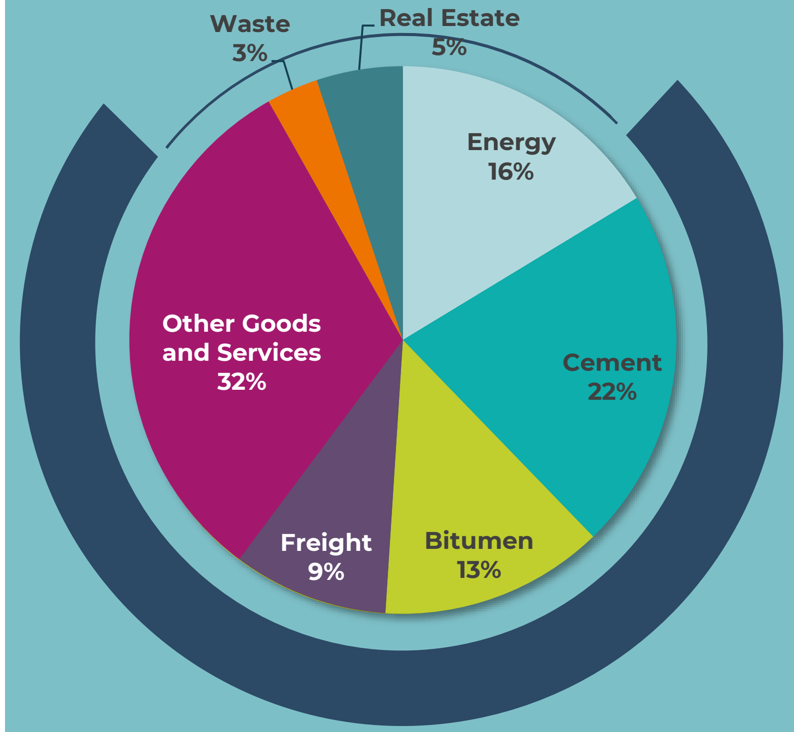
WHAT ARE SCOPES 1,2 & 3?

Anne-Laure Levent

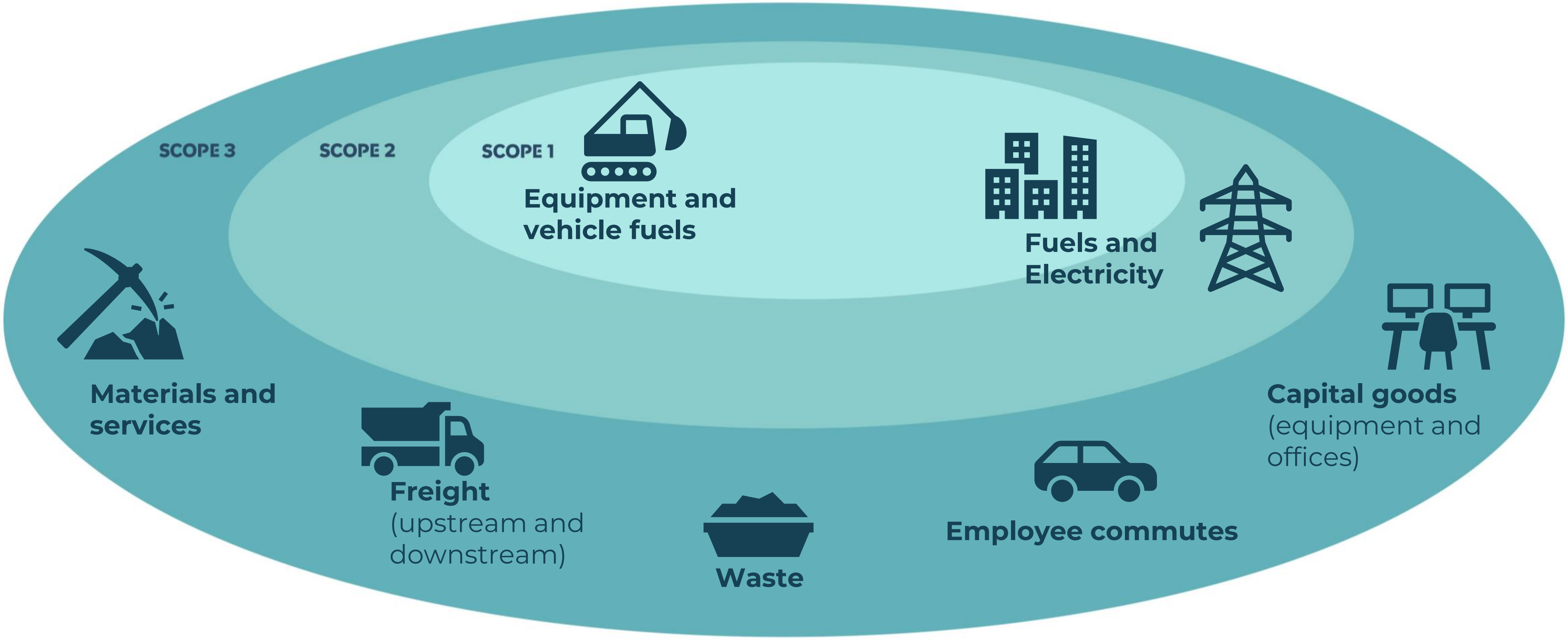
BACKGROUND



Scope 1, 2 and 3 Breakdown



IN OUR BUSINESS



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WHAT DO SCOPES MEAN IN THE HIGHWAYS SECTOR?

Anne-Laure LEVENT


PET
GLASS
INGREDIENTS
WASHING
LOGISTICS
CO2

CARBON FOOTPRINT BASICS

Scope 1

Scope 2

Scope 3a

=

Tonnes of materials/ products
(kg,l,m3)
Ex : Cement, steel, Fuels

DATA SOURCING

Physical data

×

Emission factors for materials and products
(kgCO2e/kg material)

Emission factors (COLAS SA)

Creation of a Colas database based on international/national databases:

- Database recommended by the GHG Protocol:
  - Ecoinvent (LCA);
  - International Energy Agency (IEA);
  - DEFRA (UK) ;
  - Etc.
- LCA bibliography of products related to our activities (Eurobitume, UCPRC, ...)

LOW-CARBON AND BIODIVERSITY ROADMAP

6 axis

29 commitments

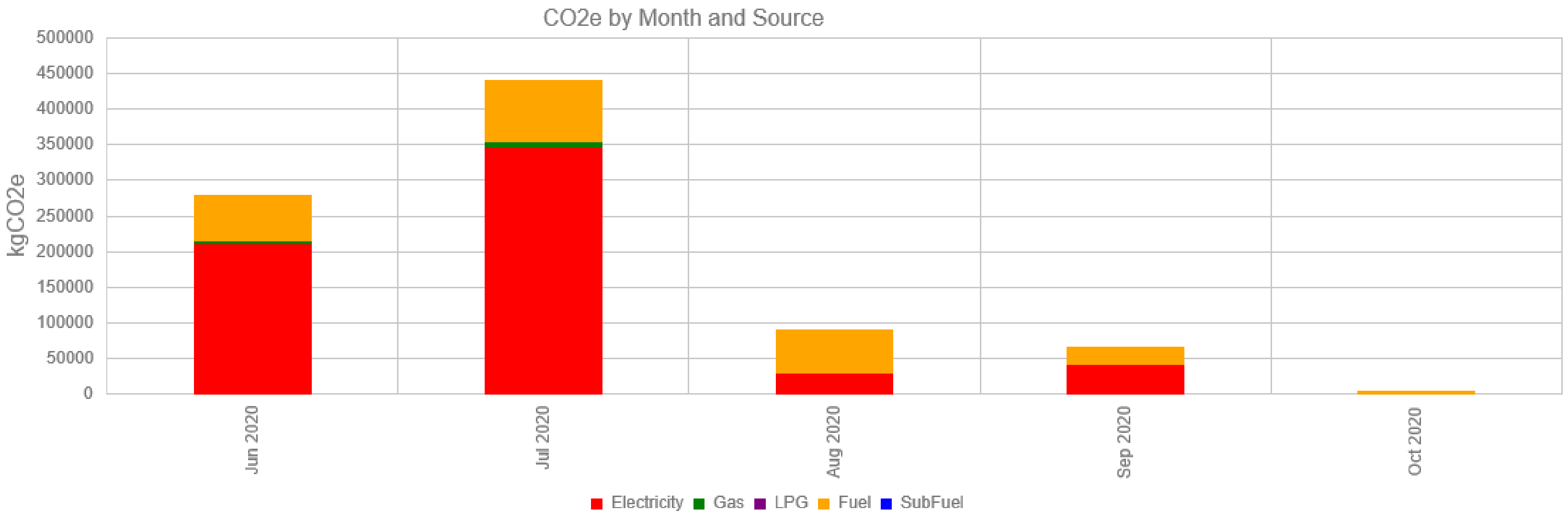
20 KPIs

Axis	Commitment	Examples
Axis 1	Integrating climate change issues into our Group strategy	EX: new lines of business, Climate Fresk
Axis 2	Reduce the carbon intensity of our direct emissions	Electrical vehicles Green hydrogen trucks
Axis 3	Develop and promote low-carbon solutions	Low carbon concrete Recycol
Axis 4	Optimize our carbon accounting of activities	Worksite carbon calculator
Axis 5	Reduce our clients/users emissions	Mobility by Colas
Axis 6	Promote biodiversity into our activities	Hedge plantations

TOOLS - SMARTWASTE

SMARTWASTE delivered by bre

- Used for managing and reducing resource use, waste outputs, impacts, time and costs
- Provides site and corporate data, reports and charts
- Data that can be captured:
    - Energy
    - Waste
        - Site waste management plans
        - Waste duty of care information
    - Water
    - Materials
    - Transport
    - Biodiversity
    - Carbon
    - Cost



TOOLS - SUSTAINABILITY SUPPLY CHAIN SCHOOL

Industry benchmark

See how your score compares to others in your industry, and across the School.

School

SECTOR AVERAGE

SCHOOL AVERAGE

5

WHAT IS ALREADY HAPPENING IN THE UK

PAUL ACOCK

SEVE

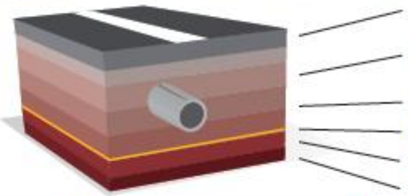
CALL TO TENDER

RAW MATERIALS — MANUFACTURING — TRANSPORTATION AND LAYING

SEVE® allows an environmental assessment of each phases of building and maintenance of your roads, earthworks and utilities networks with two specific modules.

ROAD & UTILITIES MODULE

EARTH-MOVING MODULE



SEVE Eco-comparateur

7 QUANTITATIVE INDICATORS — 2 DECLARATIVE INDICATORS

- Process energy (express in MJ)
- Green House Gas Emission (express in t eq co2)
- Preservation of the natural resource*
- Ton kilometer (express in t.km)
- Water
- Biodiversity

* Preservation of ressource included :

- Natural aggregates consumption (t)
- Reclaimed Asphalt Pavement consumption (t)
- Recycled Materials consumption (t)
- Excavated earth materials from the site and reused in the site (t)

RESULTS PROVIDED BY THE SEVE® SOFTWARE

Example of an indicator:

COMPARISON OF GHG EMISSIONS (in t eq CO_2)

Graph

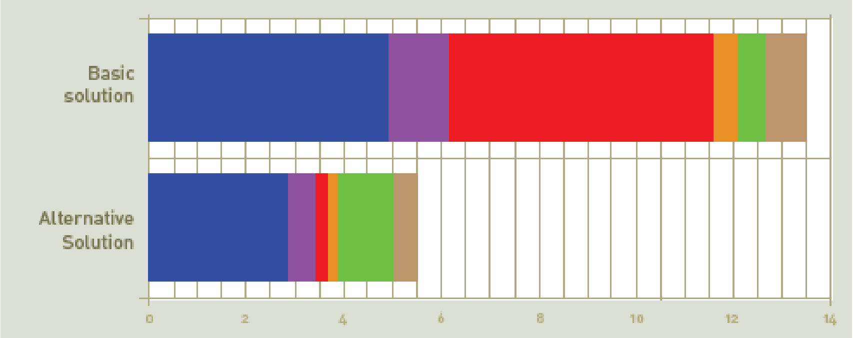


Table of results (in t eq CO_2)

Solution	Material extraction	Transport upstream	Manifacturing mixtures	Transport into the site	Laying	Transport outside the site	Total	ENVIRONMENTAL BENEFIT
Basic solution	5,0	1,2	5,5	0,5	0,5	1	13,7	60%
Alternative solution	2,9	0,6	0,2	0,3	1	0,5	5,5	

A DETAILED DOCUMENT, PDF FORMAT, PROVIDING:

- Identification of the project, the company, the owner and the contractor.
- General information about the software
- Summary presentation of the solutions
- Table of results (9 indicators)
- Detailed presentation of solutions
- List of used asphalt concrete formulas
- List of recycled materials

ASPHALT MIX PRODUCTION

	Kg CO2/t	t CO2
Current carbon footprint	32,5	1 218 750
Target carbon footprint	27,2	1 018 728
Potential savings	-16,4%	

Reference quantity
37,500,000
Tons of asphalt mix

		Current	Target	Variation	Qty	impact	
						unit	total
Increase warm mix %	30°C reduction	15,6%	50,0%	34%	12 900 000	2,7	34 830
Control of warm mix temperature	10°C reduction			16%	5 850 000	0,9	5 265
Control of hot mix temperature	10°C reduction			50%	18 750 000	0,9	16 875
Increase RAP	Same W%	16,0%	30,0%	14%	37 500 000	0,17	89 250
Reduce material moisture content				-0.7%	37 500 000	1,96	53 802
						Total impact	**200 022**

	CURRENT		TARGET	
Aggregates	1%	50%	1%	42%
Sand	3%	34%	2%	28%
RAP	5%	16%	2%	30%
Average W%		2,3%		1,6%

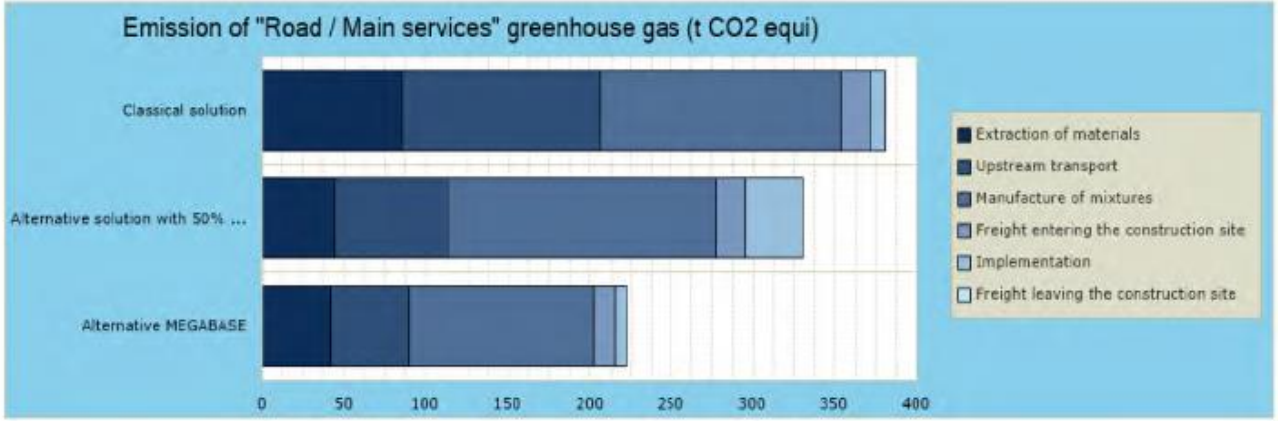
All those efforts will represent

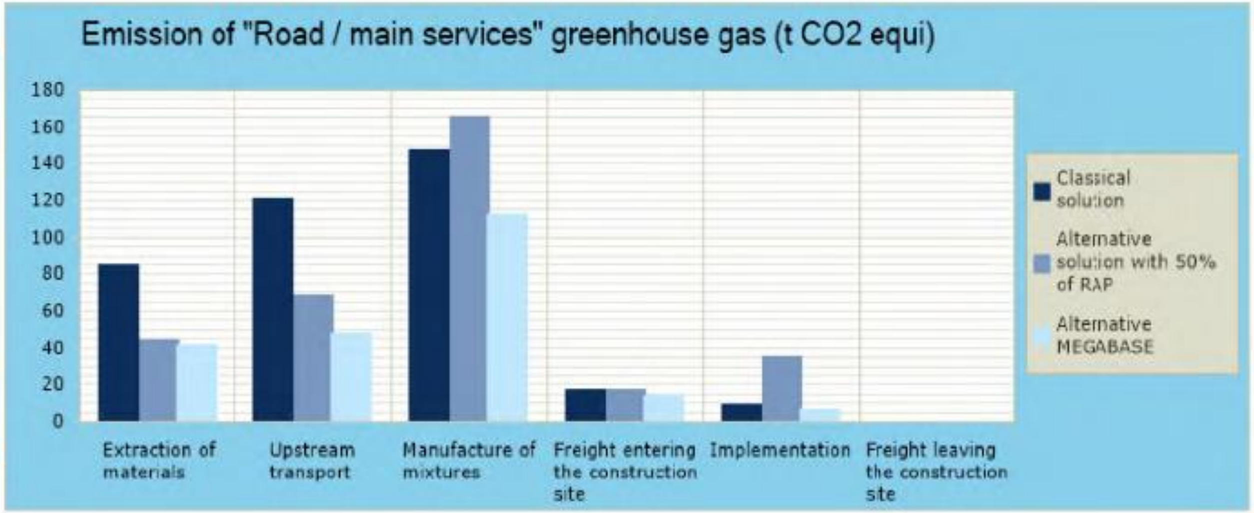
5%

of the reduction target

CARBON SAVINGS FROM ALTERNATIVE OFFERS

		Emissions of greenhouse gases (t CO2 eq)							
		Materials extraction	Upstream transportation	Manufacture of mixtures	Freight entering the site	Implementation	Freight leaving the site	Total	Comparison / Base
Classical solution	Roads and Networks	85,0	121,1	147,3	18,0	9,4	0,0	**380,8**	
Alternative solution with 50% of RAP	Roads and Networks	44,5	68,2	164,8	18,0	35,2	0,0	**330,7**	**-13,1 %**
Alternative MEGABASE	Roads and Networks	42,0	47,6	112,2	13,6	6,7	0,0	**222,2**	**-41,7 %**





ALTERNATIVE – RECYCLED AGGREGATES

Characteristics *(usual values)*	MÉGABASE® 0/31.5 mm 0/40 mm
Gyratory Shear Press Test (NF EN 12 697-31) Maximum voids at 120 gyrations, in %	9.0
Duriez Test (NF EN 12 697-12) Water sensitivity (immersion/Compression), in %	≥ 75
Rutting Test (NF EN 12 697-22) (Large Model, 60°C) Ruts at 30 000 cycles, in % Ruts at 100 000 cycles, in %	≤ 6.5 ≤ 7.5
Complex Modulus Test 15°C, 10Hz (NF EN 12 697-62) E, in MPa	≥ 11 000
Reversed Bending Fatigue Test 10°C, 15 Hz (NF EN 12 697-24) ε_6, in µstrain	≥ 100

Megabase® is a hot or warm mix, with high granularity (0/31.5 mm or 0/40 mm), typically for base layers under heavy stress. It's original formulation with a strong granular framework results in a high-performance, economical asphalt mix with low environmental impact, due to it's re-use of reclaimed rail ballast

Specificity : Coarse gradation

Optimized composition :

- ✓ Granular skeleton enhances load transfer between aggregates
- ✓ Mastic asphalt provide high density

High mechanical performance

Dedicated to areas with extreme loads (port, intermodal platform, industrial site)

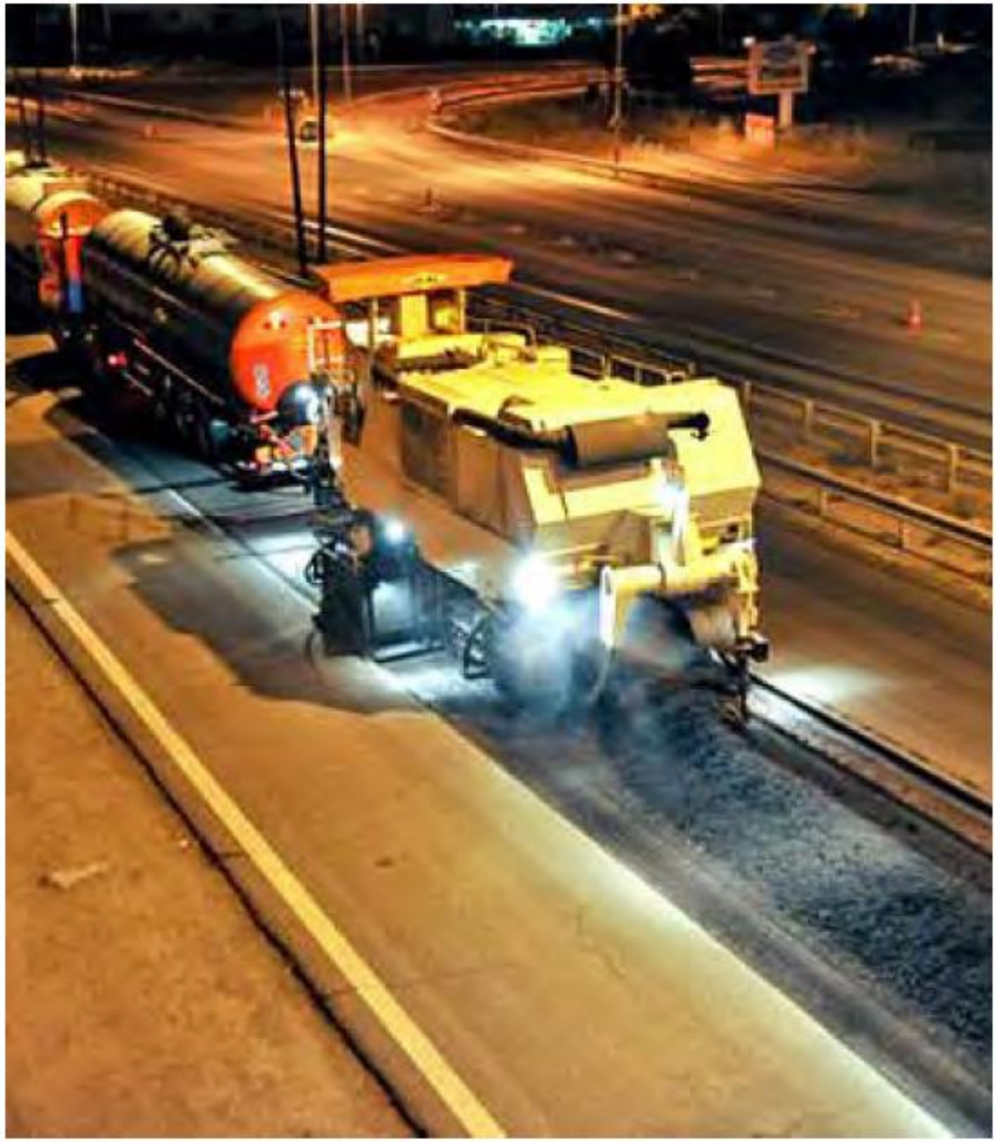
Basic solution	Alternative solution
360 mm AC 32 50 MPa	265 mm MEGABASE 50 MPa
265 mm AC 32 50 MPa	190 mm MEGABASE 50 MPa
200 mm AC 32 50 MPa	140 mm MEGABASE 50 MPa
165 mm AC 32 50 MPa	110 mm MEGABASE 50 MPa

IN-SITU RECYCLING

Novacol is a cold in place recycling technique that is used to renovate roadway layers to depths ranging from 5 to 20 cm.

The process includes planing the materials in place, metering and injecting any additional ingredients and mixing the final product that is applied as a base or binder course.

The layer will later be topped off with a surface dressing, cold micro surfacing or hot/cold mix asphalt. Novacol is a process that can be tailor-made to any project by varying the depth to which the surface is treated and by changing the type and percentage of binders and additional materials. Novacol is one of the most modern maintenance and renovation techniques available and can be used to encapsulate tar-bound arisings in a cold asphalt emulsion, making the material inert for the future.



Yield:

5,000 to 10,000m^2 per day

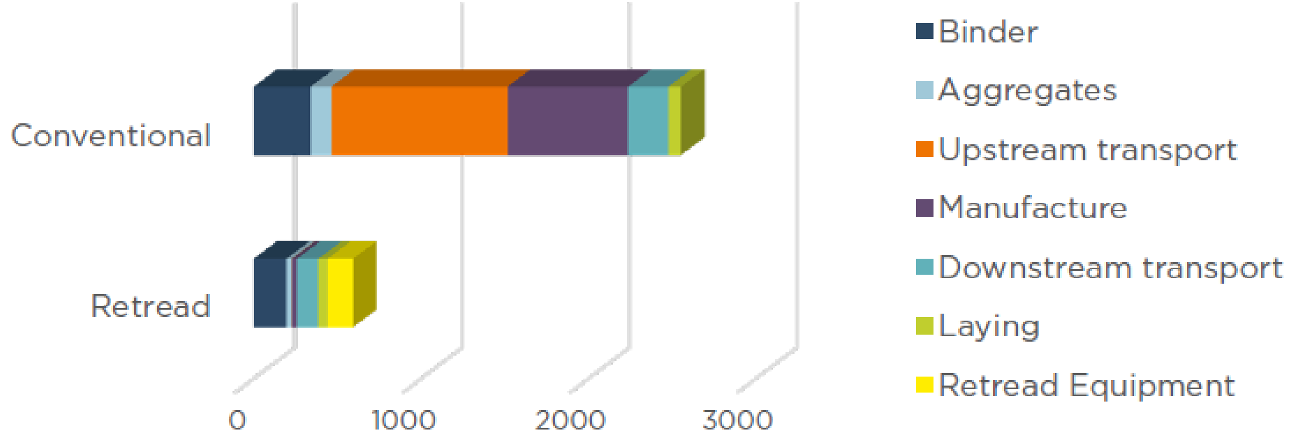
Advantages:

- Inline compact units
- Reduced overall intervention
- Quick reopening to traffic

Savings: Materials because all in place materials are reused, Transport because process is in-situ and Energy because it is a cold technique

TOTAL ENERGY CONSUMPTION & GREEN HOUSE GAS EMISSIONS

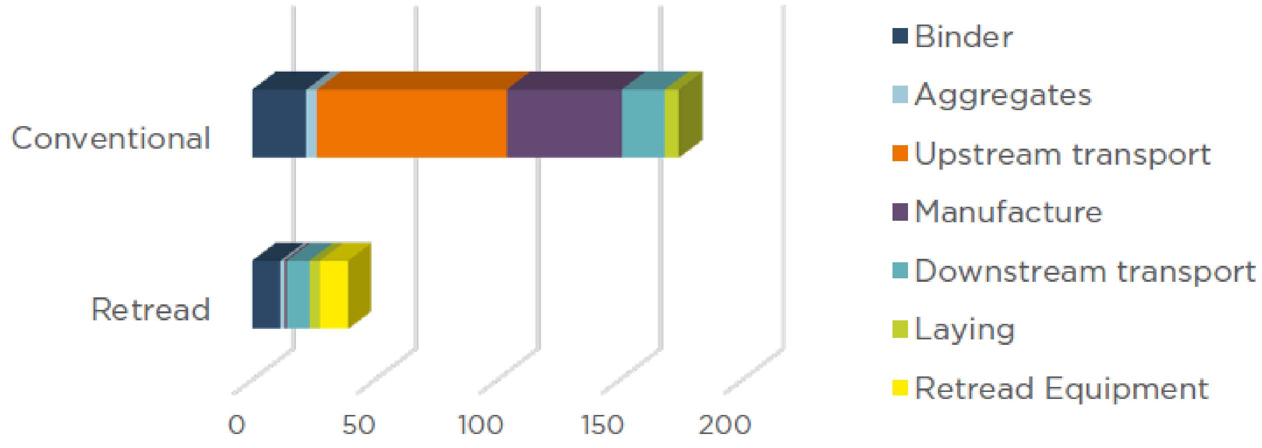
Structure	Binder	Aggregate	Upstream Transport	Manufacture	Downstream Transport	Laying	Retread Equipment	Total
Conventional	339.5	122.9	1,053.8	721.8	239.8	76.0	-	2,553.8
Retread	195.9	31.5	2.0	29.3	127.5	54.4	153.0	593.6



USING RETREAD, TOTAL ENERGY CONSUMPTION USED WAS A 76.76% SAVING COMPARED TO CONVENTIONAL SURFACING

GHG EMISSION IN EQUIVALENT CO_2 TONNES

Structure	Binder	Aggregate	Upstream Transport	Manufacture	Downstream Transport	Laying	Retread Equipment	Total
Conventional	22.0	4.4	77.5	46.9	17.6	5.8	-	174.2
Retread	11.5	1.6	0.2	0.7	9.4	4.2	11.5	39.1



USING RETREAD, TOTAL GREEN HOUSE GASES USED WAS A 77.37% SAVING COMPARED TO CONVENTIONAL SURFACING

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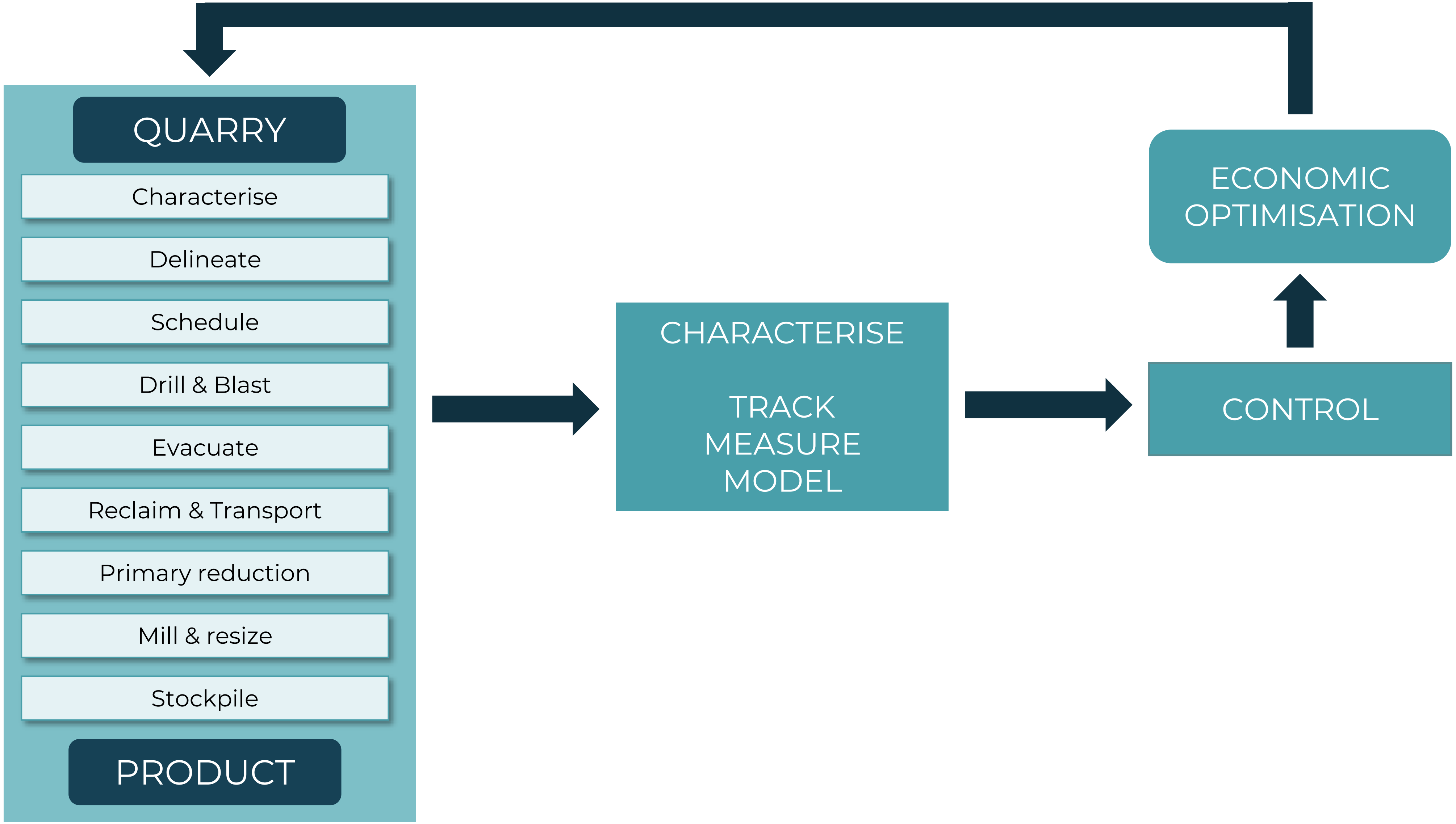
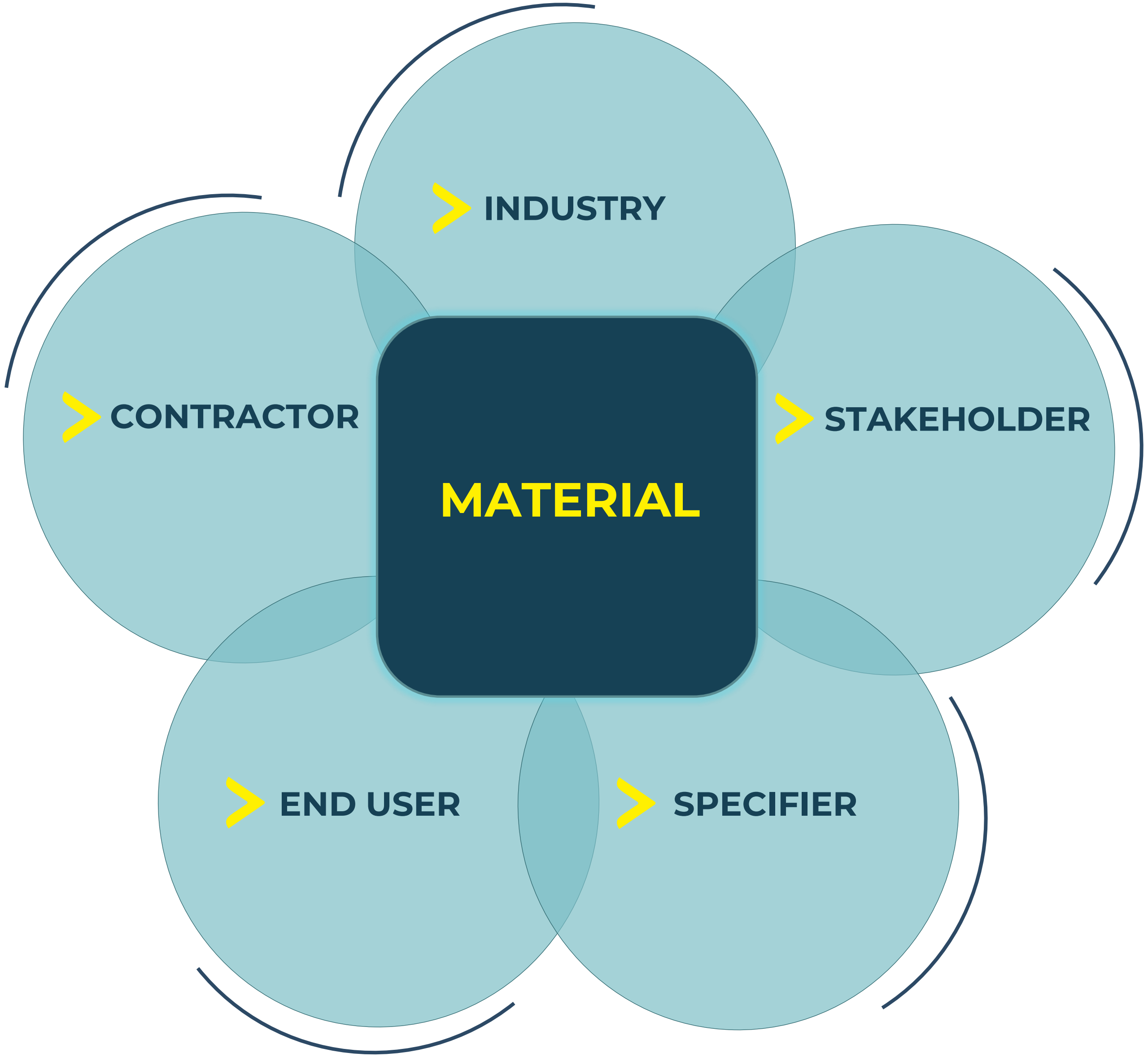
THE RAPID PACE OF CHANGE

DANIEL MORGAN

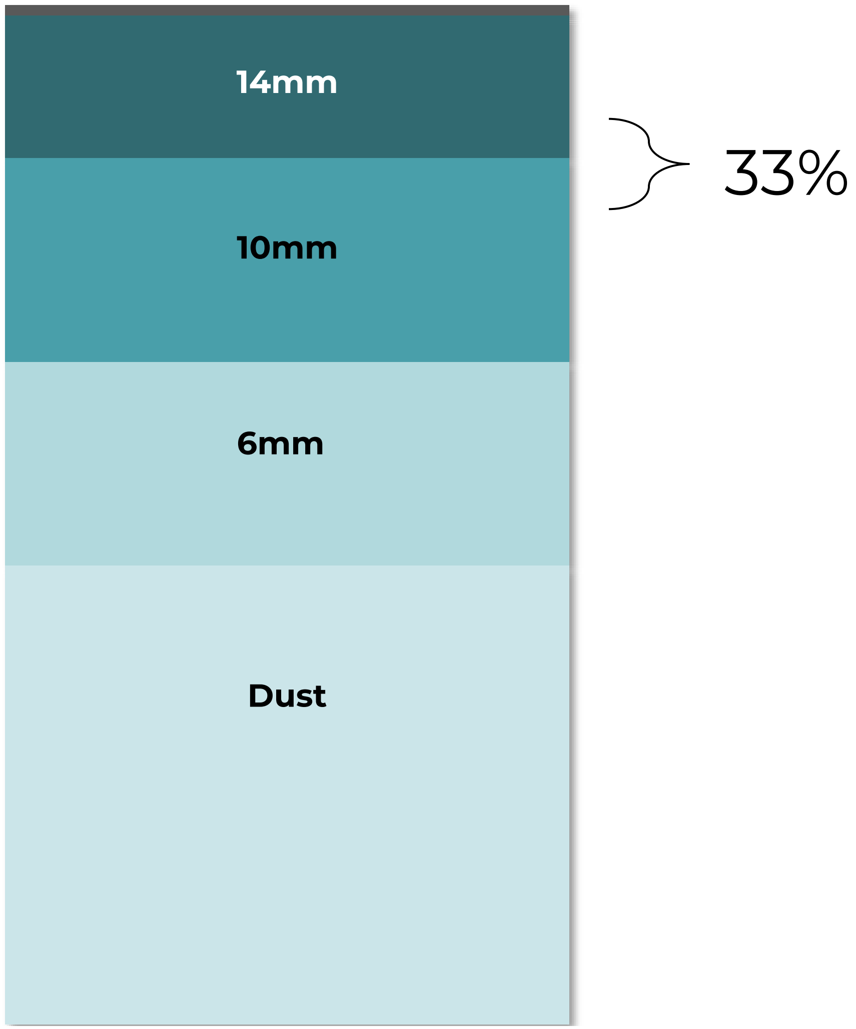
MINE TO MILL STRATEGY



MATERIAL SELECTION INFLUENCERS



MINUS 14MM PRODUCTION SPLIT



Saleable 14mm & 10mm Product

= 100k tonnes

Total production

= 300k tonnes

Low value/waste product

= 200k tonnes

GRITSTONE WASTE STERILISING RESERVE

GRITSTONE WASTES CHOKE QUARRY SITES

COLAS

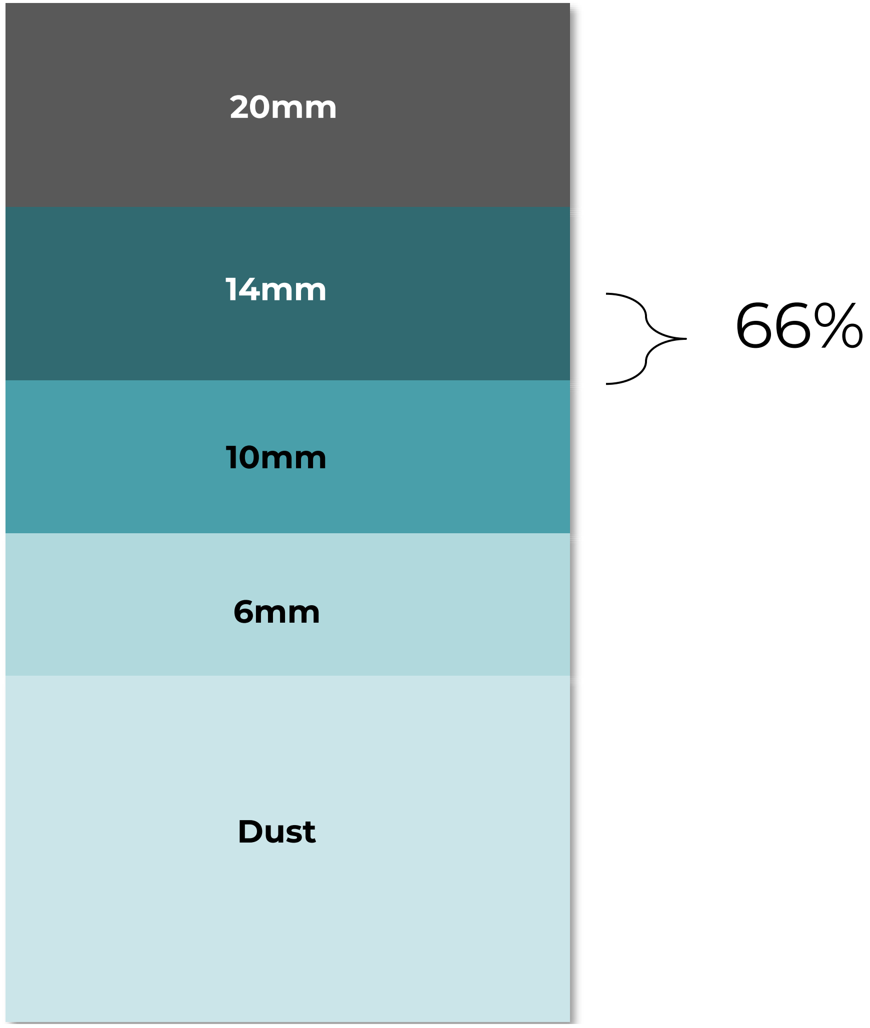
20MM STONE MASTIC ASPHALT

- Same performance as 14mm Stone Mastic Asphalt
- Texture typically 1.8mm
- Laid 50-75mm+ (performance proven up to 100mm)
- Removes the need to insert a regulating layer
- One pass operation, overall cost savings
- Strengthens the pavement
- Aggregates, more readily available

6MM STONE MASTIC ASPHALT

- Texture minimum 1.0mm
- Laid 20 - 40mm
- Quiet, smooth ride
- Tough surface finish
- Aesthetically pleasing
- Aggregates, more readily available

MINUS 20MM PRODUCTION SPLIT



Saleable 20mm, 14mm, 10mm & 6mm product

= 100k tonnes

Total production

= 150k tonnes

Low value/waste product

= 50k tonnes

CARBON REDUCTION PLAN

Actions to Achieve Carbon Net Zero

Quick wins:

- Texture minimum 1.0mm
- Awareness and Education
- Carbon Data
- Switch the focus to carbon reduction
- Innovations and Collaboration
- Increase green product ranges
- Increase efficiency of manufacturing
- Generic Product EPDs
- Offset programmes

6

WHAT IS HAPPENING AROUND THE WORLD

CLAUDE SIBAUD

DIFFERENT PROJECTS IN COLAS GROUP (AMONG OTHERS)

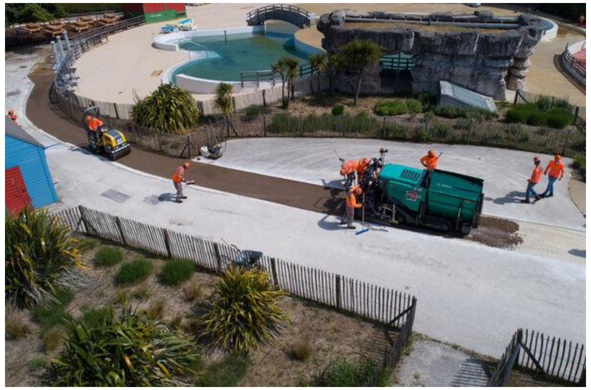
- VEGECOL 2: BIO-BASED BINDER
- ECO 5 ASPHALT
- URBAN HEAT ISLAND APPROACH

VEGECOL 2 :

1.1 – Second generation COLAS Bio-based binder:

- Developed by CST
  - a hot asphalt binder
    - Job trials in France for the last two years
  - A surface dressings binder: (hot or in emulsion)
    - Job trial in Denmark this year

1.2 – VEGECOL 2 emulsion surface dressing job trial



ASPHALT MORE SUSTAINABLE:
ECO 5 ALTERNATIVE IN AUSTRALIA

Safer Sustainable Solutions

Continuing to produce hot mix asphalt without using available technology is placing a burden on our:

1. People

- Unnecessary exposing our workers to fumes

2. Environment

- Consuming natural resources
- Generating green house gasses during heating

3. Cost

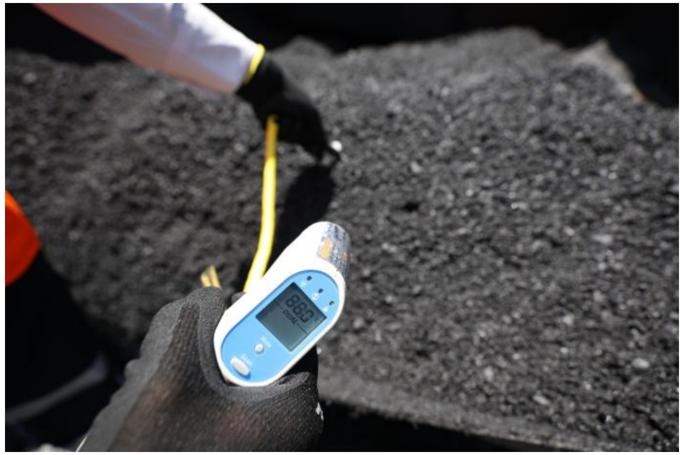
- Opportunities to reduce cost to both the contractor & customer

4. Quality

- Variability in the quality effects in-service performance and life cycle costs

How can we make asphalt more sustainable?

- Classical asphalt is produced from **non-renewable raw materials** and consumes energy in the **heating of bitumen and the aggregates**
- Asphalt can be made more sustainable by:
  1. **Reusing waste** to replace virgin raw materials
  2. **Reducing** mixing and paving **temperatures**
  3. **Improving performance** resulting in a longer service life with less maintenance and less disruption to traffic



Types of waste which can be reused in asphalt?

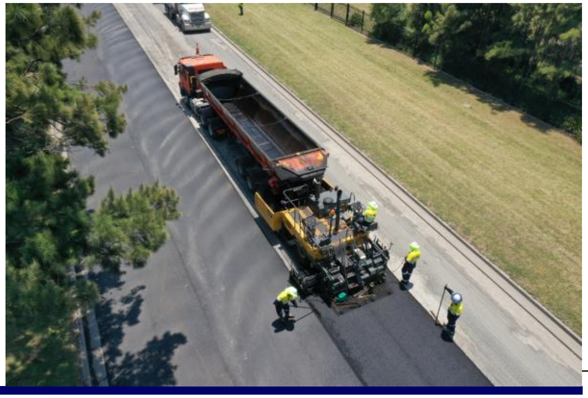
1. Recycled Asphalt Pavement (RAP)
2. Recycled Crushed Glass (RCG)
3. Crumbed rubber (CR)
4. Slag
5. Fly ash
6. Plastic

All sustainable DGA showed improved Fatigue and wheel tracking performances

Test Property	Test Method	Mix type			
		AC20HD	ECO20	AC14HD	ECO14
Fatigue at 200 mircostrain at 20°C, cycles	AGPT/T274	108,000	360,000	131000	823,000
Wheel tracking at 10,000 passes at 60°C, mm	AGPT/T231	3.1	2.6	2	1.5
Resilient modulus at 25°C, MPa	AS 2891.13.1	6,800	5,900	5600	4,900

For every kilometer lane paved with ECO5:

- 559 “End Of Life” tyres were recycled
- 56,966 “empty beer cans” were recycled
- 8t of virgin binder were preserved
- 94t of virgin aggregates were preserved
- Paving temperature = 90°C

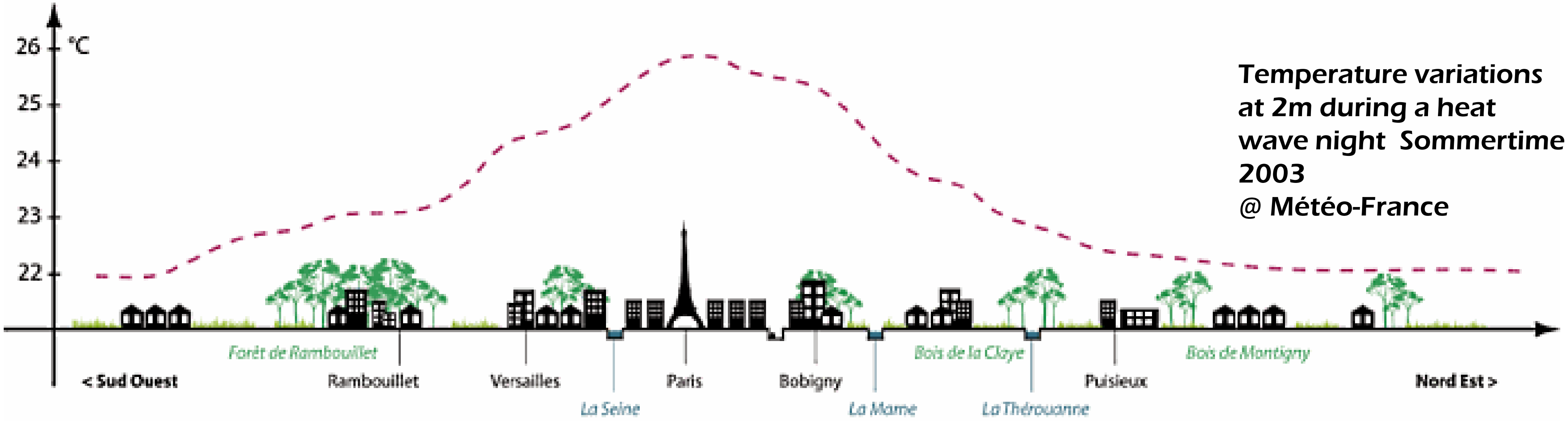


URBAN HEAT ISLANDS

APPROACH AND SUGGESTIONS

UHI : DEFINITION

➢ Temperature increases in urban areas compare to neighboring rural ones

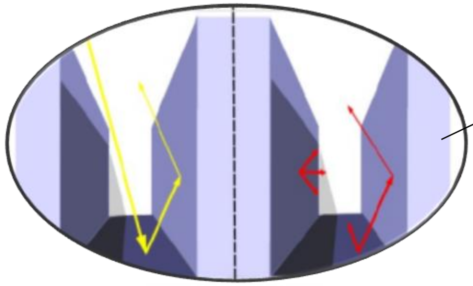


Temperature variations at 2m during a heat wave night Sommertime 2003
@ Météo-France

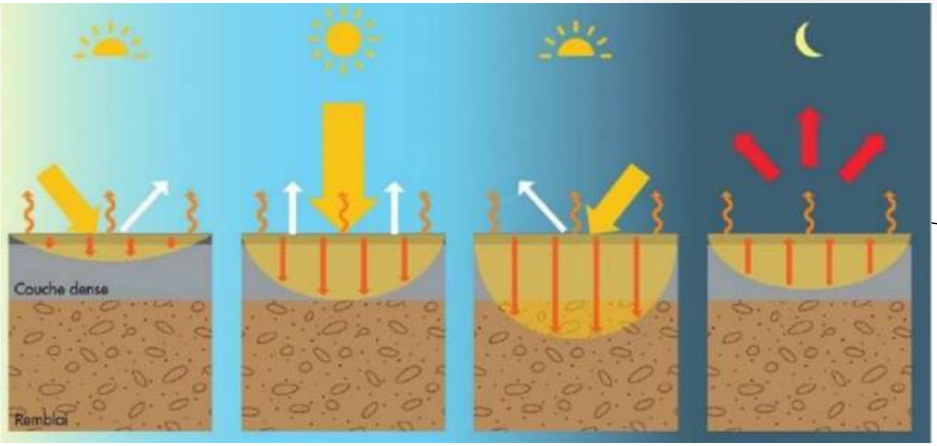
UHI : CAUSES

Parameters impacting UHI

- Radiative trapping: (canyon effect)

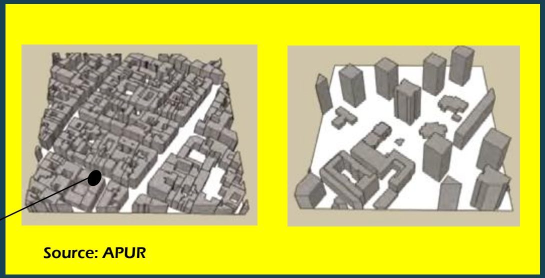


- Stored and released Solar energy cycle for (APUR, 2010)

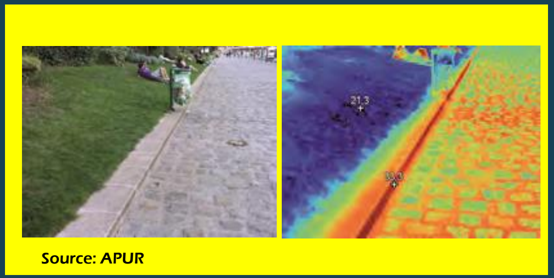


STORED | RELEASED

Insolation
Solar reflection
Conduction
Infra red radiation
Convection
Stored energy

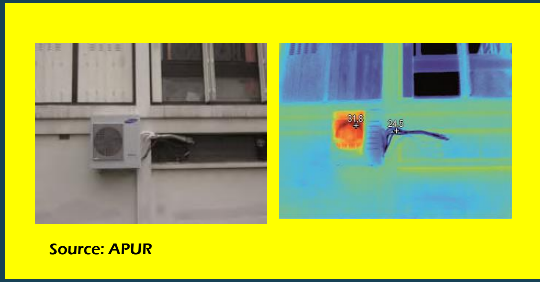


Urban Morphology



Soils natures

Thermal & radiative performances



Human activity concentration

UHI : CONSEQUENCES

➢ UHI & Heat waves

UHI — ΔT 3/4°C

UHI increases temperature variations during heat waves

ΔT = 8 à 10 °C (UHI during heat wave night)

Climate change: Increase of Heat wave events frequency and intensity

➢ Conséquences

- ✓ Confort conditions degradations
- ✓ Sanitary / health risks increases
- ✓ Air conditionning

….

ANALYZE IN ORDER TO RECOMMEND

ANALYZE

in order to

RECOMMEND

Take into consideration: site constraints, micro-climatic considerations, client usages and objectives

- Materials characterisation
- Digital simulations and modeling
- On-site instruments
- Observations, investigations

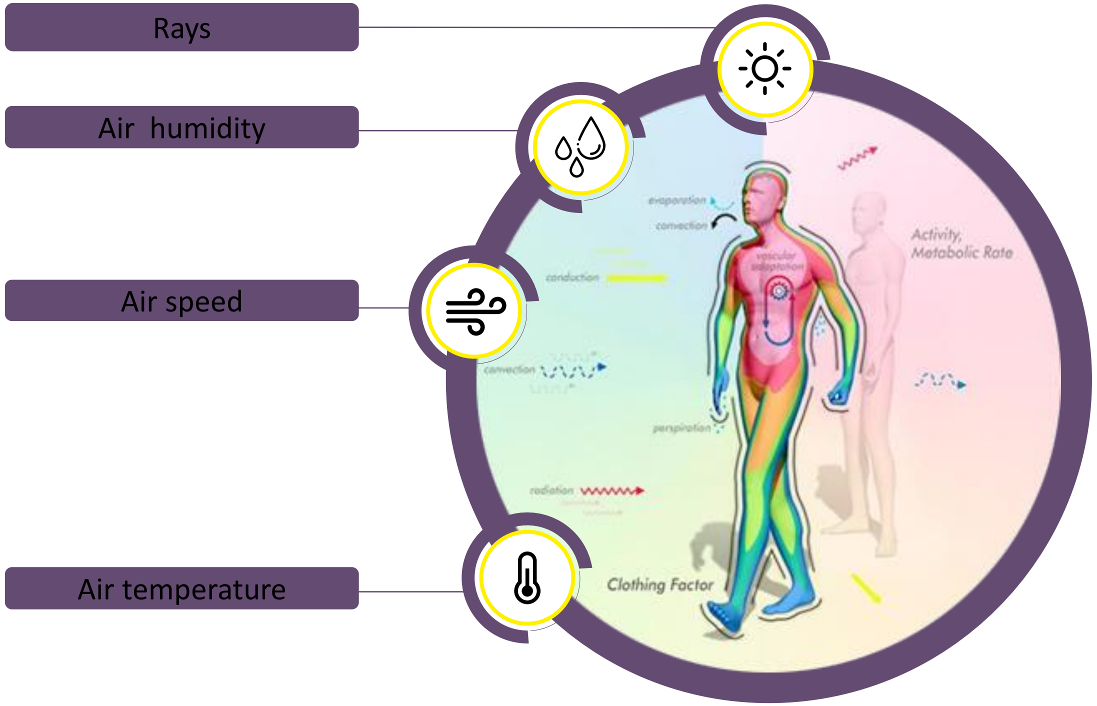
Make the right suggestion

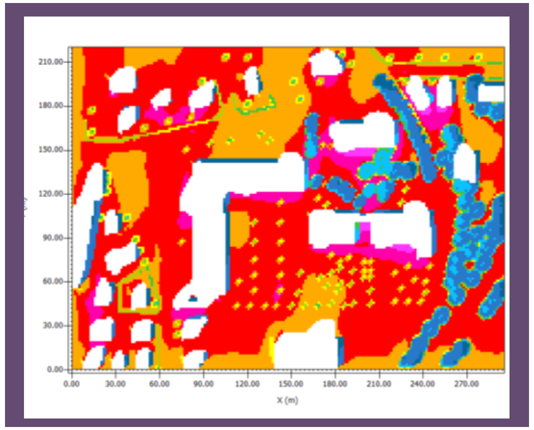
- Reduce heat absorbed by mineral surfaces
- Create shade
- Enhance beneficial effects of storm water
- Enhance beneficial effects of green spaces

Bring nature into the city

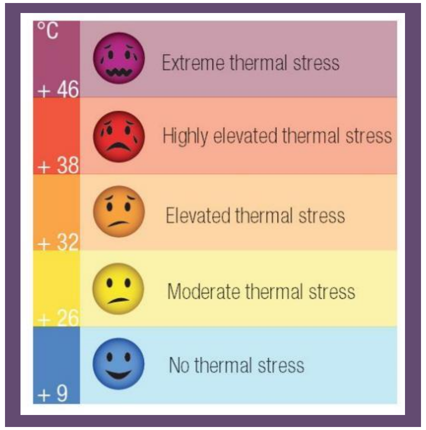
1. DEVELOP SOLUTIONS THAT PROMOTE COMFORT AND WELL-BEING

- **Optimising the thermal comfort of users in open urban spaces**
- **Qualifying user perception**
  - ➢ **Albedo**
  - ➢ **UTCI**





Calculating UTCI with digital simulations and modeling



UTCI (Universal Thermal Climate Index)

Measuring the different parameters required for UTCI calculations (CLOWN project)

2. DEVELOP SOLUTIONS WITH MULTIPLE BENEFITS

Sustainable rainwater management

retention, infiltration, storm water recycling

Bringing biodiversity and nature back into town

upgrading soil ecology, adding green spaces, etc.

Reducing pollution

improving air quality, reducing noise, etc.

Circular economy and carbon reduction

reusing materials,
low-carbon materials and processes

TOWARDS AN INTERDISCIPLINARY APPROACH

PRIOR ASSESSMENT

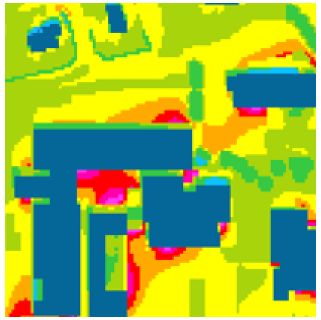
- Check the effectiveness of suggested solutions in advance
- Calculate the potential gain in coolness

OPERATIONAL ASSESSMENT

- Assess the performance of the solution in real conditions

DIGITAL MODELISATION

- Optimisation with utilisation of materials that we know the ALBEDO



ANALYZE

- Materials characterisation
- On-site instruments
- Digital simulations and modeling
- Observations, investigations

SUSTAINABLE MANAGEMENT OF STORM WATER

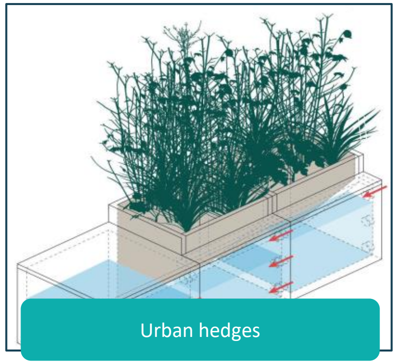
- Mitigate soil sealing
- Store and re-use RW

WATER USAGE DURING A HEATWAVE

- Watering plants
- Moistening pavements
- Misting systems


Permeable structures (retention / infiltration)


Misting systems built into the pavement


Urban hedges


Permeable pavements


Pavements that retain water for later evaporation


Misting systems built into street furniture

RECOMMEND

Enhance beneficial effects of storm water

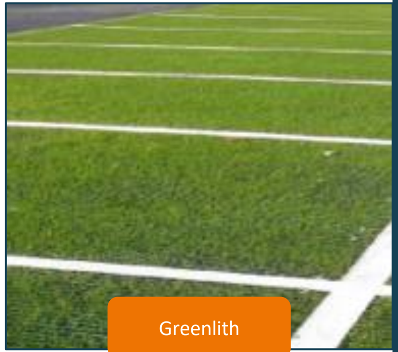
GREEN SPACES

PLANTS AND PAVEMENTS

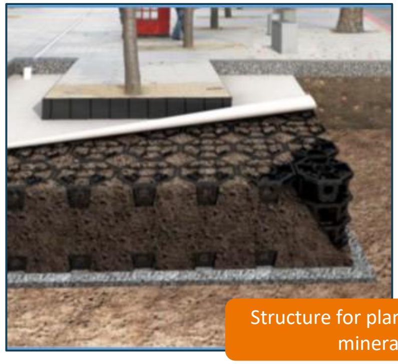
ADDING THE RIGHT PLANTS (TREES, PLANTS, GRASS)

- Improving the ecology of the soil and growing plants in the ground
- Growing plants in dense urban environments (little access to the ground)

Paving blocks with grassy joints



Greenlith



Structure for planting trees below a mineral surface

Modular structure featuring plants

RECOMMEND

Harness the beneficial effects of plants

SHADE

SHADE CREATED BY TREES

STREET FURNITURE

RECOMMEND

Create shade

7

PRACTICAL NEXT STEPS

3 KEY ACTIONS

1

- Identify carbon production across scopes 1,2 & 3 within your Local Authority and in your supply chain

2

- Local Authorities to develop 10 year carbon reduction road map - identify the activities they control, including key stakeholders and the activities they control

3

- Collaborate across the sector & Stakeholders, sharing best practice of carbon reduction progress and wider visibility of those challenges that are still out of reach, utilising the wider ADEPT community to pool resource to identify solutions to achieve Carbon Net Zero 2050

WE NEED TO WORK **COLLABORATIVELY** TO IMPLEMENT **DIFFERENT SOLUTIONS** TO DELIVER THE **DECARBONISATION** TARGETS

8

THANK YOU

Q&A