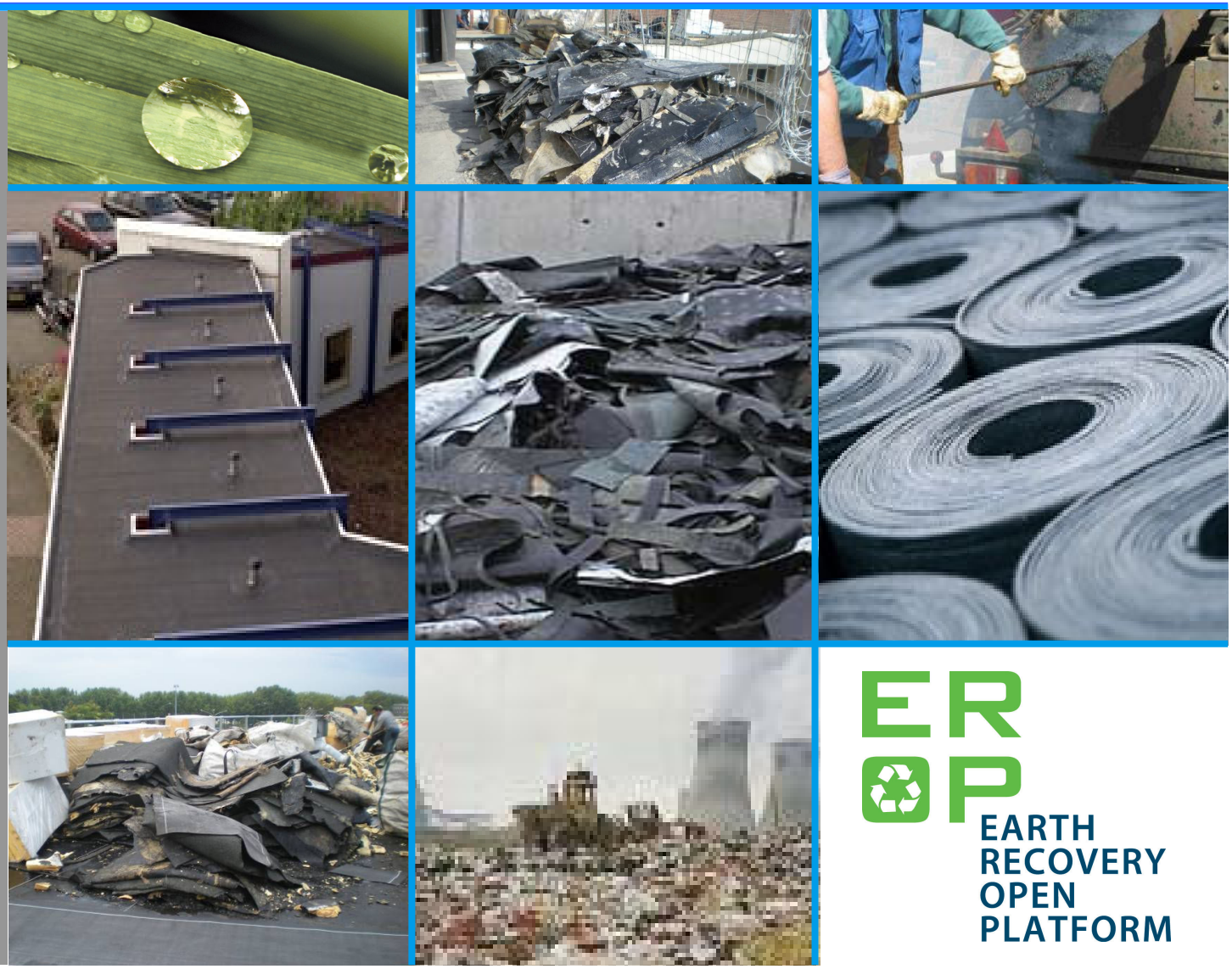
Commercial Roofing Material Recycling In Europe

Icopal Program for Recycling Bituminous Roofing Materials in Europe



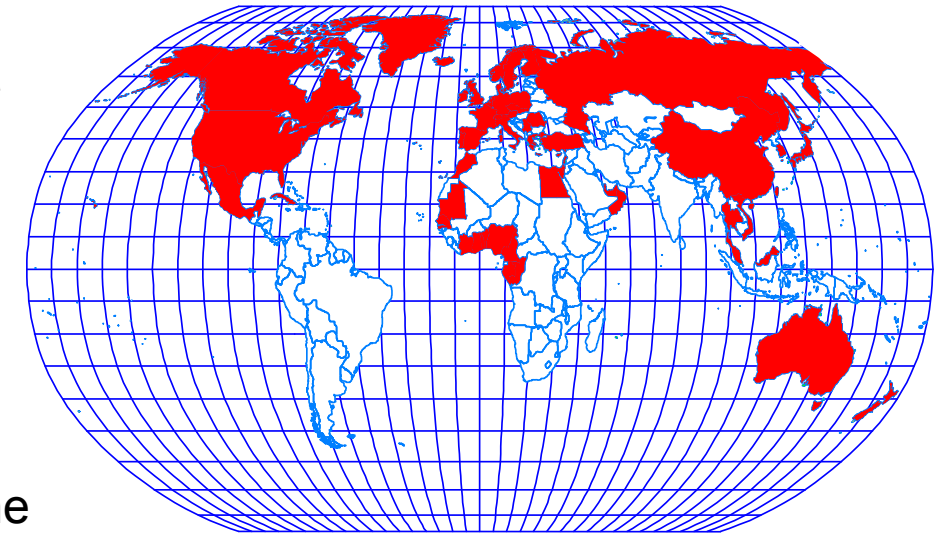
EARTH RECOVERY OPEN PLATFORM

Siplast In The United States

- Manufacturer of SBS-modified bitumen systems in the United States since 1981.
- Supplier of lightweight insulating concrete systems since 1995.
- Manufacturer of PMMA liquid roofing, flashing, and waterproofing systems since 2003.
- A full-line supplier of roofing accessory products for over 10 years.

Siplast & The Icopal Group

- Siplast is a member of the Icopal Group, one of the world's largest manufacturers of roofing and waterproofing systems, with:
  - Business activity in 85 countries.
  - 36 manufacturing sites.
- This corporate affiliation offers the advantage of shared R&D initiatives and field experience, as well as exchange of best practices among Icopal companies.
- These best practices are not only product-related, but also employee-related.



The Icopal Group is one of the world's largest commercial roofing manufacturers.

European Issues With Roofing

- Europe is roughly similar in size to US, but more than twice the population.
- Oil prices and the cost of bitumen raw materials typically higher.
- Growing regulation on the landfill disposal on construction materials, particularly in Germany, France, Belgium and especially The Netherlands.
- Cost of dumping materials EU the landfills on the rise.
- Corporate image as environmentally responsible in the spotlight.

European Roofing Waste Elimination: Current

Icopal Group Country	Dumping Cost €/t Dumping Forecast	Old Roof Recycling	Recycling Channel
			I Incineration W Roofing Recycling D Dumping R Roads
Germany	120 Restricted	yes	I,W
France	100 Restricted	yes	R,D
UK	70 Restricted	no	D
Norway	100	no	D
Denmark	80	yes	R
Sweden	65 Restricted	yes	I
Netherlands	150 Restricted	yes	W, R, I

The Netherlands Issues With Roofing

- Equal in size to Maryland, but the population of New York State with 25% of the land below sea level.
- Landfills are used for less than 10% of all waste.
- 70,000 tons of roofing waste annually ends in landfill or is incinerated.
- Ministry of Housing and Spatial Planning & Environment (VROM), University of Rotterdam & Icopal Programme to 2008-2020 to recycle 200 m² or existing bitumen roofing into new roofing felts of same coverage.

Recycling Bitumen Roofing: A Short Icopal NL History

- In The Netherlands Esha started in 1994 with a Siefer-Ecken machine, which utilized shredder (slow double-screw, heated and lubricated with molten bitumen) and a Siefer mill. Esha is now Icopal BV, Groningen, NL.
- Siefer-Ecken technique was used successfully for many years but was only suitable for production waste – could not extract screws, stones, or other foreign matter.
- BiELSo® technology was developed by the Icopal Group and subsidized in part by the European Commission (life+ subsidy program).

Types Of Bituminous Roof Membranes In The Netherlands

Coating type	Time Period	Estimated Roof Area	New Roofs 2011
Coal Tar	19th century – 1980	± 20 million m^2	0%
Oxidized Bitumen	1970 – 1985	± 55 million m^2	< 10%
SBS	1983 – present	± 35 million m^2	15%
APP	1980 – present	± 150 million m^2	80%

New roofs are 20 million m²/year. Annual waste is estimated at 40-100 k tons.

Most bitiminous roofing is incinerated since dumping of waste in the Netherlands is strictly regulated.

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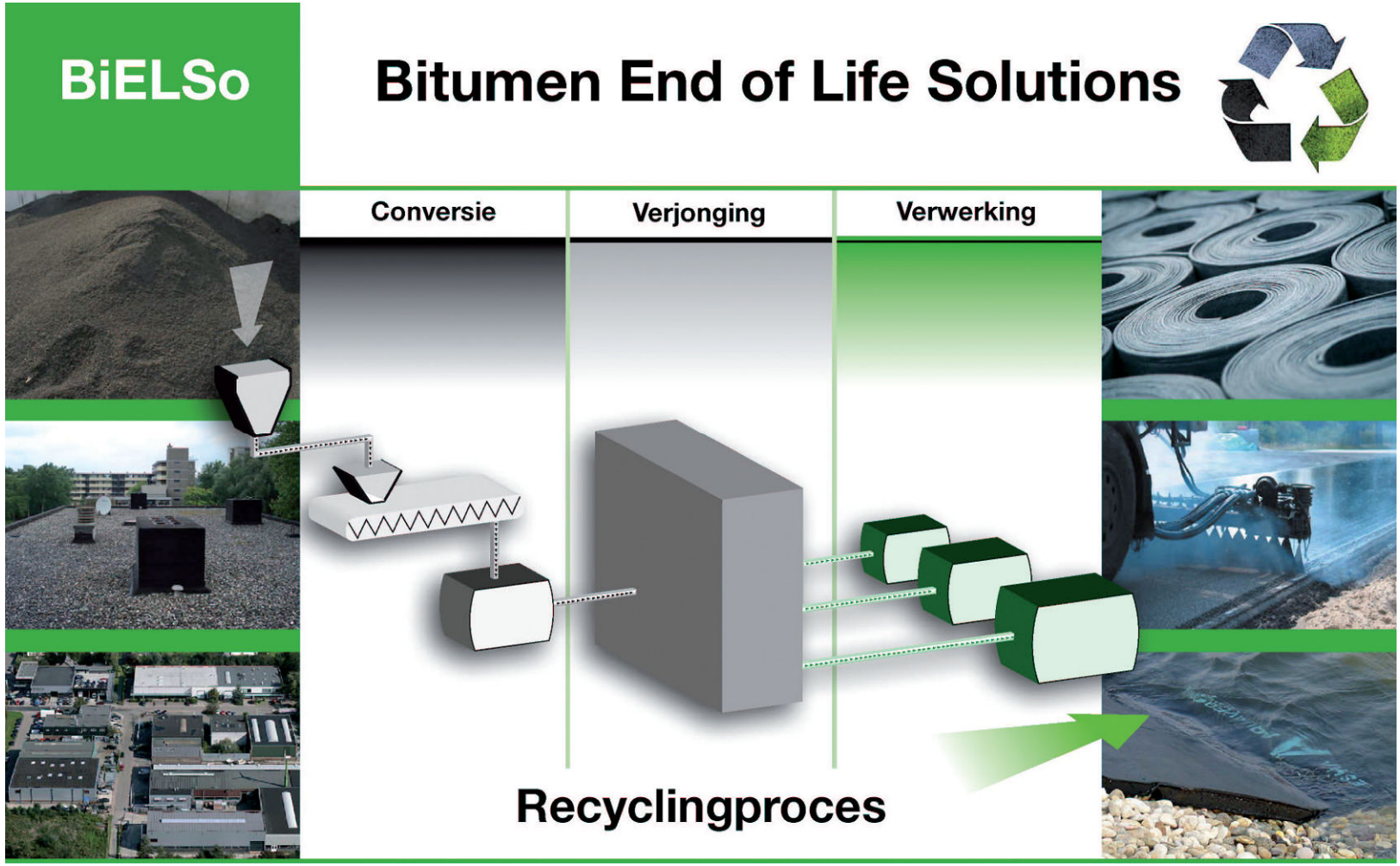


Recycling Of Roof Membranes

BiELSo®: Bitumen Endless Life Solutions

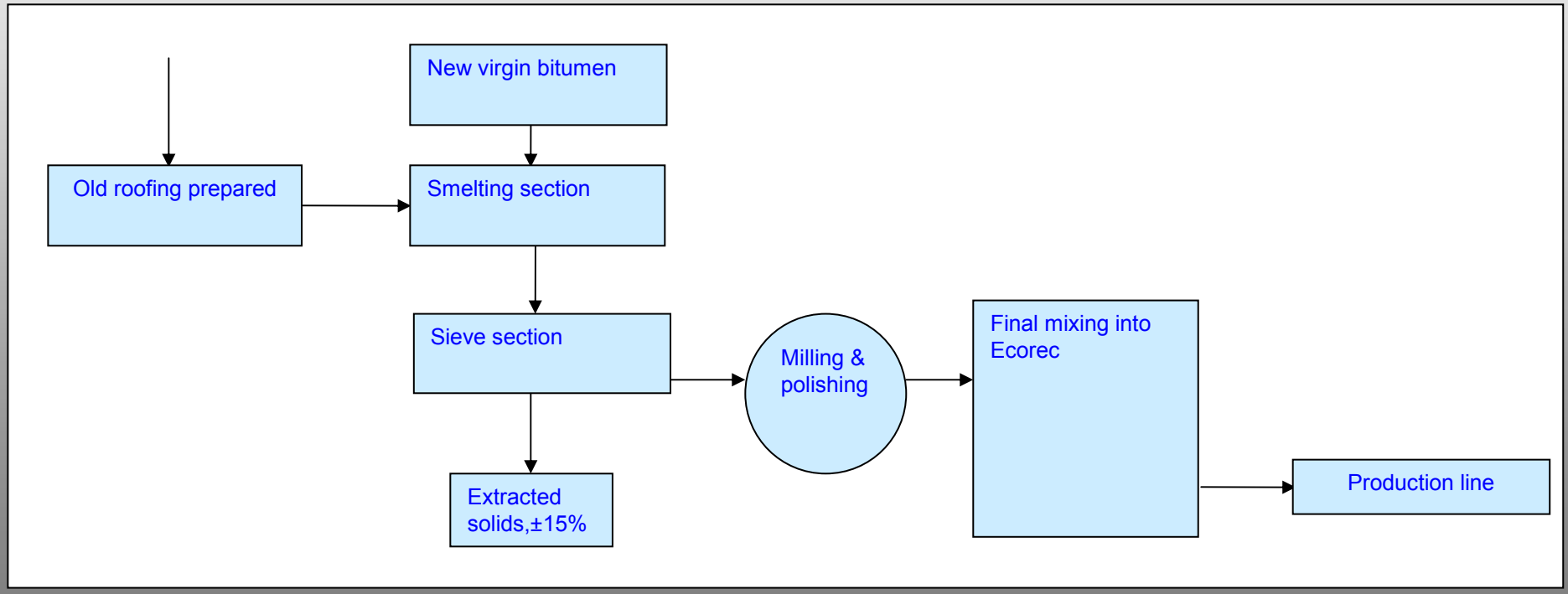
- Unlike previous recycling, this program is the route to full recycling: cradle-to-cradle or more appropriately, roof-to-roof.
- “Bitumen balance” – intent of full chain of custody from production waste, demolition waste, etc. – into processing new roofing membrane production and related materials.
- BiELSo gains recognition for reduction of carbon footprint; customers can receive a CO2 certificate from the MBDC cradletocradle

BiELSo Recycling Process

- The process is currently utilized primarily for oxidized bitumen and for APP. No coal tar or asbestos.
- Quality control starts on the roof before demolition.
- Bitumen rejuvenation is needed (to compensate for hardening/aging and to help extract the waste).
- Reinforcement (glass & polyester) fibers, sand, and slate surfacings are milled down to filler size.
- Contamination (construction materials such as gravel, wood, nails, and metal) are sieved out.

BiELSo Processing Steps

The output blend after milling is called Ecorec®.



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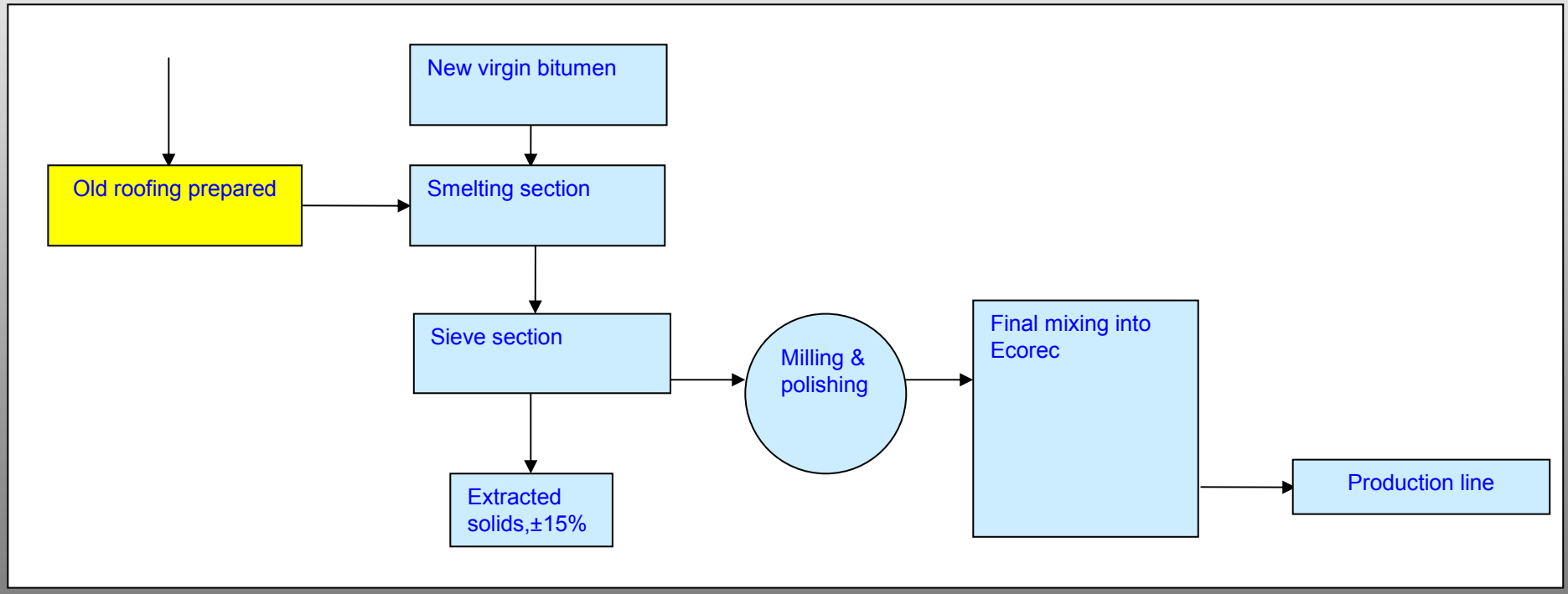

BiELSo Processing Steps: Old Roofing Prepared

Jobsite organization:

- Materials are sorted by a waste specialist before delivery to Icopal.
- Insulation is sorted on the roof into large bags, and placed into 16-10 m³ containers on the ground.
- Membranes are organized into bulk on the roof, and placed into 8-16 m³ containers on the ground.

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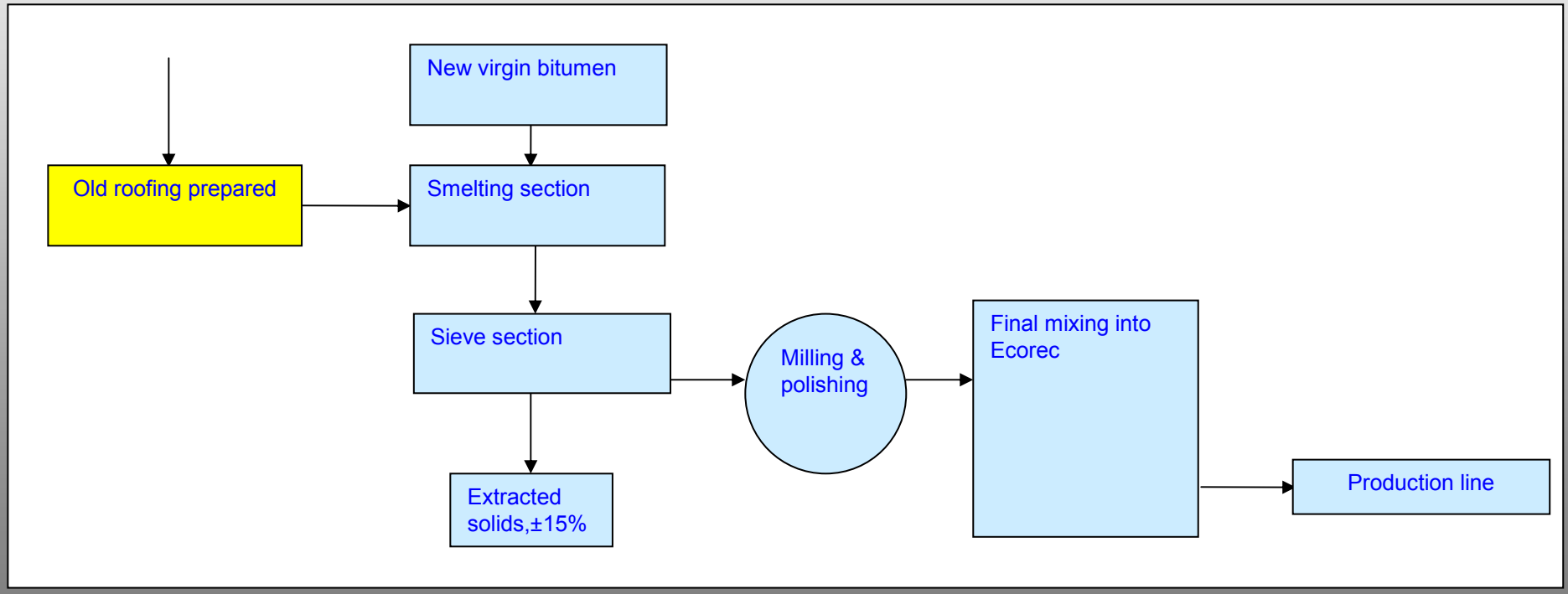

BiELSo Processing Steps

Shredder - Front View

BiELSo Processing Steps

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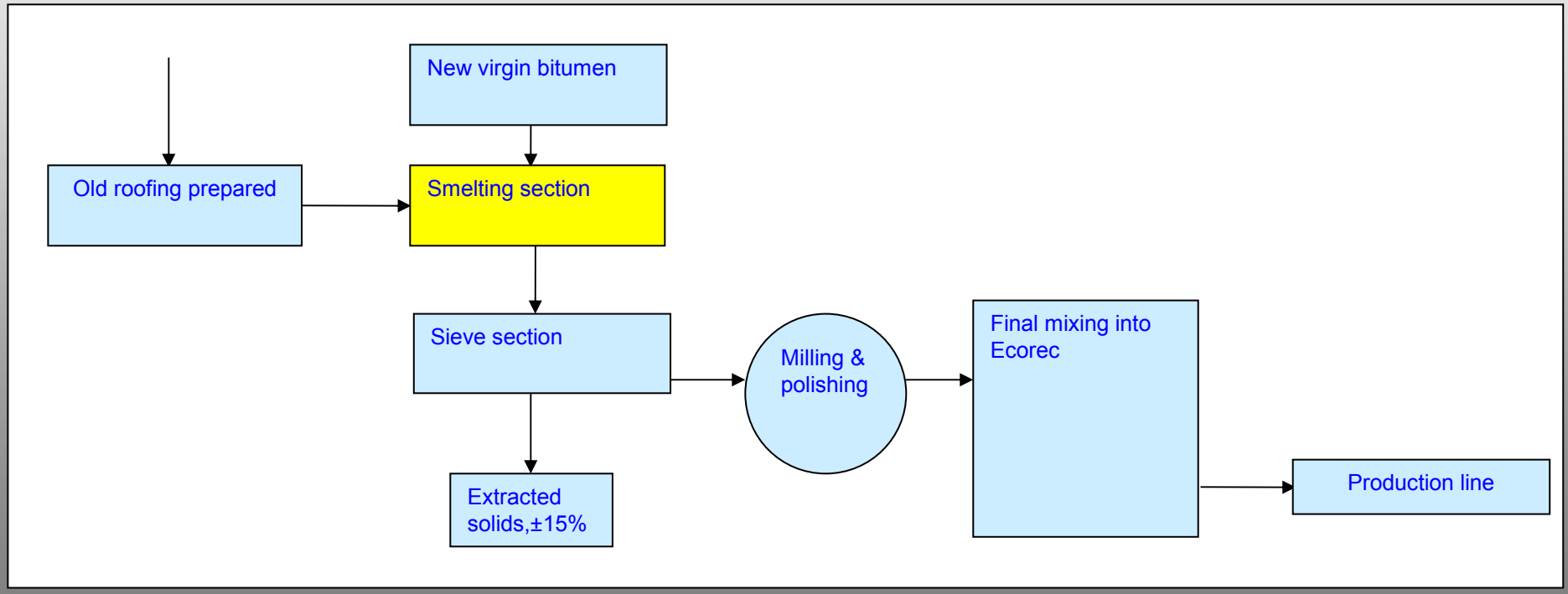

BiELSo Processing Steps

Smelter Section

BiELSo Processing Steps

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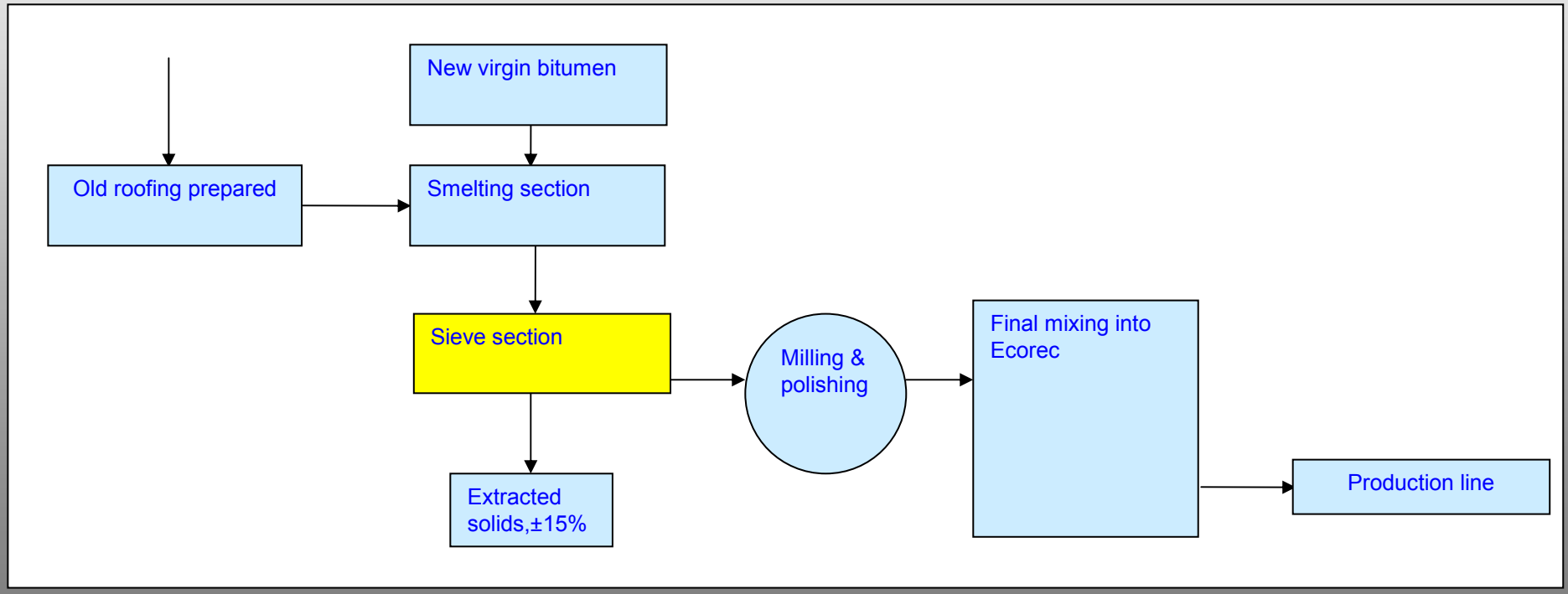
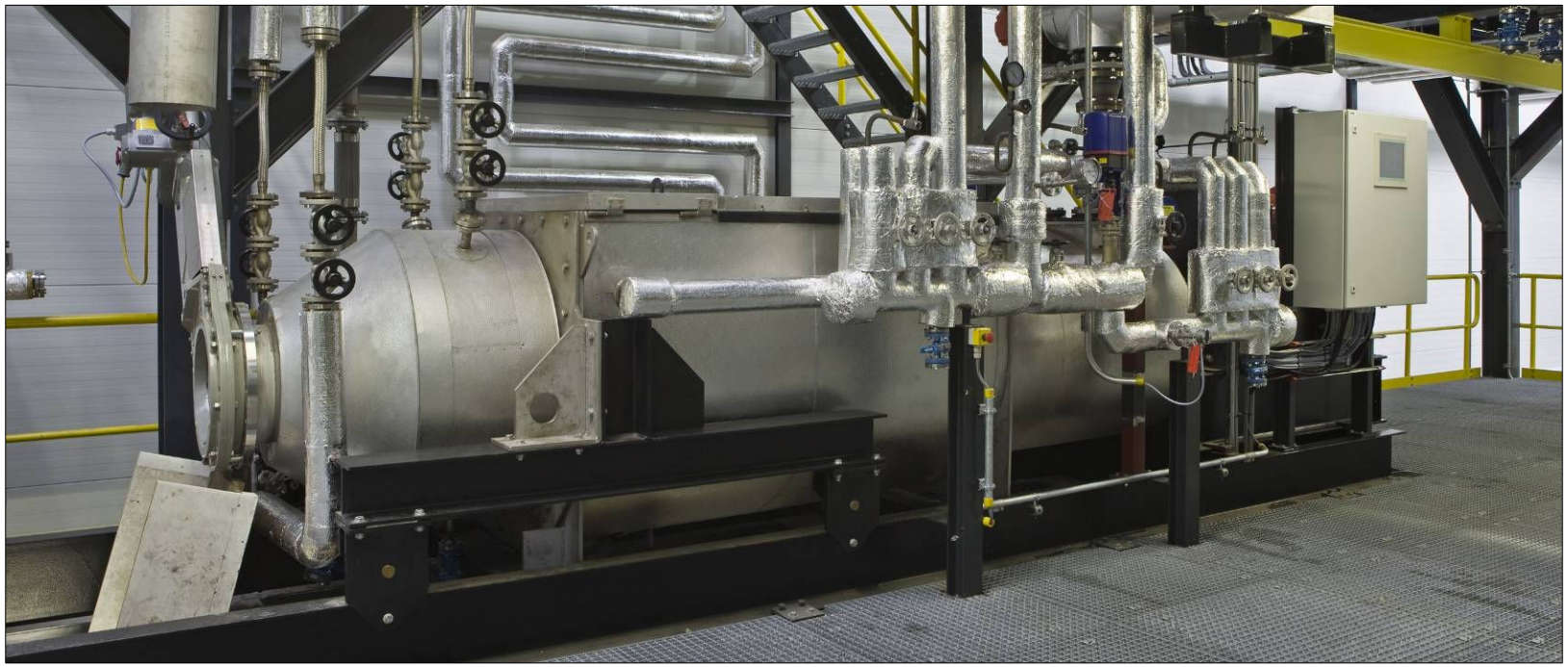


BiELSo Processing Steps

Separator – Sieve Section



BiELSo Processing Steps

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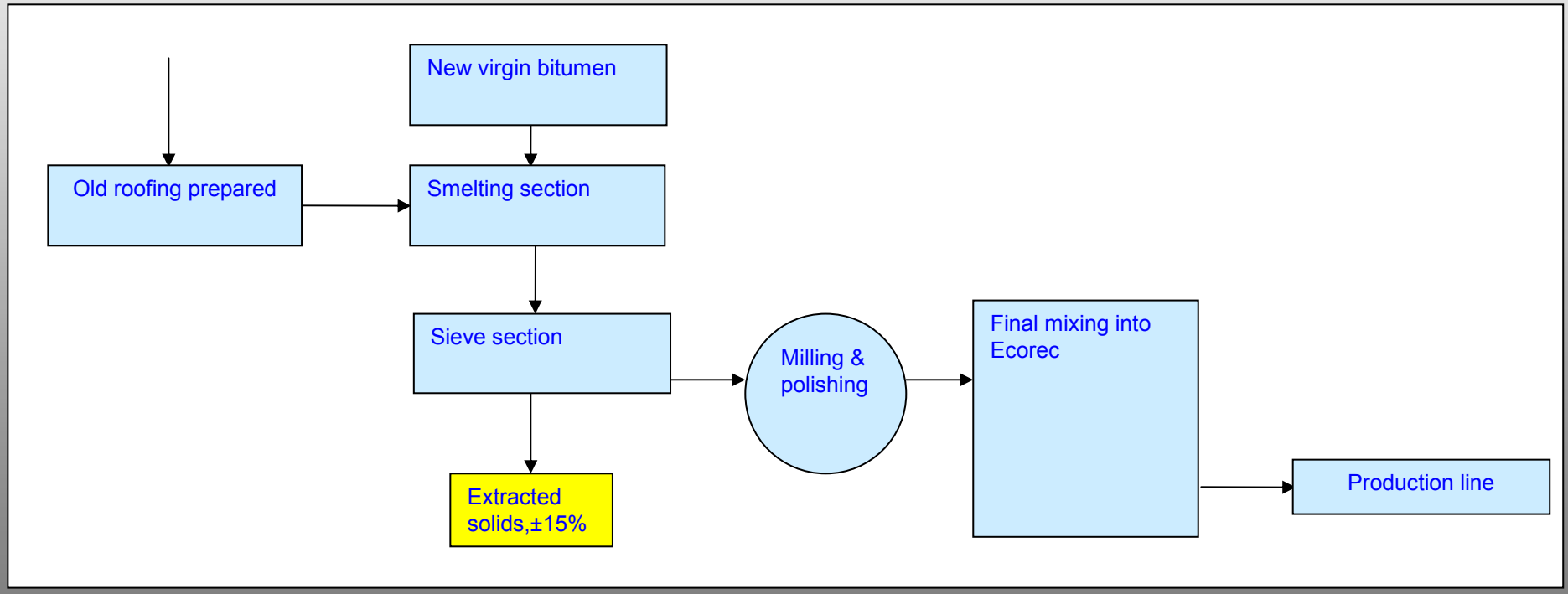

Sieving – Extracted Solids

BiELSo Processing Steps

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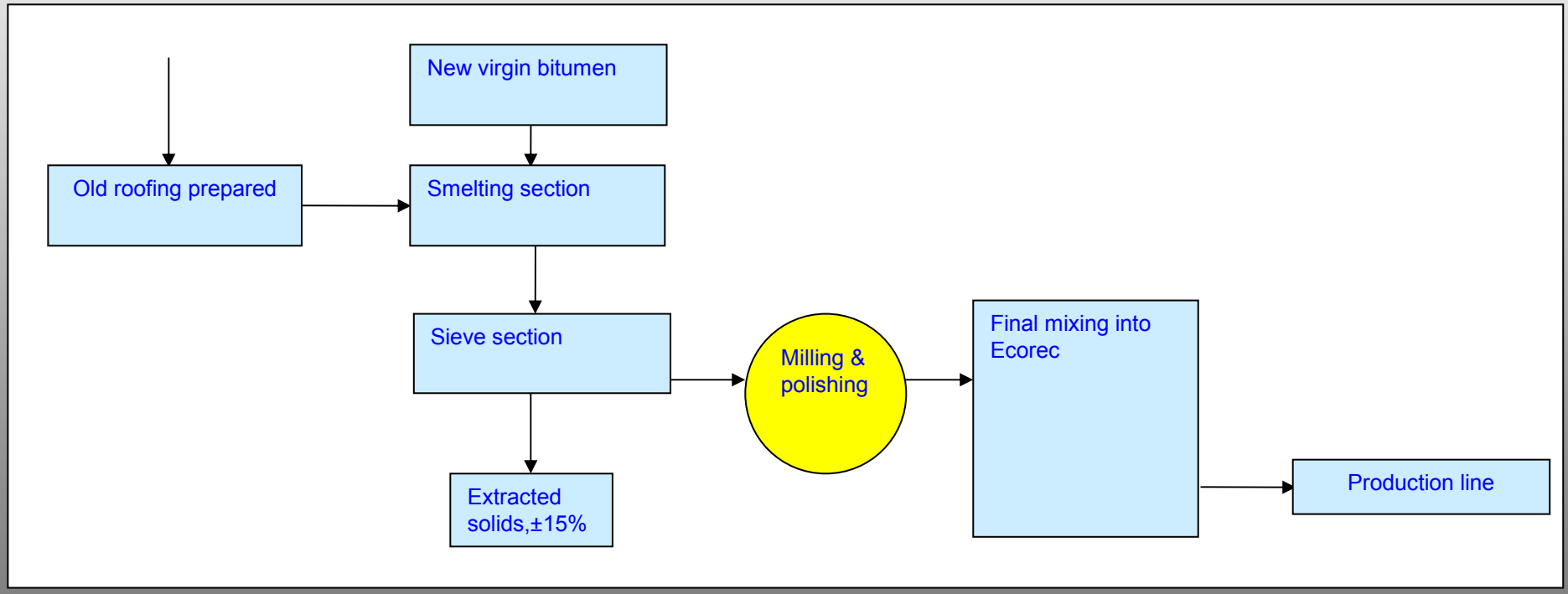
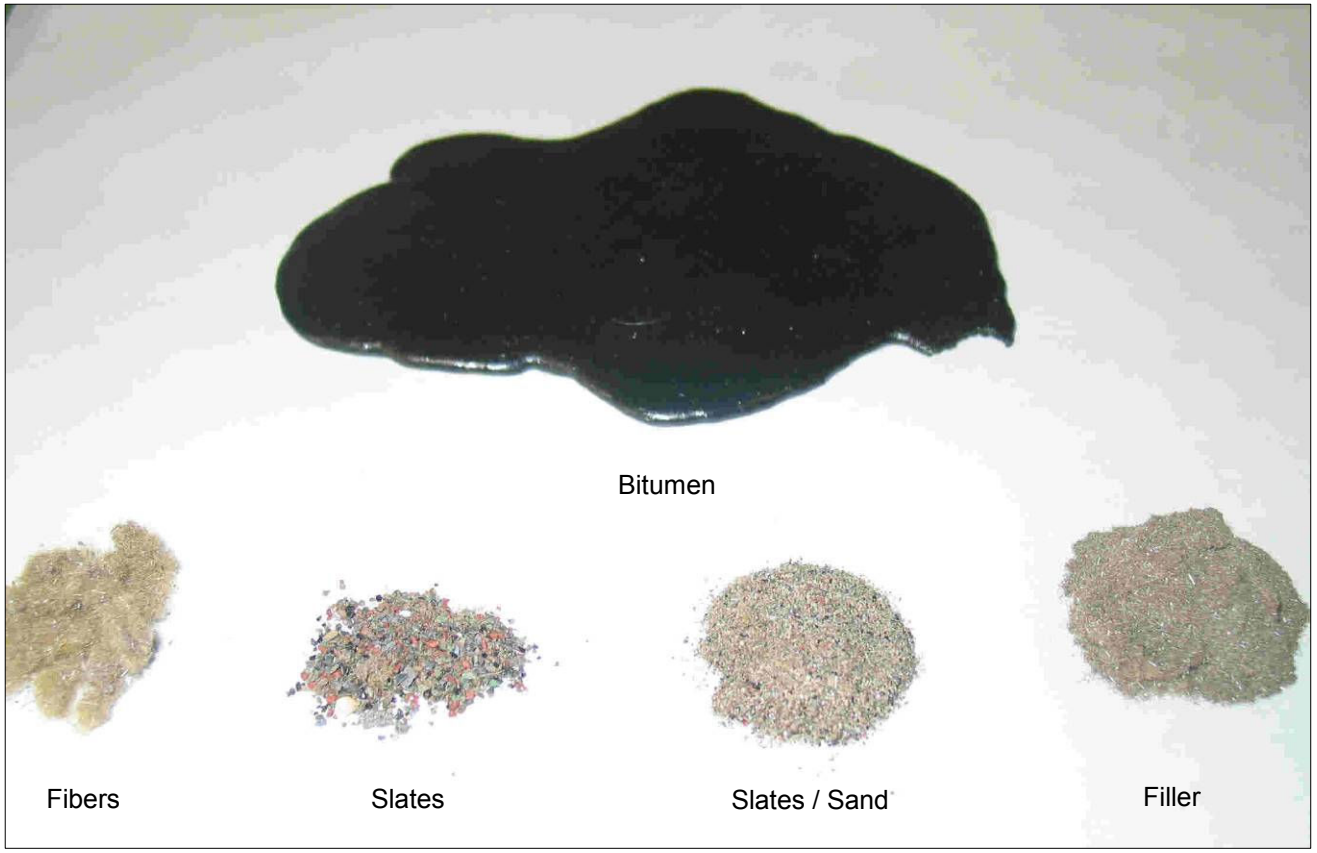


Composition Ecorec Bitumen



Techniques

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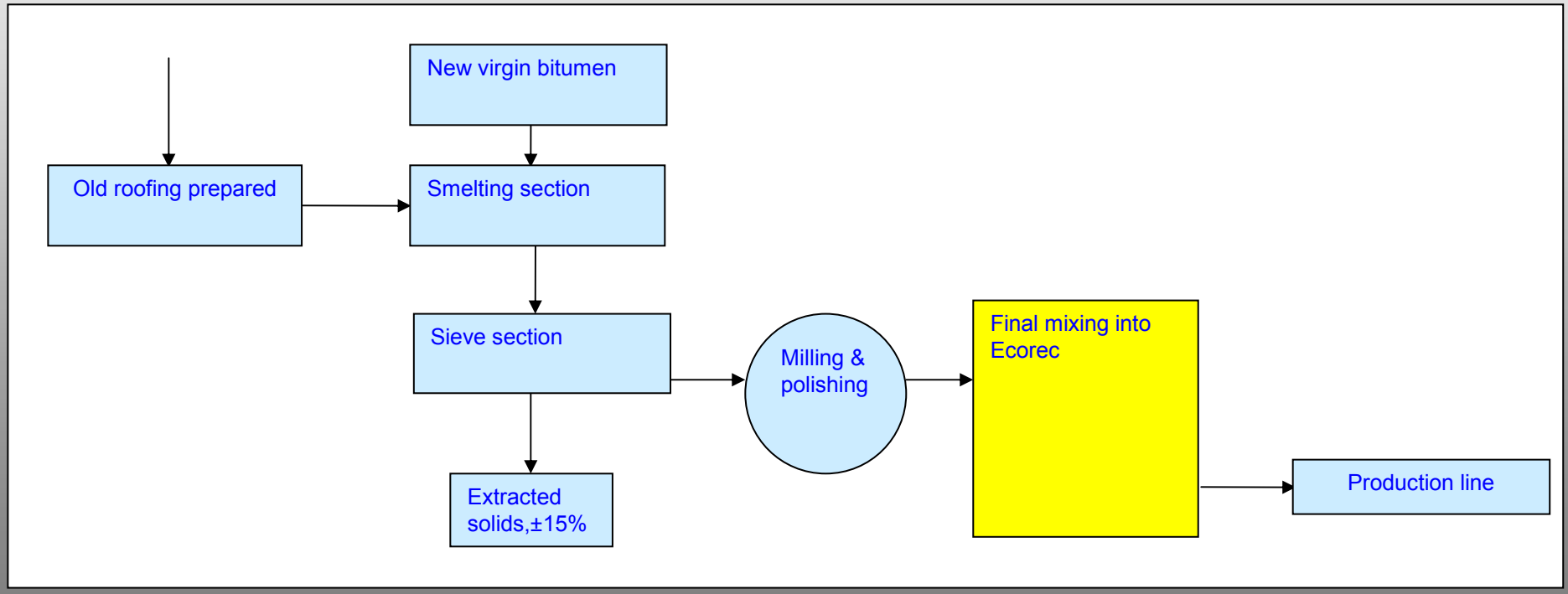
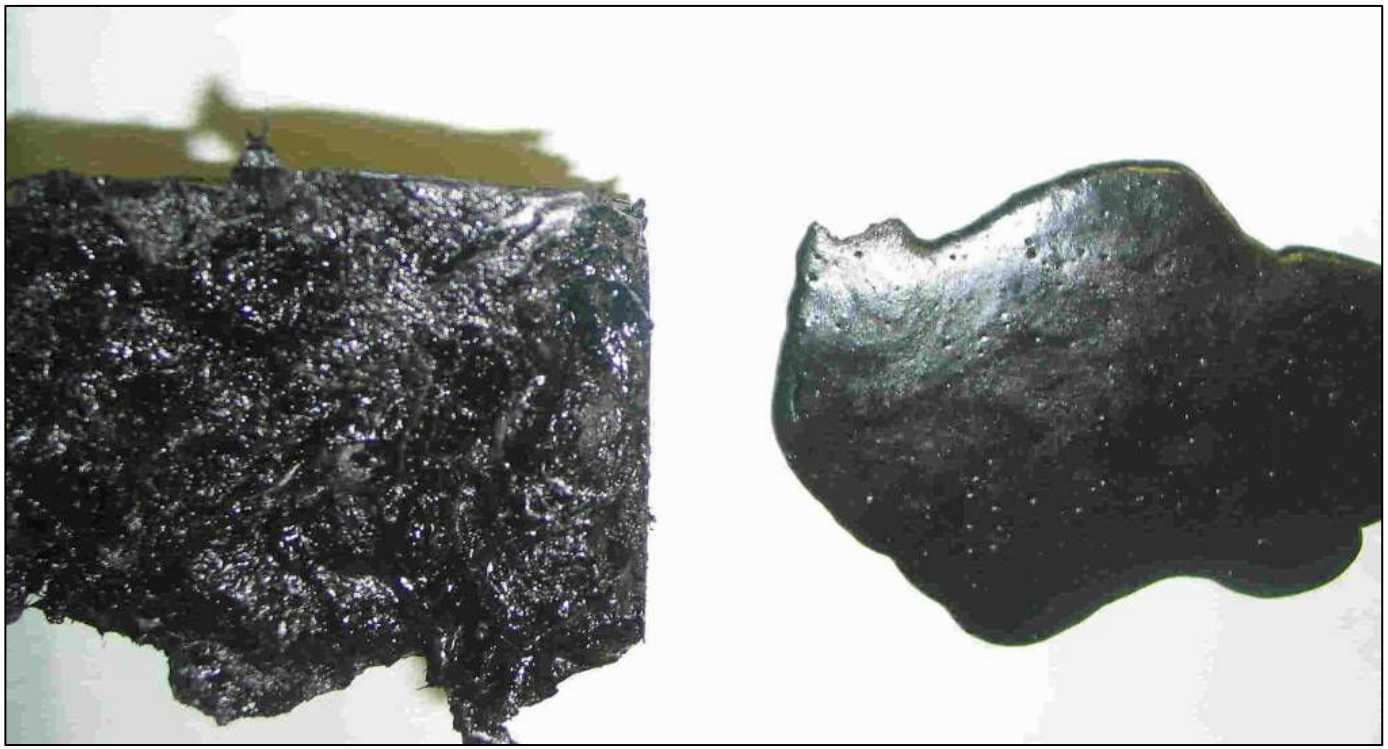


Properties Ecorec



Molten waste

Ecorec before use in production

Techniques

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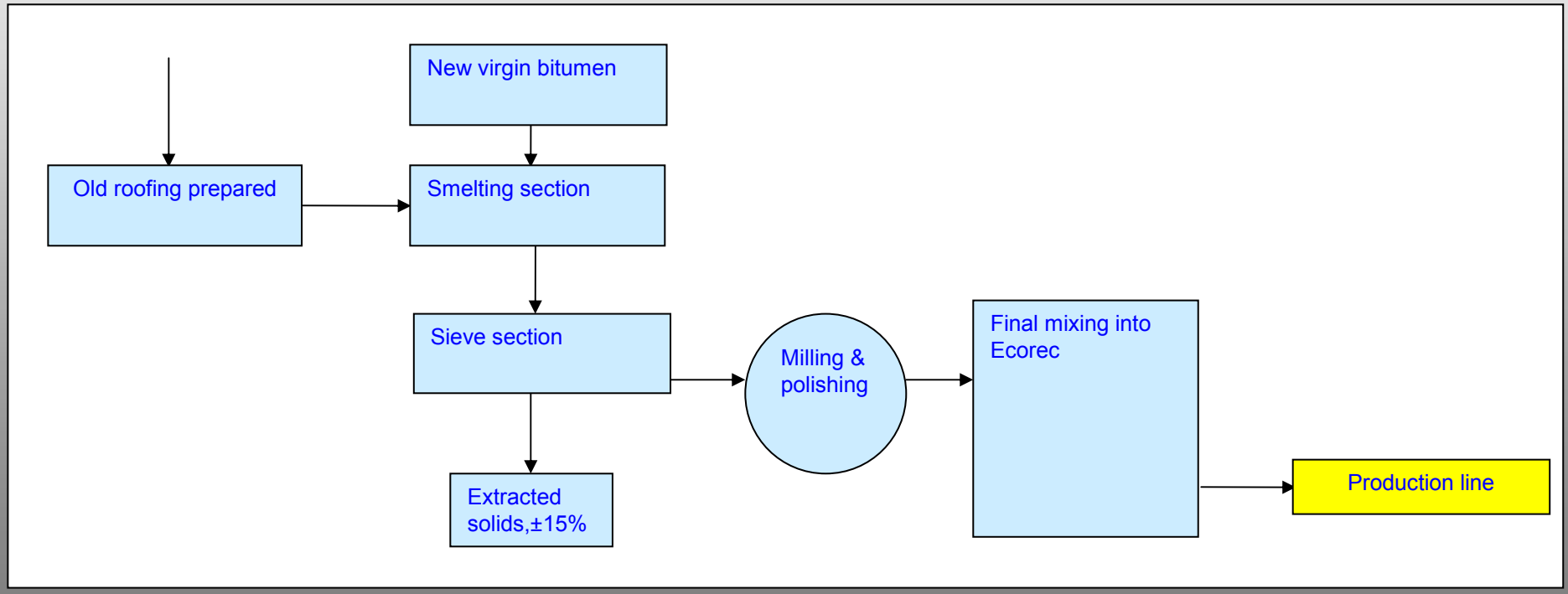
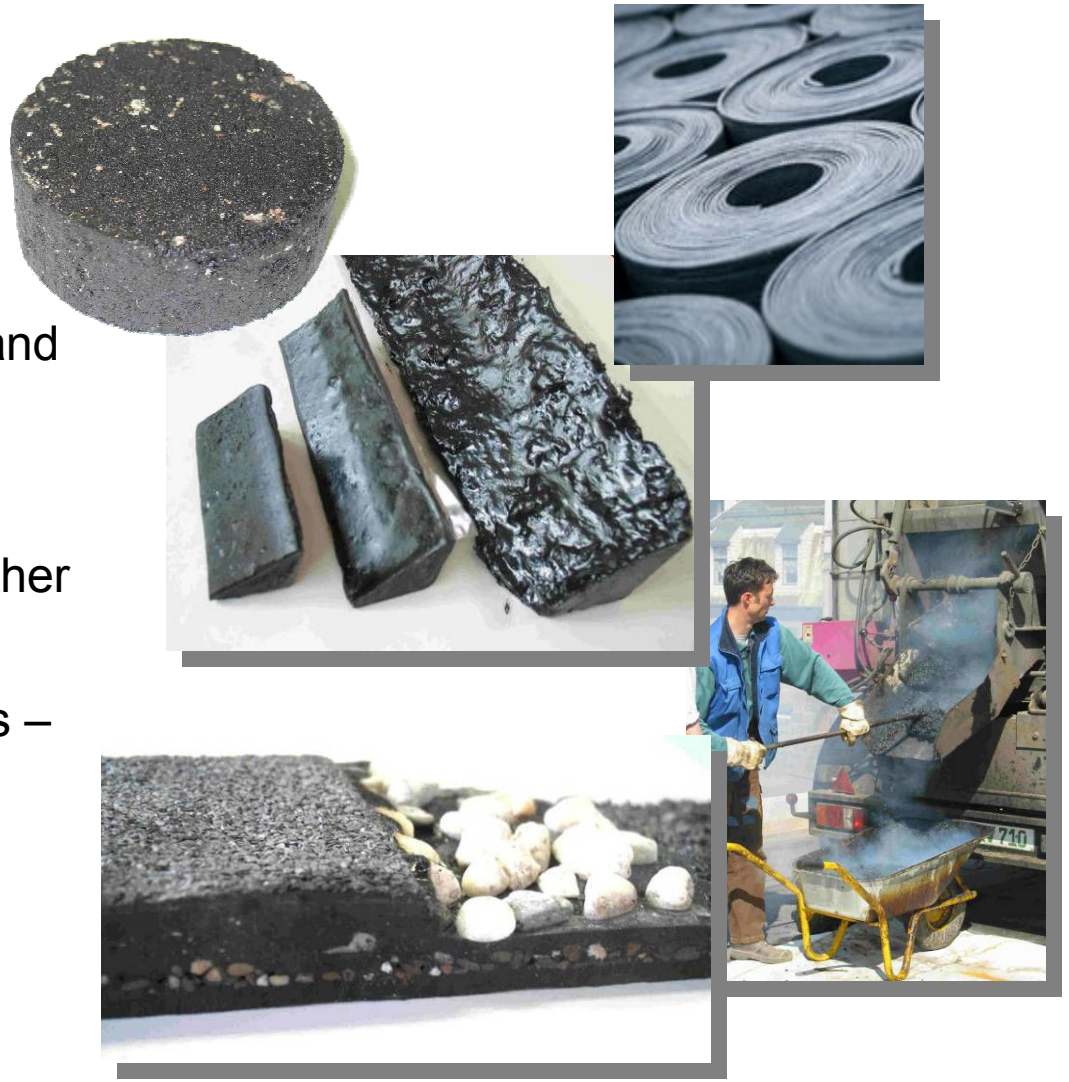


Applications Ecorec Binder

Possible applications:

- Roofing – oxidized felts.
- Roofing – APP felts.
- Roof ashesives, cements, and mastics – asphalt binder.
- Roofing – block bitumen.
- Roofing – cant strips and other fillett products.
- Road construction materials – binders and pellets.



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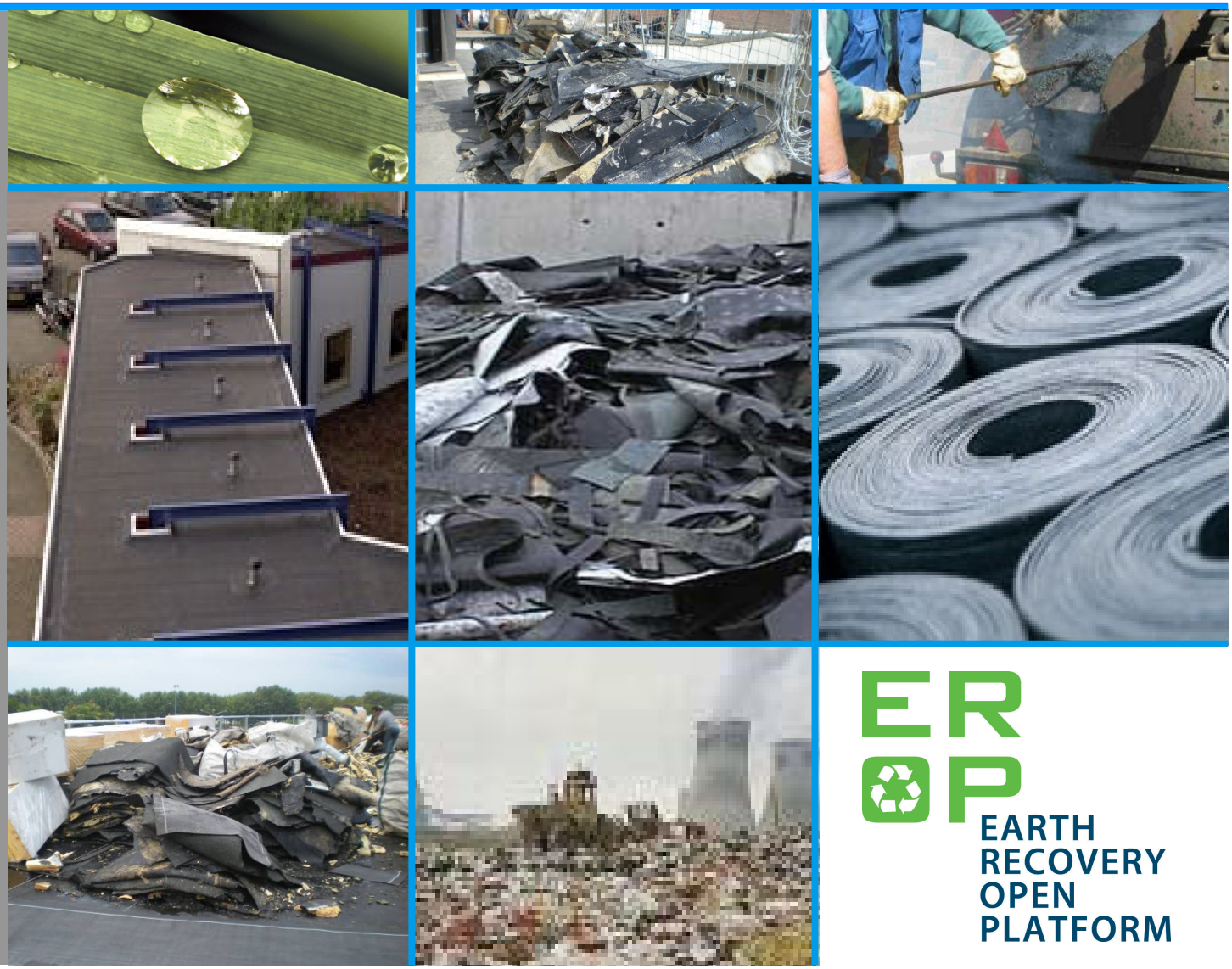

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