Recycling of passenger- and light commercial vehicles

Case study the Netherlands

Pieter Kuiper

Prometia – 9th Scientific Seminar Barcelona

© ARN, 1 december 2022

ARN Auto Recycling Nederland

Legislation

- EPR: Extended Producer Responsibility.
- 85%/95%
- The Netherlands: ARN - vehicles
- Take back of starter batteries and propulsion batteries (both hybrid and BEV): ARN - batteries
- Joining ARN – batteries (collective): managing of EPR battery responsibilities.

Structure of ARN

- ARN, Auto Recycling Nederland, established in 1995 by four organisations from automobile industry – all in our board

ELV Directive / Bba

1

ARN’s recycling system

1. A finance system
2. A stimulus for all operators in the ELV chain
3. A stimulus for the last owner of a vehicle
4. A monitoring body

1. Successful finance system

Recycling fee is paid at first registration of a car in the Netherlands

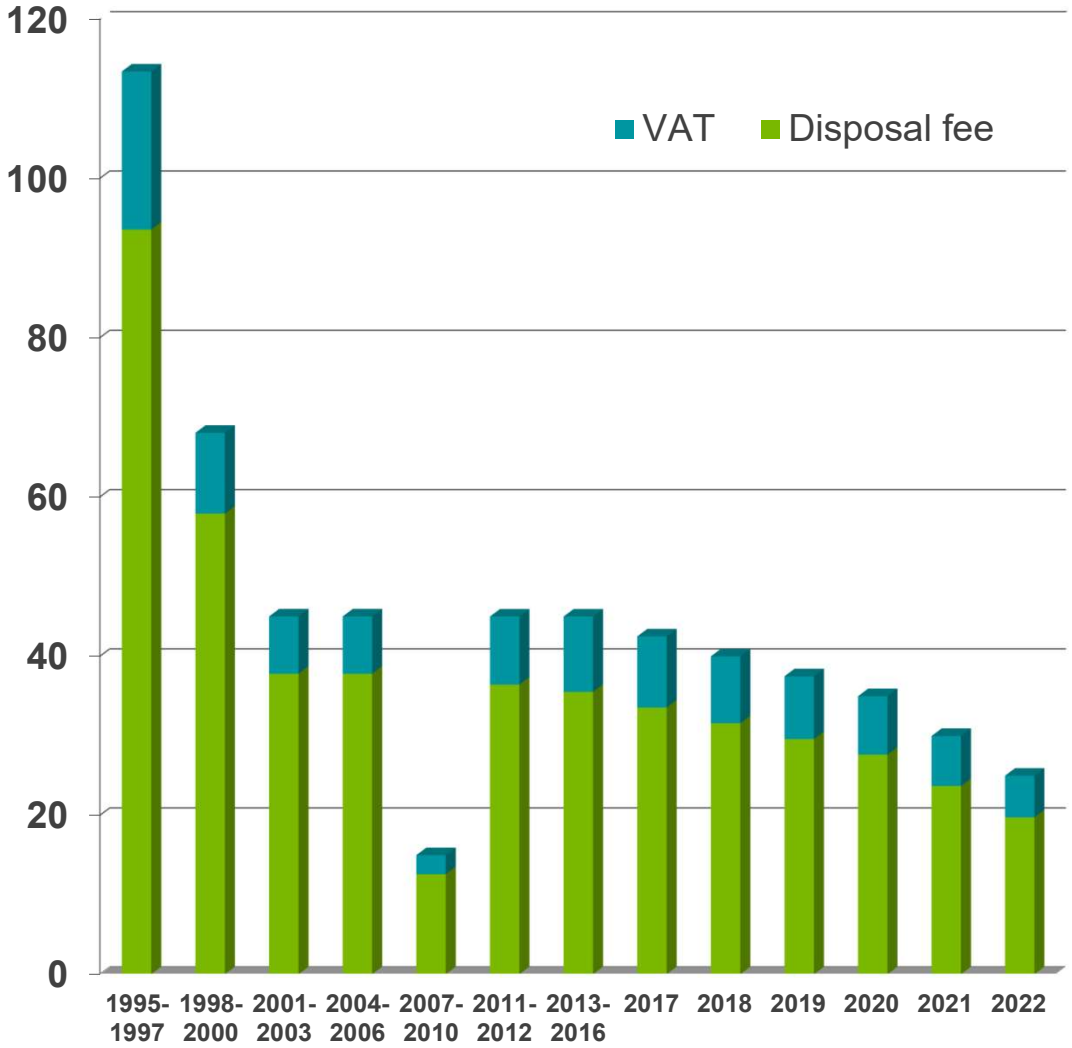
→ € 25,00 (incl.21% VAT) in 2022

Fee does not reflect actual recycling cost per car

Equal for all brands

Invoiced to importers by ARN

Payment obligatory for new and used cars entering Dutch market since 01-01-2021



2. Stimuli for operators

Transportation companies and recycling companies are being paid for the work they do.

Car dismantling companies:

- ARN takes care of collection and treatment of hazardous materials and tires
- ARN pays administrative fee for the information
- ARN pays quality audits

Quantity and quality of the recycling activities are checked by ARN's account managers 'in the field'

ARN covers ASR processing cost (PST) of shredding companies

3a. De-registration as stimulus for last owner

De-registration stops the ownership and tax- and insurance obligation of the last owner:

- Linked to road tax
- Only possible with certificate of disposal
- Only possible with special RDW license and environmental permit

All contracted dismantling companies have online connection to RDW

De-registration is the moment where ARN takes over following the car from the government

The de-registered mass is one of the sides of the recycling mass balance.

RDW

Vrijwaringsbewijs

Met blokletters invullen
Dit vrijwaringsbewijs is alleen geldig indien het volledig ingevuld is
U dient het vrijwaringsbewijs zorgvuldig te bewaren!

Hierbij verklaart ondergetekende dat het voertuig met het

Kenteken

bij de RDW in bedrijfsvoorraad van ondergenoemd bedrijf is aangemeld. De door de RDW gemelde datum en tijd van registratie zijn die, welke genoemd zijn in de ondertekening van deze verklaring.

Bedrijfsnaam

Straat

Huisnummer Toevoeging

Postcode

Vestigingsplaats

Bedrijfsnummer

Door de RDW is teruggemeld als

Transactiecode

Datum Uur en minuten

Vrijwaringsbewijsnummer

Handtekening P OOOOOO

Rijkseigendom: iedere eigenmachtige aanvulling of verandering in dit bewijs is verboden!
Auteursrecht: Staat der Nederlanden

Postbus 30000
9640 RA Veendam
Telefoon 0900 07 39 (€ 0,10 p/m)

3 E 0315f

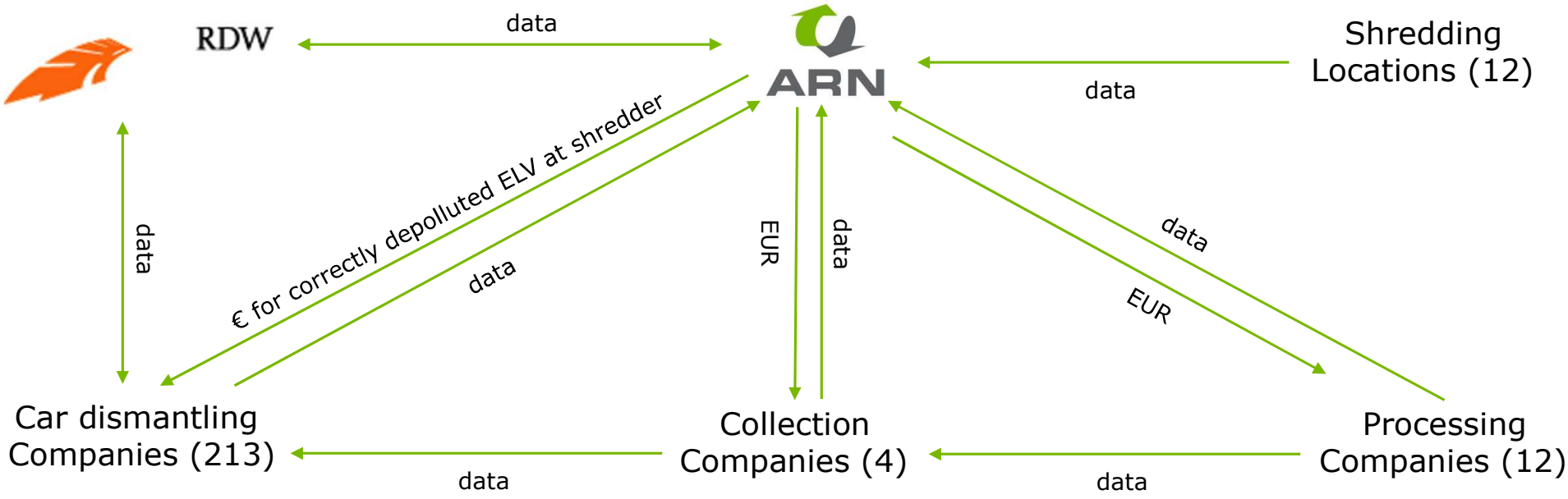
ARN Auto Recycling Nederland

3b. Registration in the Netherlands

- Unique connection between license and vehicle
  - Traceability
  - An existing car without license plate is **not** possible
  - An existing car without owner is **not** possible

- Ownership tax
  - As long as there is a private owner of a car, tax is paid
  - Enforcement by tax authorities, based on RDW information
  - Incentive for last owner to bring/sell car to ATF/trader

4. Monitoring system



Reporting

- Reporting the compliance with the legal framework of the End-of-Life Vehicle (Management) Decree (2000/53, in Dutch: Bba) and the Decree on Management of Battery and Electric Accumulators (Bbb)
- Bba: report a new, worthwhile and sustainable purpose of > 95% of the weight of scrapped cars
  → mass balance
  → one hand: deregistered mass
  → other hand: all materials, final applications, classification

- Reporting a high recycling percentage continuously improved by a decrease in CO_2 emissions and costs, realized with chain partners

Key figures the Netherlands (2015)

9,1 million cars
on the road

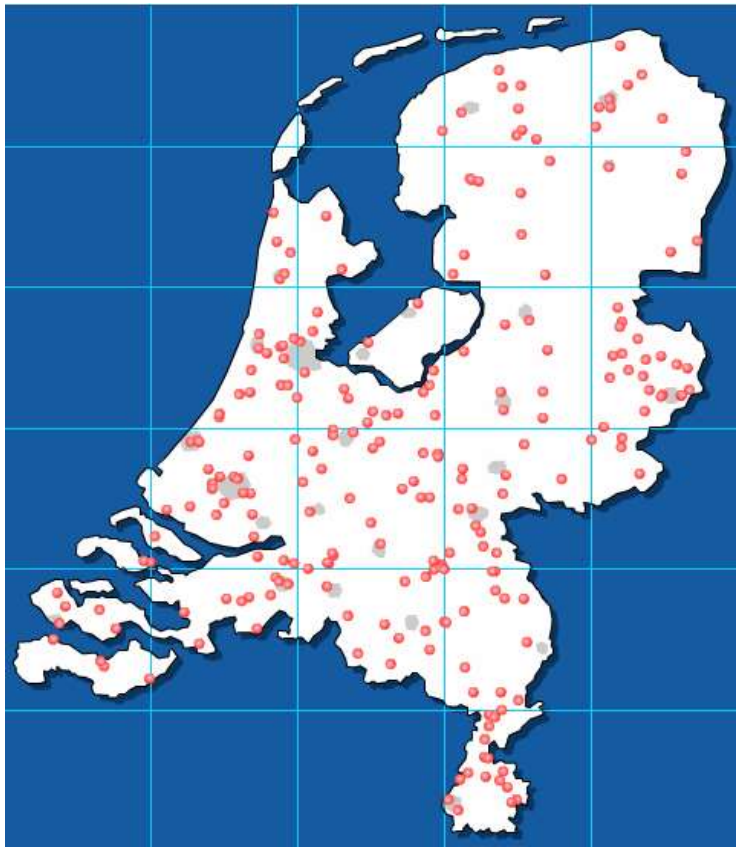
500.024 new
car registrations

150.731
imported cars

213.639 ELV's deregistered
Average age **18,1 years**

277.735 cars exported
Average age **12,3 years**

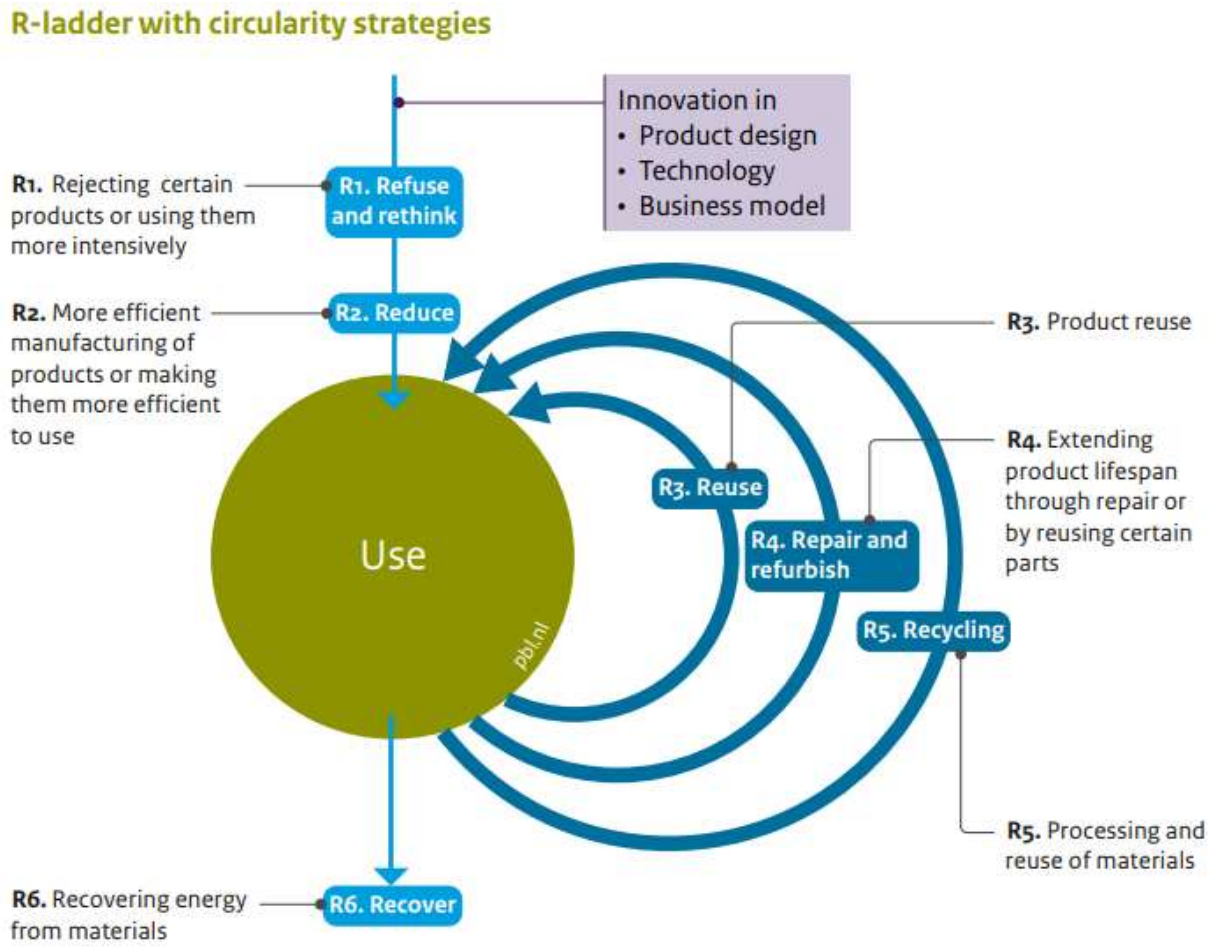
Current state of ARN's system



Operational	1995
ELVs processed since '95	> 5 million
ELVs ARN/ year	178,136 (2021)
Market share	80,6 %
Reuse, recovery, recycling	98,7 %
Legal quota R+R+R:	95 % (since 2015)
Recycling chain partners	283

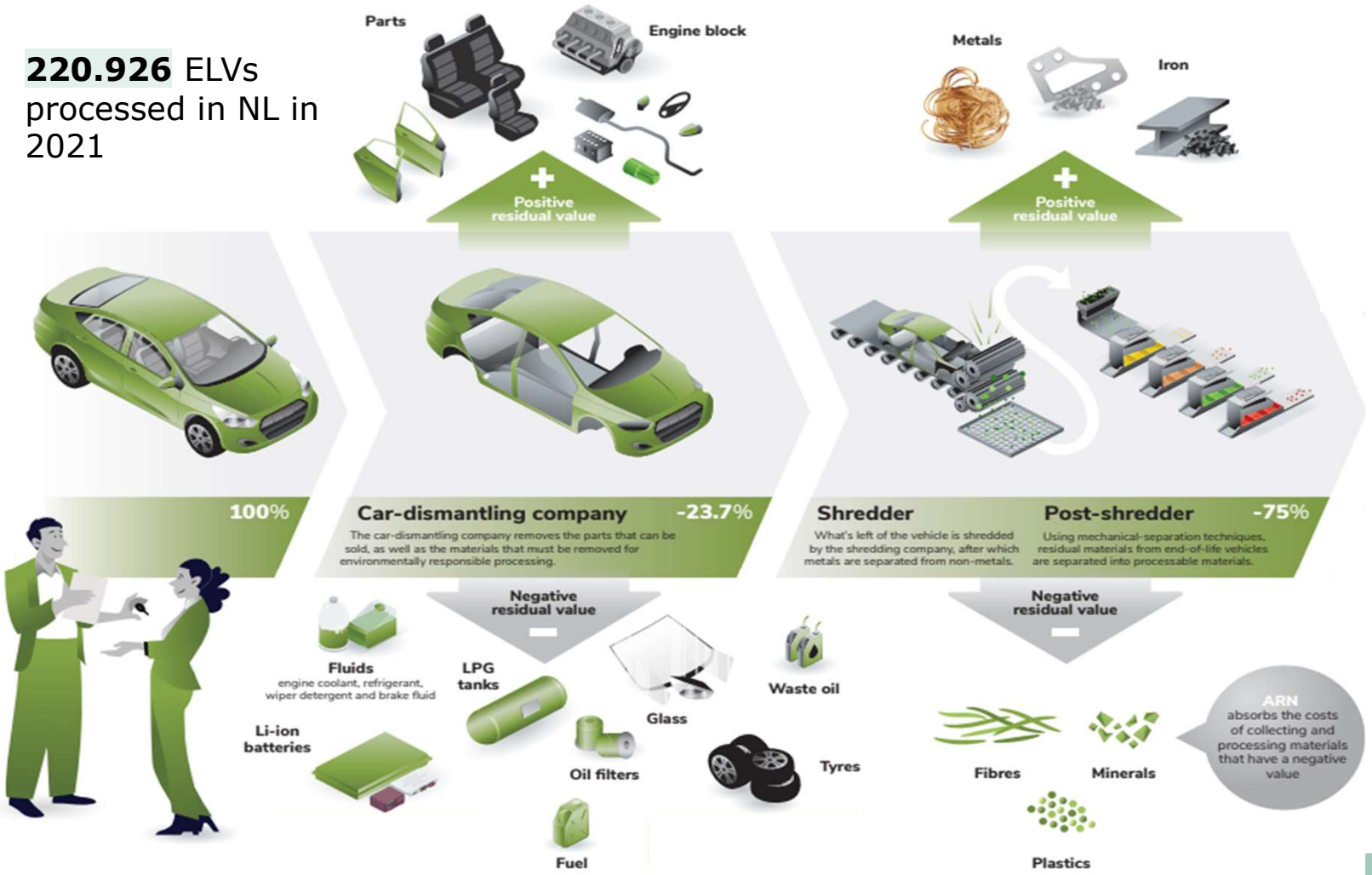
213 car dismantling companies
4 collection companies
12 processing companies
41 traders
12 shredding locations
1 post-shredder technology plant

R-ladder: different circularity strategies



Car recycling in the Netherlands

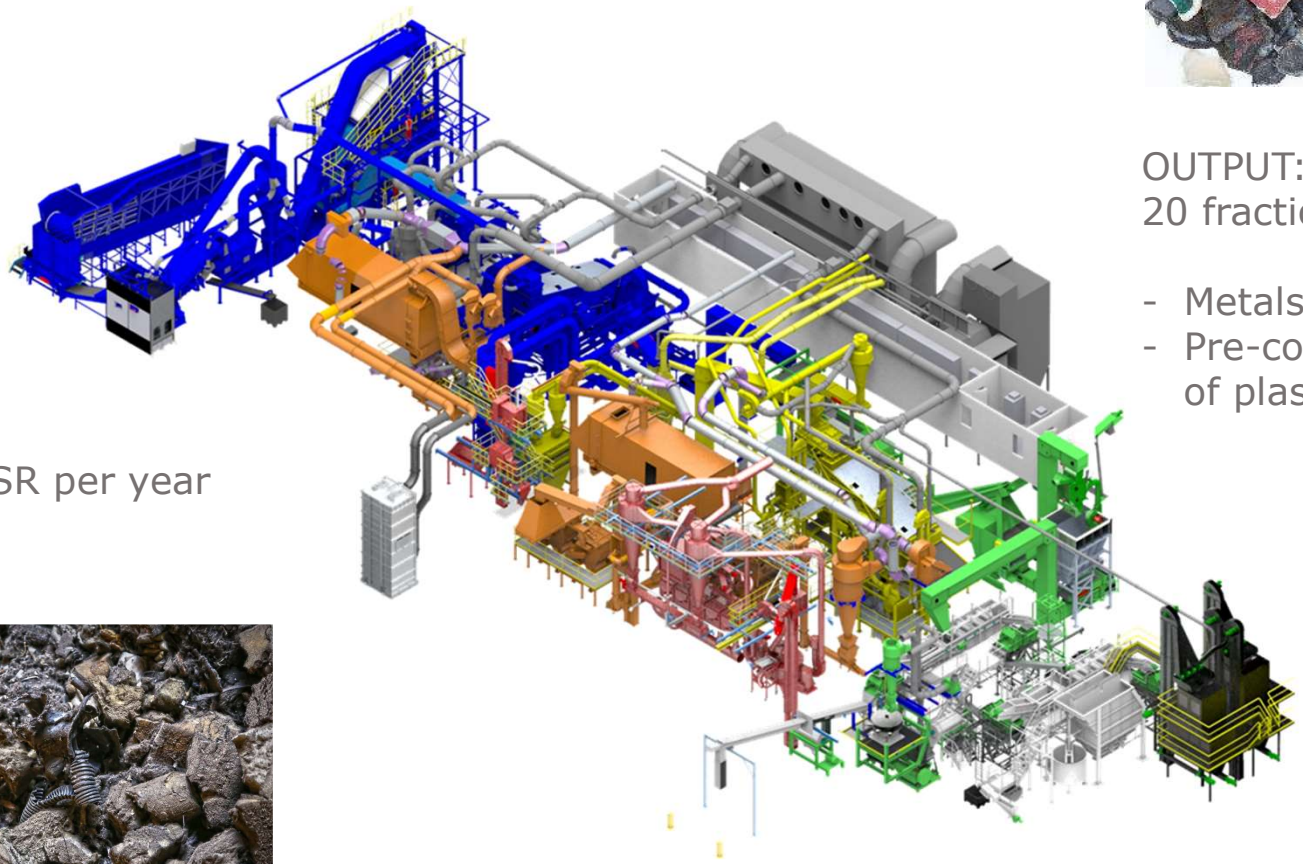
220.926 ELVs processed in NL in 2021



98.7 %

ARN Auto Recycling Nederland

Treatment of shredder residues



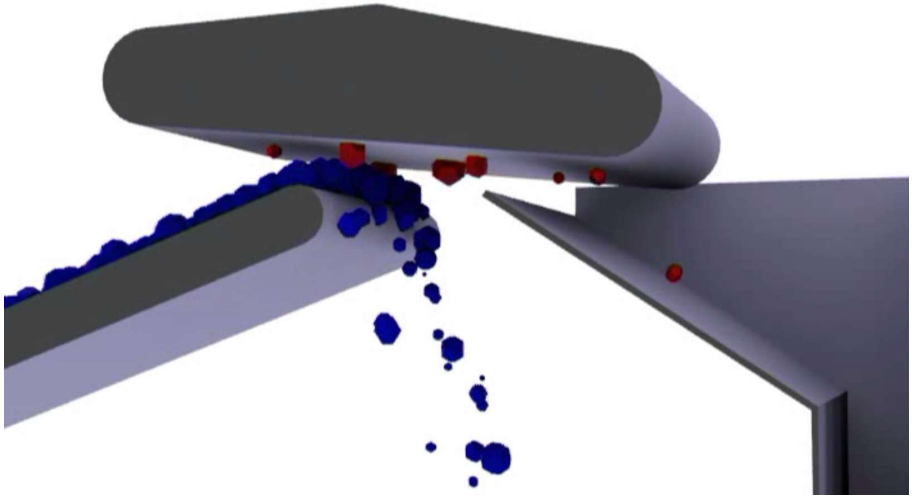
OUTPUT:
20 fractions

- Metals
- Pre-concentrates of plastic

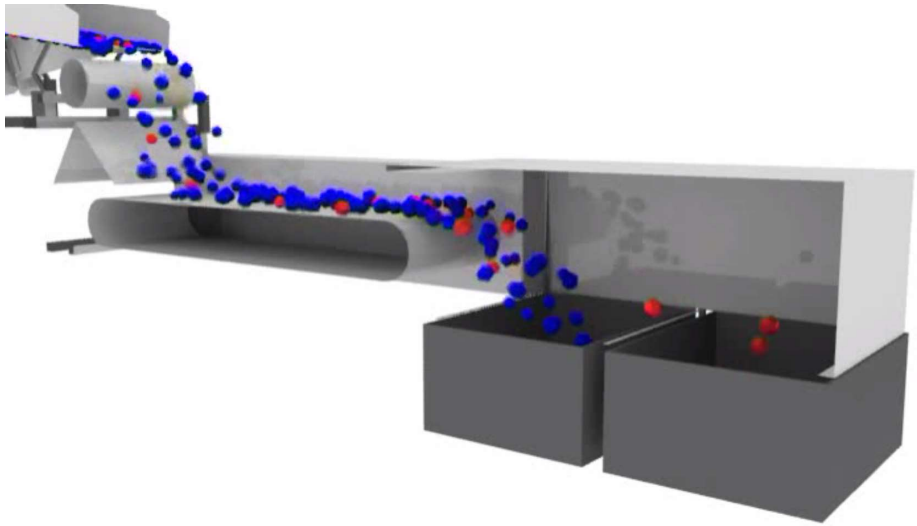
INPUT:
42 kton ASR per year

Metals - shredder residue particle separation based on material properties

Ferrous metals and non-ferrous metals / non metals → magnet



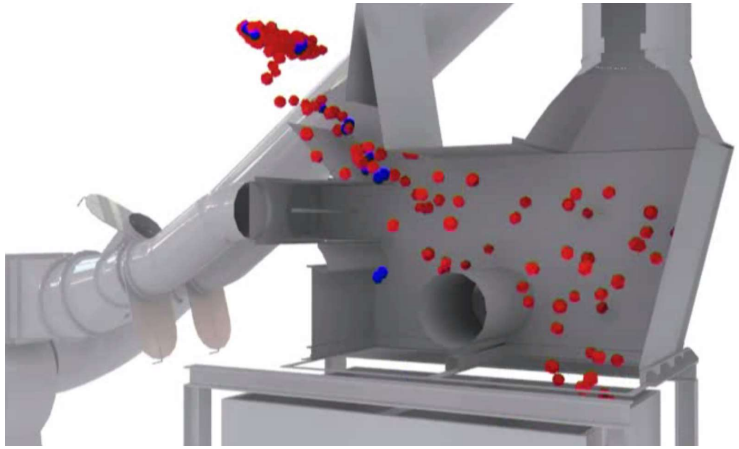
Non-ferrous metals and non-metals → eddy current separator

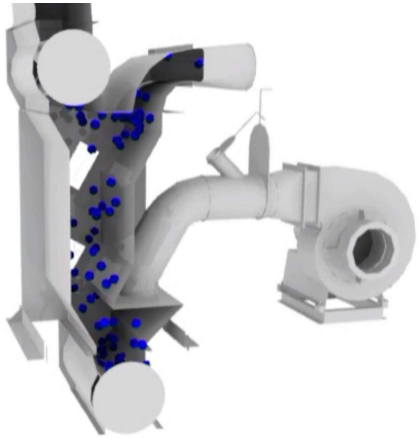


Density - shredder residue particle separation based on material properties

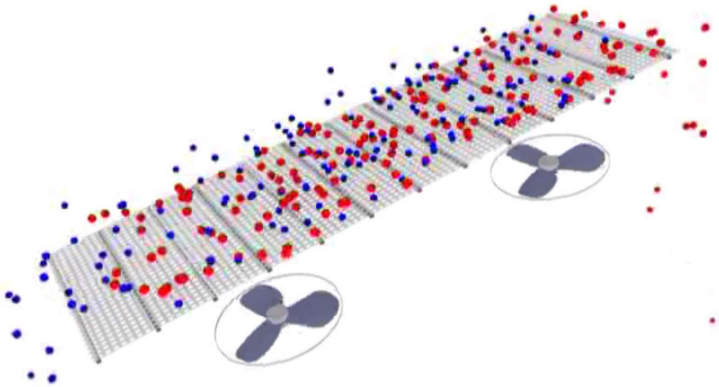
Separation by carefully set air flow

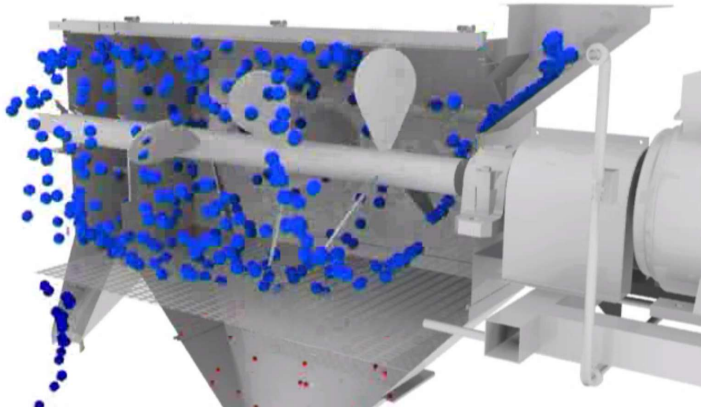
fibers	vs	minerals
fluffy and light	vs	small and heavy





Trenntisch



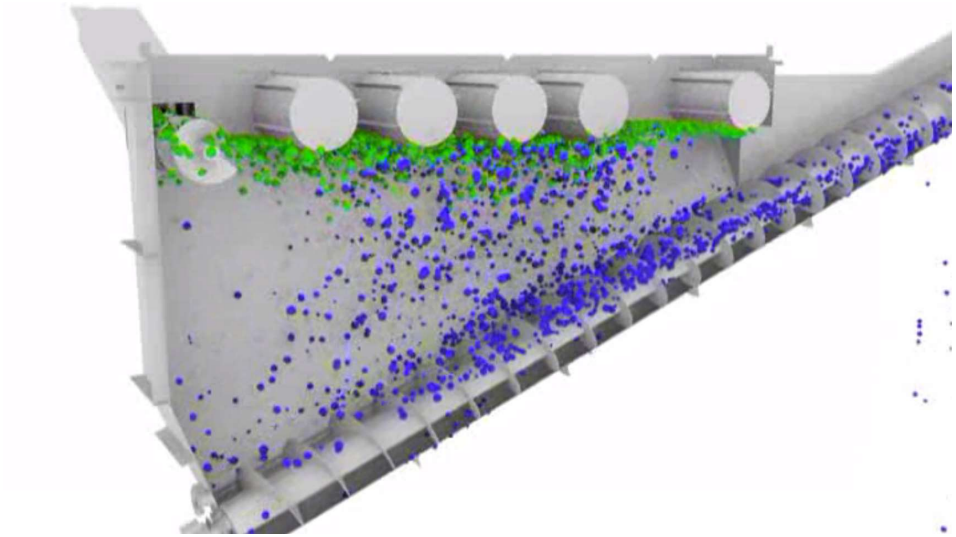


Density - shredder residue particle separation based on material properties

Separation of several types of plastics → two float-sink separators

Density:

< 1.1 kg/m^3	PP, PE, PS
1.1 – 1.3 kg/m^3	PC, PA, PVC
> 1.3 kg/m^3	PET, PVC



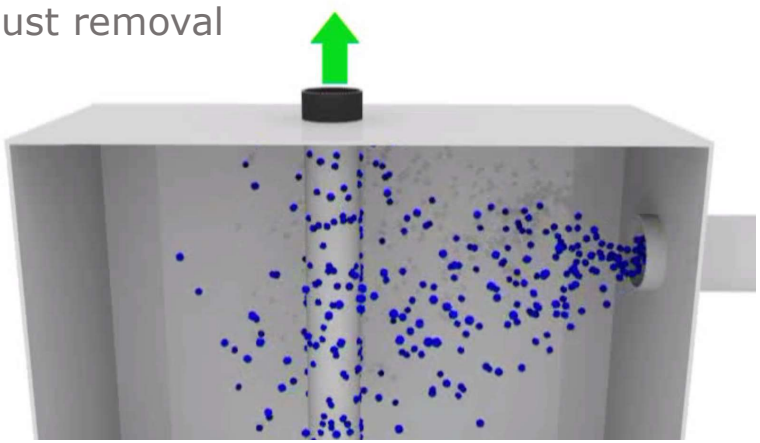
Size - shredder residue particle separation based on material properties

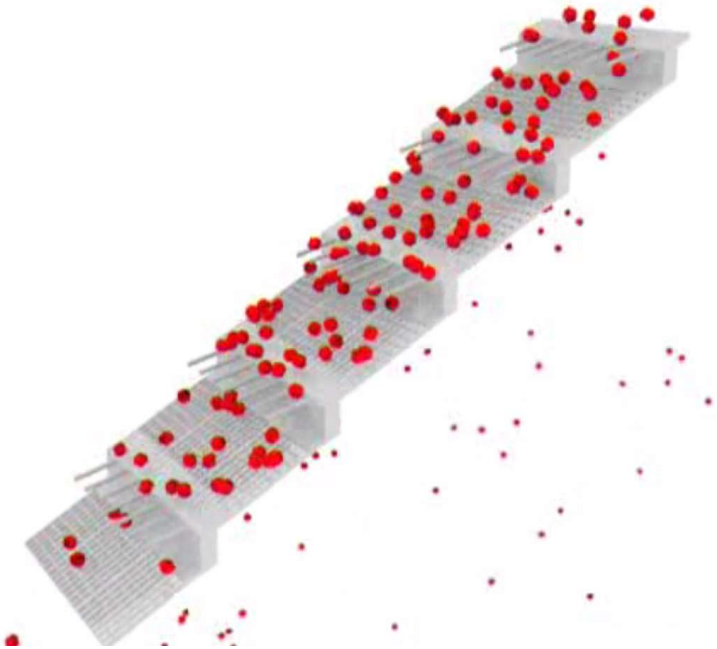
Separation minerals from plastics and fibers

Minerals and metals separated by brittleness and size

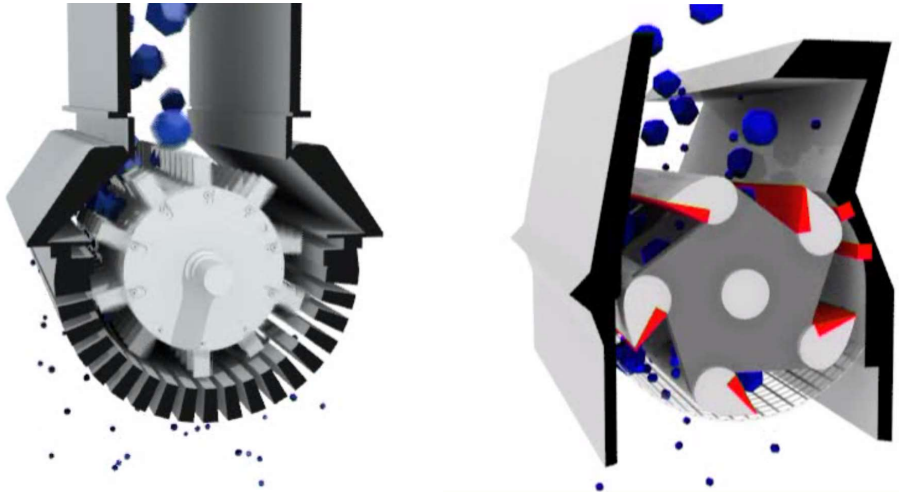
Separation of dust from fibers

Dust removal

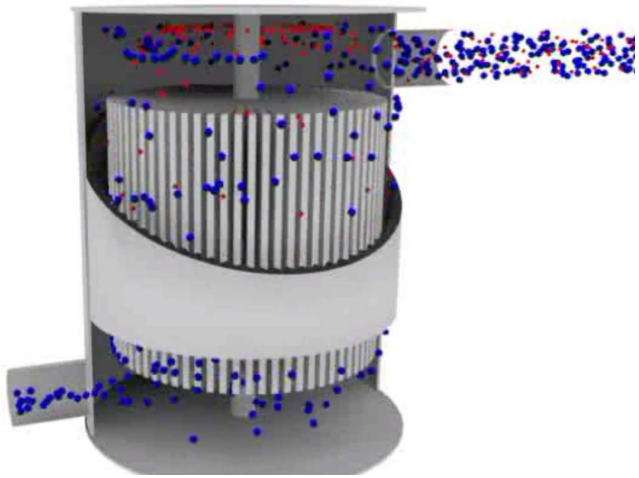




Changing material properties



Grinding of minerals



Reshaping copper wires from wires to balls

ARN facilitates: drainage installation for safe de-pollution

- Installations for removal of vehicle fluids
- Owned by ARN
- Located at recycling yards of ARN-contract partner companies (dismantler)
- Currently being given to dismantlers

Concrete contributions to the circular economy - 1

Manufacturers use our high-quality raw materials for sustainable semi-manufactured products, e.g.

- Aluminium by Roba Metals
- Plastics by Galloo Plastics
- Glycol by GS-Recycling

- Recycling materials form dismantlers like oil, washer fluid, coolant, etc.

Concrete contributions to the circular economy - 2

Timbering of banks:

- Life span of 40 years
- Circular, can be recycled 99% in the same product
- Price is competitive with wood

Sustainable score:

- Avoided CO_2 Eq: 22 ton per km
- Avoided lumber: 25 trees per km

Continuing change and development

Technology changes pose ongoing challenges

- New battery technology in cars
- Changing car composition
- Numerous new raw materials

ARN accepts these challenges and acts

- Initiated training in handling hybrid / BEV in 2013
- Since then, personnel of 200 of the 213 ATF's (dismantlers) trained
- Refunds the cost of E-related tools to ATF's investing in E-handling

Review ELV-Directive

IMPROVE Circularity

- Merge ELV-Directive and 3R (type approval) Directive, alignment with other regulations
- Obligations for recycling content in new products (eco-design/circularity)
- Specific recycling targets for materials such as plastics, metals, aluminium, CRMs?

INCREASE traceability

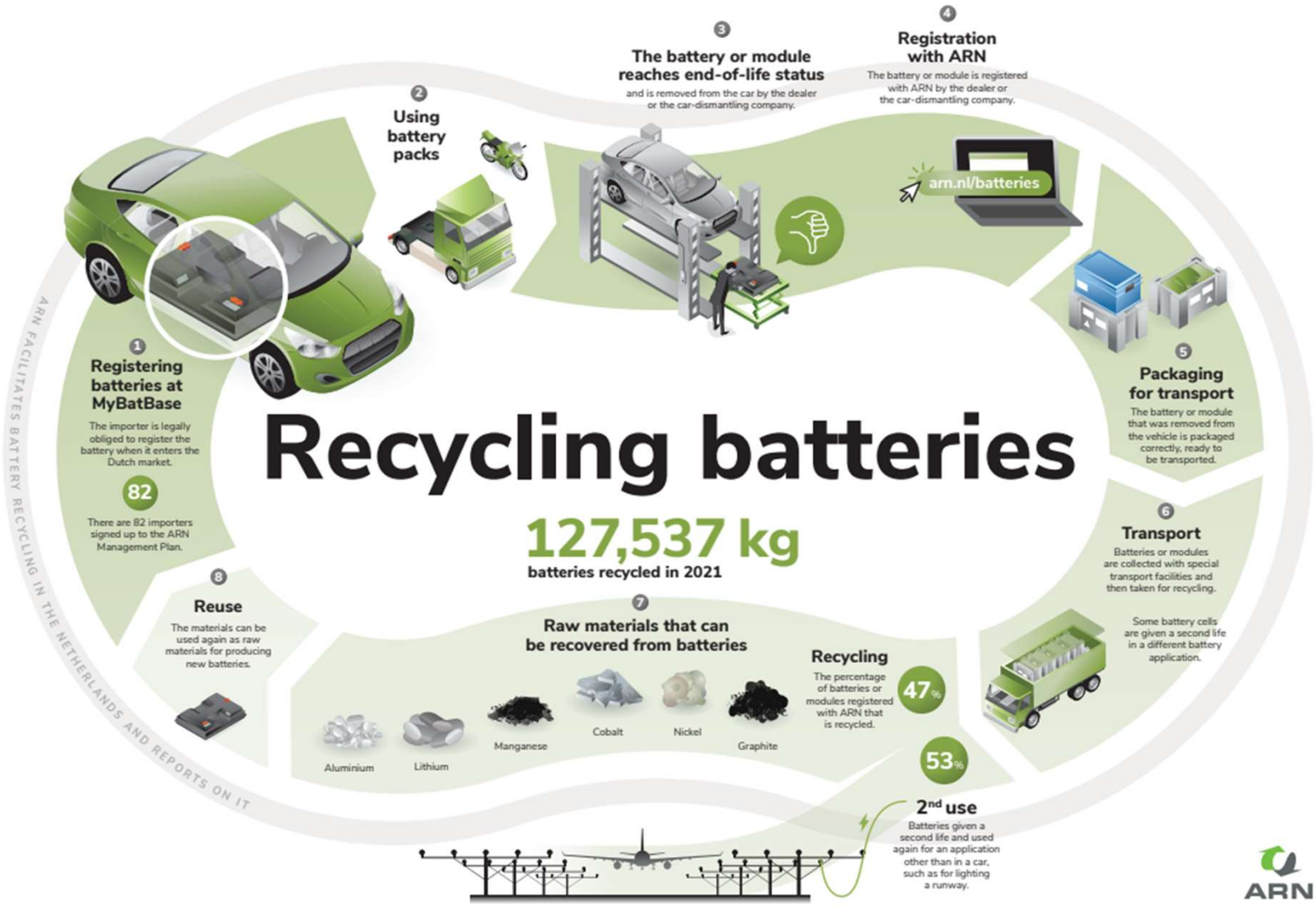
- Missing vehicles, improve exchange of information between EU MS
- Improve definitions and conditions
- Regulate export of cars
- Better enforcement

EXTEND scope

- motorbikes, trucks, busses?

Batteries

2



ARN Auto Recycling Nederland

ARN Management plan for batteries

- Set up in 2008 as program for all mobility products
- Since 2012 Li-Ion propulsion batteries entered the market in larger quantities

- **Participants automotive batteries:**

Cars, trucks, motorcycles, microcars, scooters, battery importers, wholesale

- **Participants industrial (propulsion/Li-ion) batteries:**

Cars, trucks, motorcycles, microcars (EV's)

  - Registration system for Put-on-market
  - Payment recycling fee depending on the weight of the battery (€3 - €65)
  - 70% of all EV's Put-on-Market participate collective system
  - Collection & recycling batteries
  - Training, education & communication

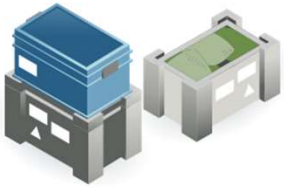
Battery recycling in practice

1
REGISTRATION WITH ARN

The battery or module is registeredby the dealer or car-dismantling company.

2
PACKAGING FOR TRANSPORT

The battery or module that was removed from the vehicle is packaged correctly, ready to be transported.



3
TRANSPORT

Batteries or modules are collected with special transport facilities and then taken for recycling.

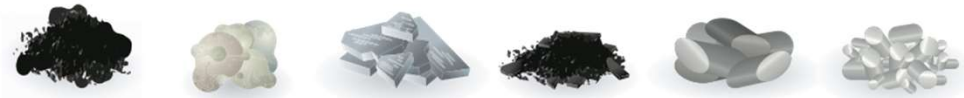
Some battery cells are given a second life in a different battery application.

4
RECYCLING

The percentage of batteries or modules registered with ARN that is recycled.

47%

RAW MATERIALS THAT CAN BE RECOVERED FROM BATTERIES

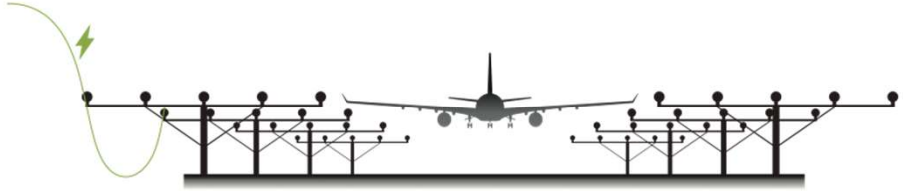


Graphite | Nickel | Cobalt | Manganese | Lithium | Aluminium

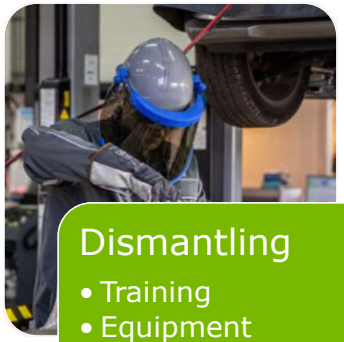
2nd USE

Batteries given a second life and used again for an application other than in a car such as for lighting a runway.

53%



Battery recycling chain



Dismantling

- Training
- Equipment
- Safety
- Storage
- Certificate for EV dismantling soon available

Collection

- Classification
- Packaging ADR
- Storage

2nd Use

- Business case
- Quality/warranty
- Legal transfer of responsibility

Recycling

- Capacity in EU
- Different chemistries
- Export
- Purity output fractions

Dismantling - battery out of the car

- 98% from still driving cars – 2% EOL
- Training EV dismantling
- Certification program on EV dismantling
- Classification training
- Support ATFs with starter set dismantling

Intensive training and coaching

"Such a battery should not enter the shredder as part of the hulk"

Rob van der Linden

ARN

Questions?

At ARN, we believe that car recycling contributes to the circular economy

Driving force behind the Dutch car recycling chain

Ir. P.C. Kuiper
Pieter.Kuiper@arn.nl

De Corridor 5, 3621 ZA Breukelen, the Netherlands
P.O. Box 190, 3620 AD Breukelen, the Netherlands
Tel: +31 346 728 229 | Cell: +31 6 29 56 58 00