

CE4CE Circularity Compass & Knowledge Platform introduction

CE4CE

TROLLEY:MOTION ZERO-EMISSION BUS CONFERENCE

23rd October 2024, Prague

Marta Woronowicz, trolley:motion

WHY DO WE NEED TO SHIFT TO CIRCULAR ECONOMY IN TRANSPORT?



The road transport sector is energy-intensive

- The most significant energy consumer in the European Union – about **33%** in 2019



Transport is resource-intensive

- Roughly **12%** of steel produced worldwide
- Approx **70%** of natural rubber production worldwide
- Approx **23%** of aluminium worldwide



The increasing trend to e-mobility - especially private - will demand more energy, raw materials and critical raw materials by 2030

- **10%** expected demand energy increase (in the EU) compared to 2018
- **60%** lithium, **30%** cobalt, **10%** nickel just for EV batteries worldwide
- Demand is expected to be **5 -10** times higher compared to 2018

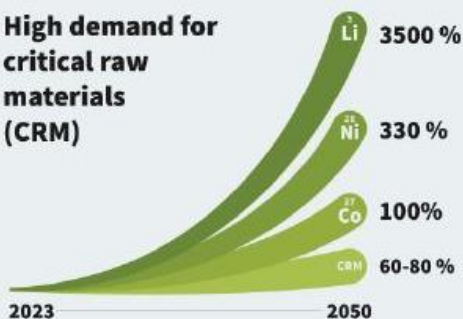


The transport sector is carbon-intensive

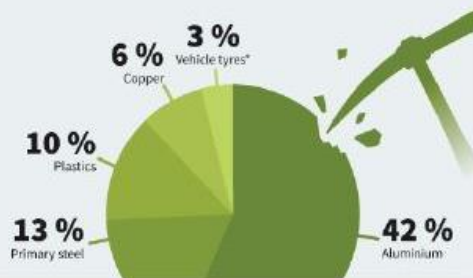
Responsible for as much as **25%** of total EU GHG emissions

**A journey to
carbon neutrality
in transport
demands
a modal,
awareness and
production-
consumption
patterns shift**

High demand for critical raw materials (CRM)



High demand for raw materials



The real ecological footprint of the road transport sector

Tailpipe emissions are not the whole story

The road transport sector is responsible for about a

QUARTER

of the total **CO₂** emissions in the EU

High demand for energy

About **33%** of total demand in the EU in 2019



Electrification is no silver bullet

Embedded GHG emissions:

50-60% of an EV's

Compared to

10% for combustion cars (T&E).

Only (or less)

25%

primary steel

19%

plastic

30%

cement

8%

CRM

is recycled

Embedded emissions are becoming the **next frontier in our battle against climate change**

WHY CIRCULAR ECONOMY IN PUBLIC TRANSPORT?



Public transport is the backbone of sustainable mobility

- Generally, a **modal shift** to public transport can **cut back tailpipe emissions** (scope 1) by **50-70 %**
- Further significant reductions can be achieved by **shifting to renewable energy** (scope 2) and by **addressing emissions along the whole value chain** (scope 3)
- Just as with electrification and automation, **Public Transport is a pioneer and leads by example as concerns the incorporation of circularity principles**. It is thus at the **forefront of innovation and experimentation** that leads to general **policy and market transformation**

But how do we incorporate circularity in public transport?

We came up with the **CIRCULARITY COMPASS** – an easy-entry orientation tool to foster circularity throughout the entire public transport life-cycle value chain

It is a **cradle-to-grave** concept framework that supports incorporating the circular mindset, principles, and solutions throughout the public transport value chain to take stakeholders from “**take-use-throw**” to “**avoid-extend-transform-enable**”.

This approach is applied to four PT pillars:

- Fleets
- Infrastructure
- Energy
- Governance (cross-cutting)



THE CIRCULARITY COMPASS

Four building blocks



Vehicles

Self-propelled machines are designed to carry passengers between different locations (buses, trolleybuses, trams, and trains).

Circular vehicles are equipped with energy-efficient technologies and alternative propulsion systems, and are designed for durability, reparability, and recyclability.

Subcategories

- Vehicles
- Batteries



Infrastructure

Underlying system of built and fixed structures, installations and facilities that support public transport operational activities.

Circular infrastructures maximise resource efficiency, prioritize the use, reuse, and recovery of low-carbon and high-quality materials, and are designed for durability and disassembly.

Subcategories

- Railway infrastructure
- Electric Infrastructure
- Buildings



Energy

Fuels (with a particular emphasis on electricity) employed to generate the power, heat, or electricity essential for conducting public transportation activities and operations.

Circular public transport systems are powered by renewable energy, and their use is optimized throughout the lifecycle of processes and operations.



Governance

System of policies, structures, processes, institutions, and mechanisms that guide decision-making, promote stakeholder management and facilitate the transition to a circular economic model.

This section encompasses multi-level policy and planning, knowledge and collaboration, monitoring and evaluation and funding and financing.

Illustrated by the Circularity Compass, how could circularity in public transport look like in a nutshell referring to more circular use of:
VEHICLES, ENERGY and INFRASTRUCTURE?

INITIAL LIFE CYCLE STAGE

In circular public transport systems, **avoidance** is paramount, aiming to **minimize unnecessary resource extraction**. Thus, **refrain and resign** from using if you can, i.e. don't use if you don't have to, use only as much as you need **= USE LESS**

MIDDLE LIFE CYCLE STAGE

Once resources enter the value chain, **extension** principles are employed to maximise their lifespan. Make most what you already have, use more efficiently eg. maintain well and deploy vehicles as long as possible = **USE MORE**

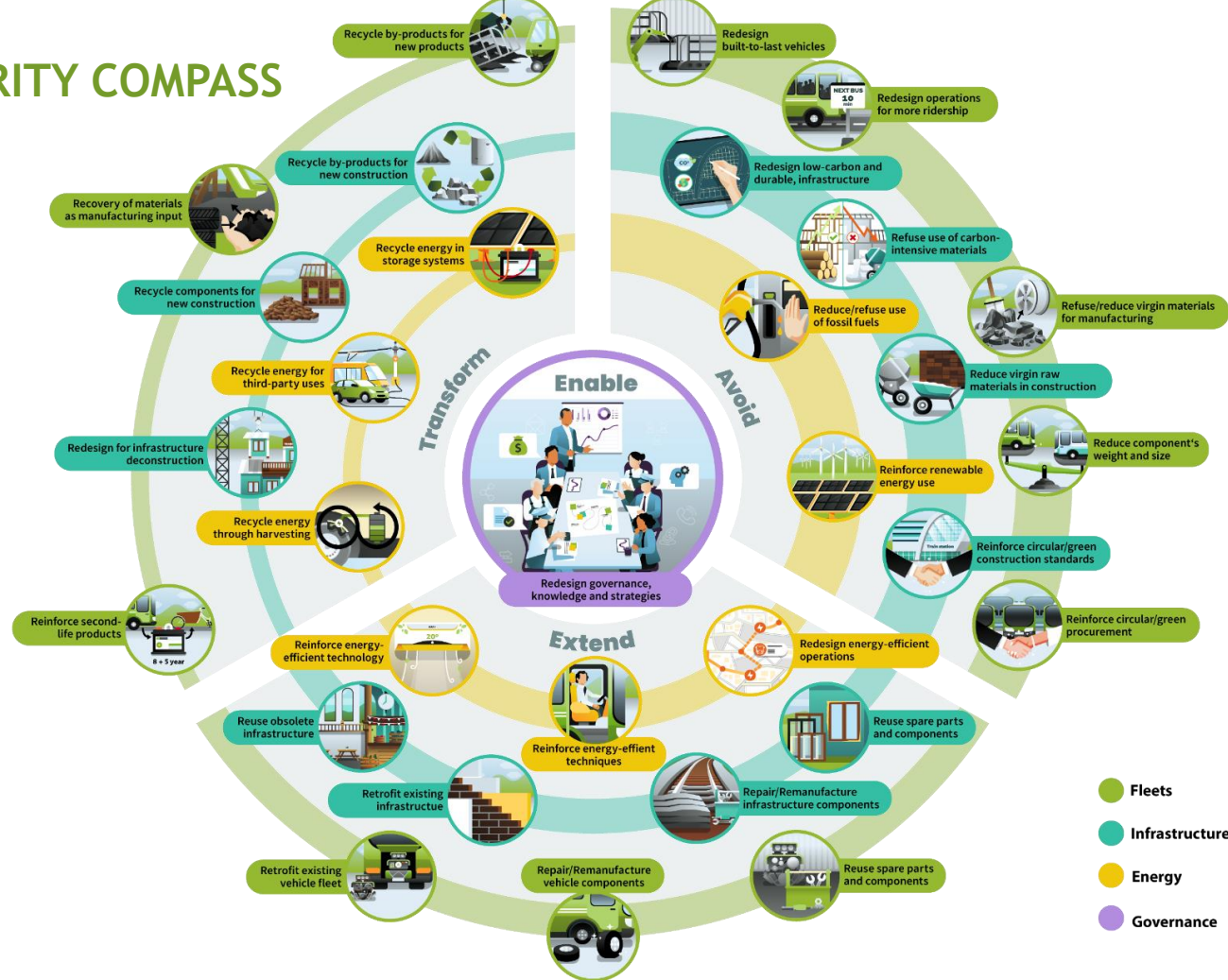
FINAL LIFE CYCLE STAGE

Finally, when resources can no longer fulfil their initially intended basic function, **transformation** come into play, allowing end-of-life resources to be processed and reintegrated back into the value chain, whether for their original use or a new purpose. **= USE AGAIN**

A CROSS-CUTTING PRINCIPLE - ENABLE

Enabling principles support this framework by fostering a conducive regulatory and strategic environment, encouraging collaboration and behavioural shifts, and building the necessary knowledge and capabilities to install circularity throughout the whole value cycle.

THE CIRCULARITY COMPASS



High

Order of priority



Low

- **Refuse:** prevent raw materials use
- **Reduce:** decrease raw materials use
- **Renew:** redesign product in view of circularity
- **Re-use:** use product again (second hand)
- **Repair:** maintain and repair product
- **Refurbish:** revive product
- **Remanufacture:** make new product from second hand
- **Re-purpose:** re-use product but with other function
- **Recycle:** salvage material streams with highest possible value
- **Recover:** incinerate waste with energy recovery

THE CIRCULARITY COMPASS COMPONENTS

- A **vision** of how circularity can look like and be incorporated into public transport systems
- A **self-assessment tool** to gauge PT systems' **current status and readiness levels** for circular economy adoption
- **9-R Actionable solutions catalogue** to operationalise circularity across the entire life-cycle value chain of public transport systems.



THE CIRCULARITY COMPASS

Circularity self assesment

Simplified entry point for mass public transport agencies (TAs) and operators (PTOs) to evaluate their status of integrating circular economy principles, practices, and approaches in their public transport activities.

It reflects not only their direct activities but also their impact along the entire value chain.

Four independent building blocks, each comprising 10 to 20 questions. Upon section completion, respondents are directed to **the results page**, which provides a summary of the answers, an overall score, and a three-tiered circularity level framework (low, moderate, high)

A stepping-stone toward more detailed evaluations.

Link to the survey in Qualtrics:

https://geurope.eu.qualtrics.com/jfe/form/SV_4YsotiBK9sDQ6fc

Link to the survey in pdf:

[Circularity self assesment](#)

Circularity factsheet

- Underlines the importance of incorporating circularity in public transport
- Outlines a vision, approach, and principles for incorporating circularity in public transport, considering the whole transport value cycle.
- Proposes key areas for analysis and action
- Provides an overview of the status of circularity of public transport systems and potential pathways for advancement.

6-10 pages document

The CE4CE KNOWLEDGE PLATFORM



CE4CE PUBLIC TRANSPORT CIRCULARITY KNOWLEDGE PLATFORM

Objective:

1. To identify and represent the skills and knowledge required for the successful introduction and implementation of circular economy principles in public transport (PT)
2. To increase knowledge and capacities of stakeholders in public transport to identify circularity gaps
3. To provide tools and best practices to close these gaps in own organizations through co-creation (circularity compass) and training

Target groups:

- all PT life-cycle actors
- decision takers
- general public

[CE4CE \(circularity4publictransport.eu\)](http://circularity4publictransport.eu)

Interreg
CENTRAL EUROPE



Co-funded by
the European Union

Home

Competence Map

Circularity Compass

Best Practice

CE4CE Knowledge Hub

Matchmaking Forum

Circular economy in public transport

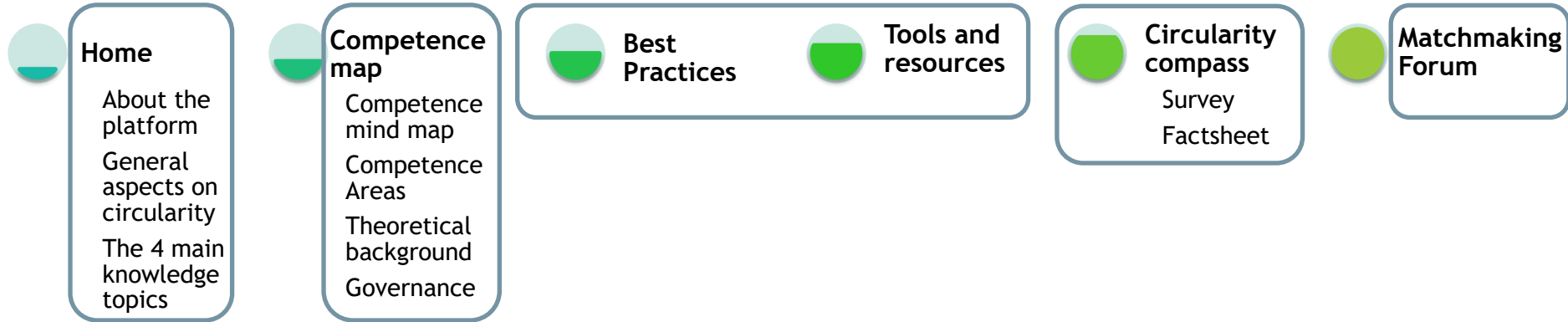


Interreg
CENTRAL EUROPE

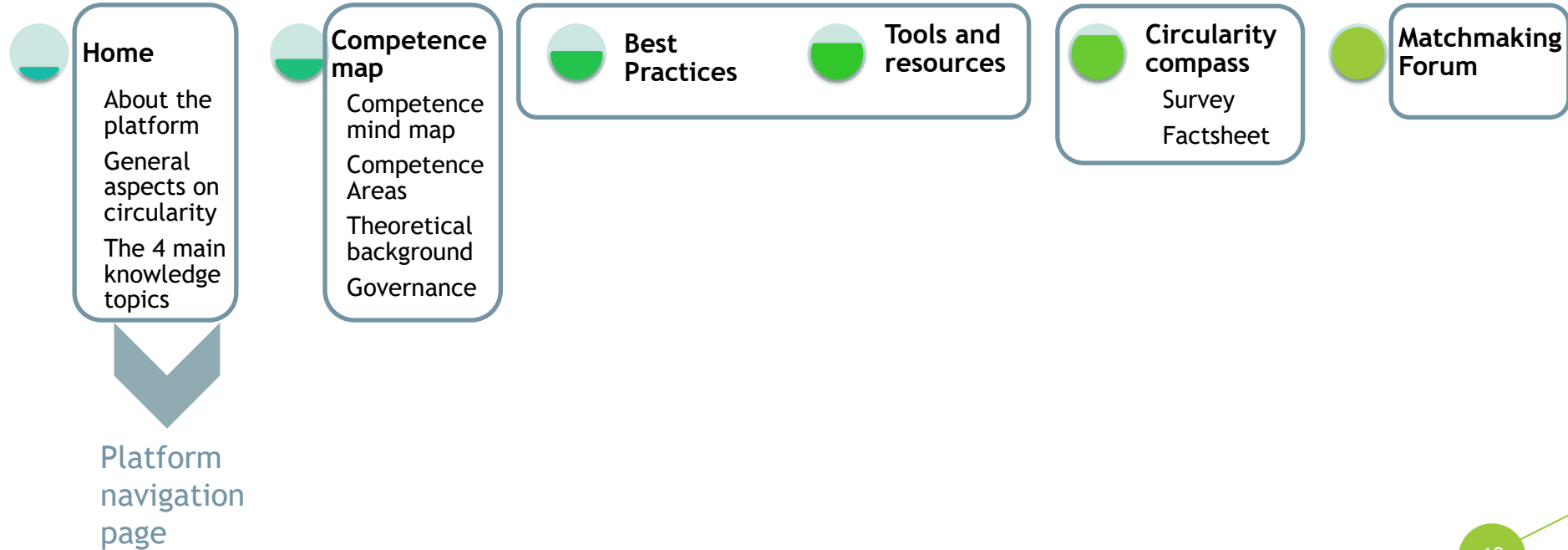


Co-funded by
the European Union

CIRCULARITY KNOWLEDGE PLATFORM

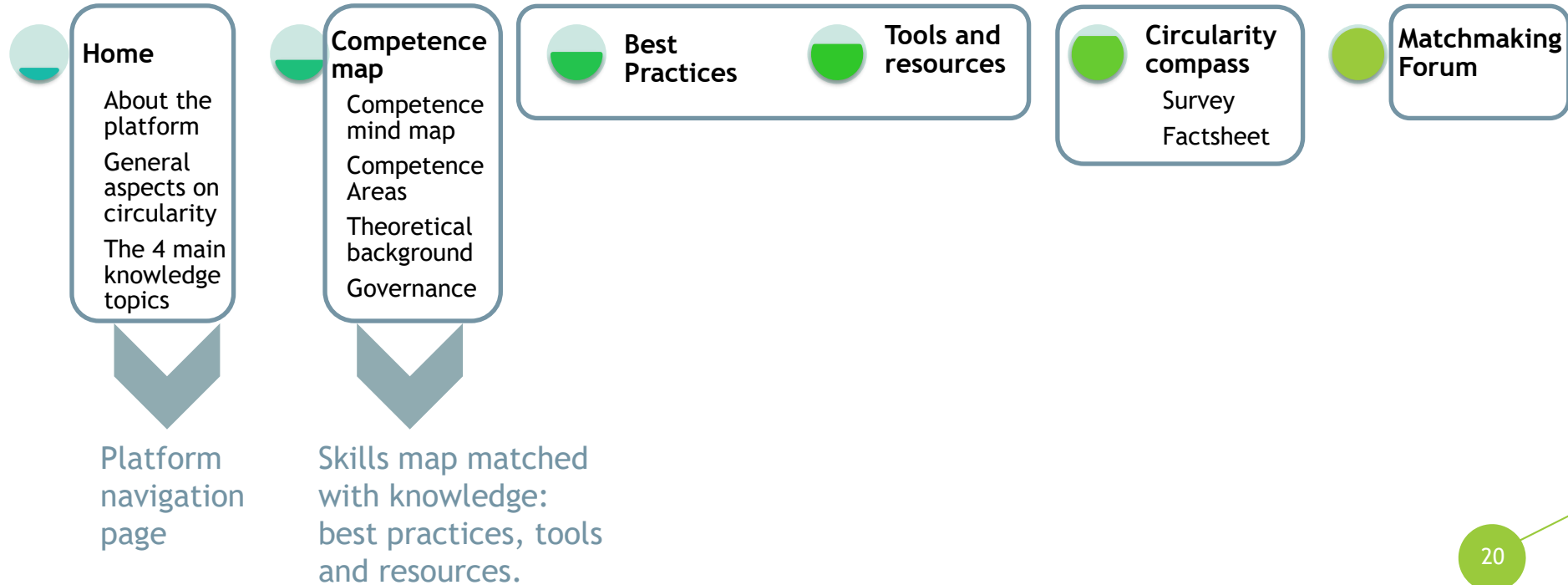


CIRCULARITY KNOWLEDGE PLATFORM



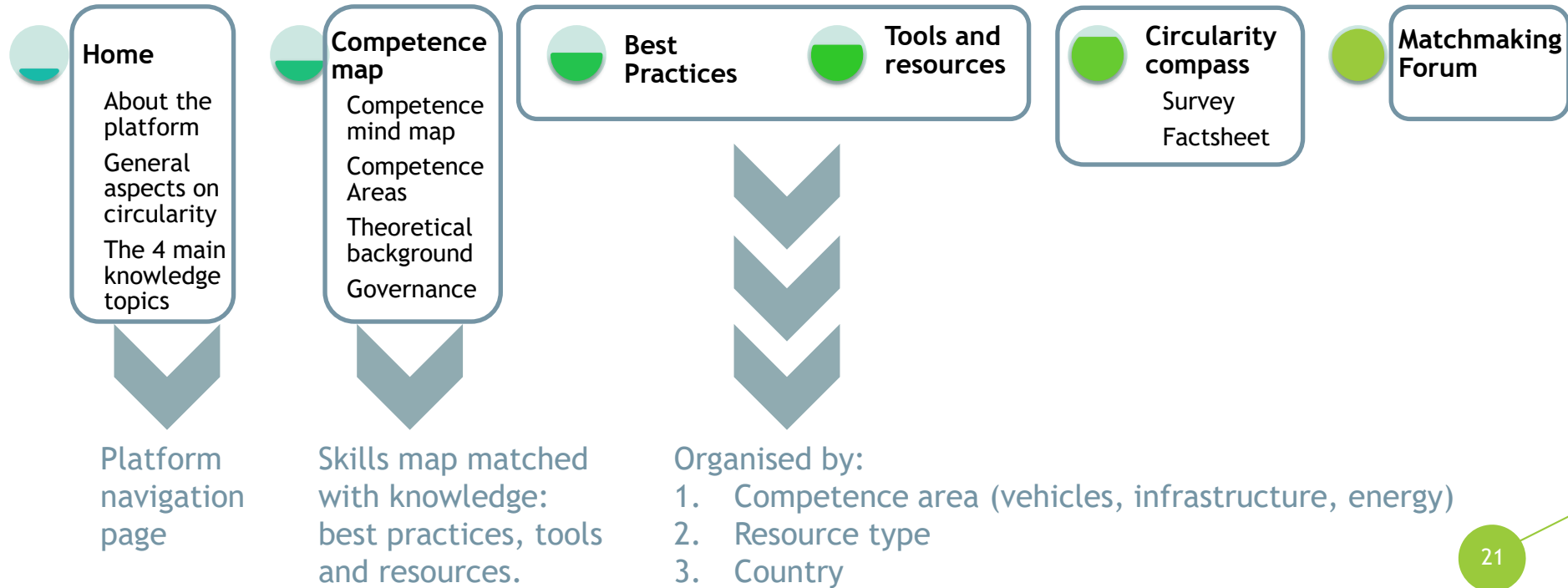
CIRCULARITY KNOWLEDGE PLATFORM

LINK: <https://circularity4publictransport.eu/>



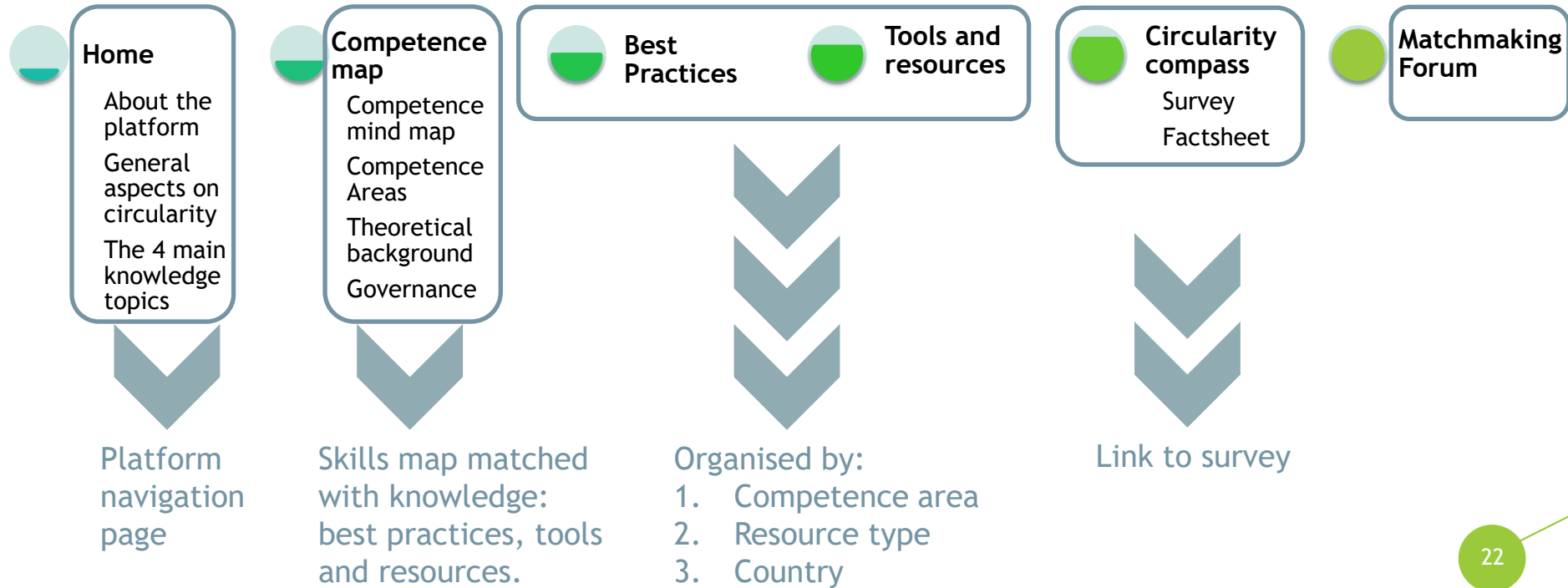
CIRCULARITY KNOWLEDGE PLATFORM

LINK: <https://circularity4publictransport.eu/>

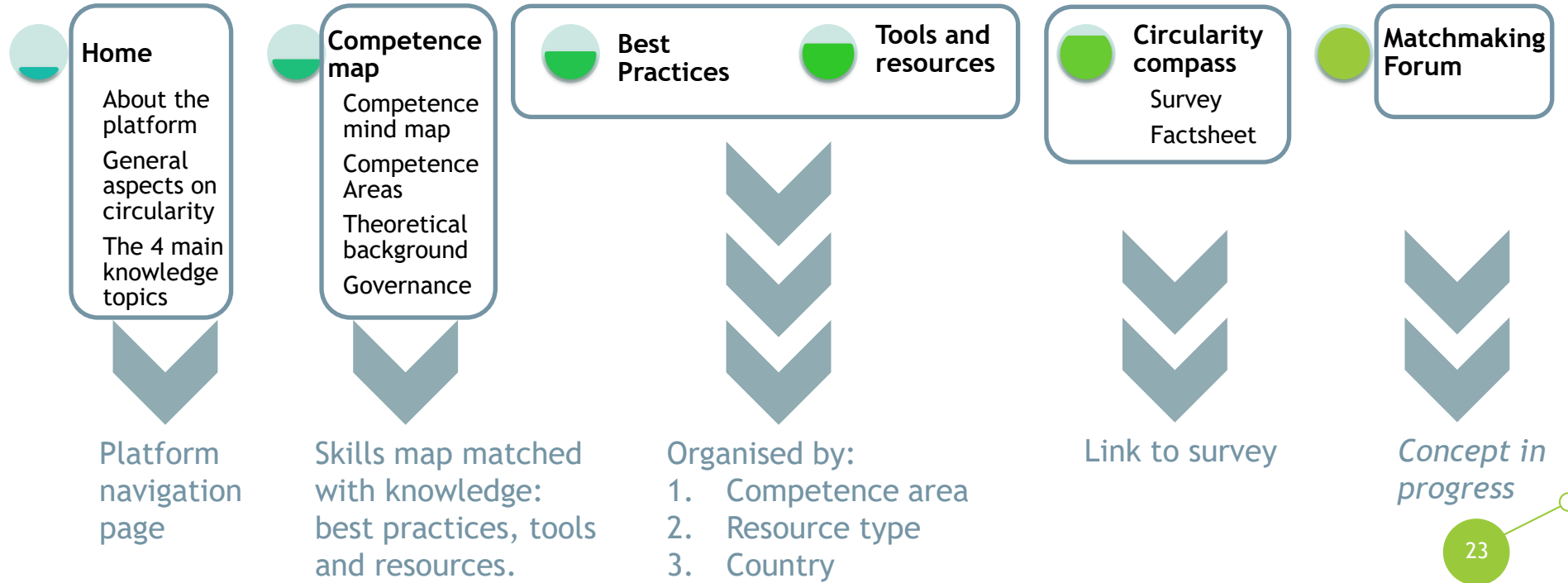


CIRCULARITY KNOWLEDGE PLATFORM

LINK: <https://circularity4publictransport.eu/>



CIRCULARITY KNOWLEDGE PLATFORM



Best Practices

The Best Practice section on the CE4CE knowledge platform serves as a comprehensive resource for public transport stakeholders. This section showcases successful case studies and innovative solutions from various cities, providing practical examples and insights into effective circular economy practices. This collection of best practices is designed to inspire and guide public transport operators, policymakers, and other stakeholders in adopting and scaling circular economy solutions within their own contexts.





CIRCULARITY KNOWLEDGE PLATFORM

Organisation of best practices, tools and resources

Resource type:

- Guideline
- Tool
- Method
- Software
- Online training
- Best practice
- Report
- Study
- Other

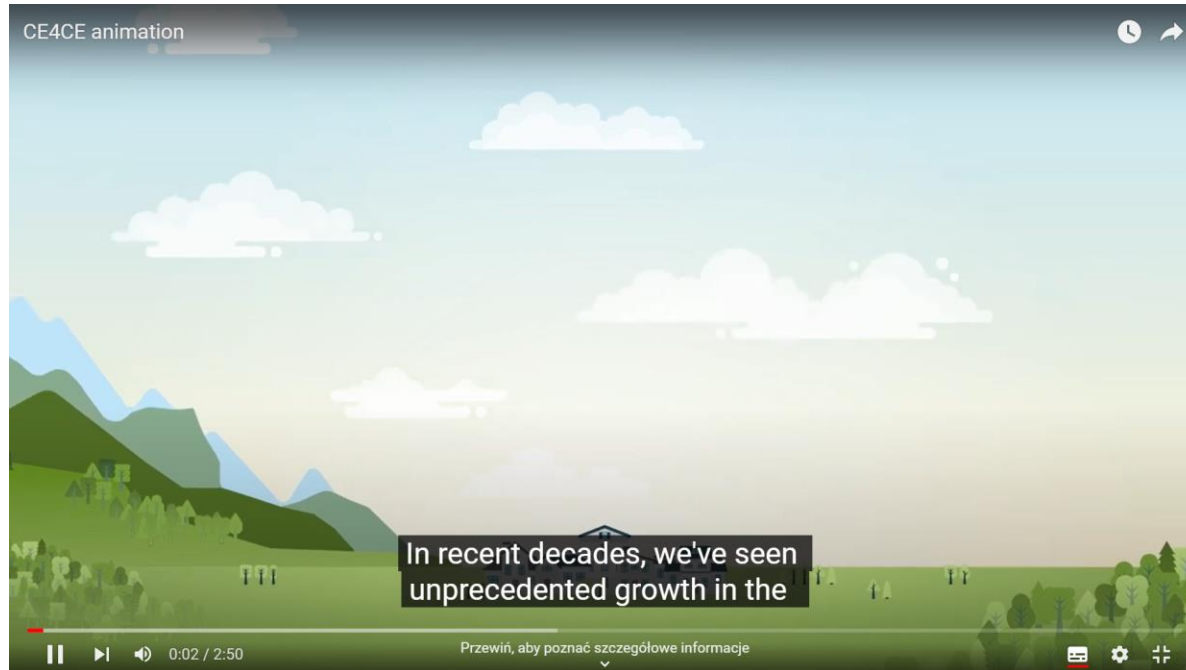
Competence areas:

- Vehicles → Vehicles
- Infrastructure → Batteries
- Energy → Railway
- Theoretical background → Electric
- Theoretical background → Buildings
 - Circular economy
 - Sustainability
 - Design & systems thinking
- Governance
 - Policy & regulation
 - Green finance & economics
 - Circular business models
 - Participative project management
 - Stakeholder engagement
 - Communication

A SHORT VIDEO ABOUT UPTAKING CIRCULAR ECONOMY PRINCIPLES IN PUBLIC TRANSPORT AND A TOOL TO FACILITATE THE PROCESS, I.E. CIRCULARITY COMPASS

YOUTUBE LINK TO THE VIDEO:

<https://youtu.be/lbCKKBCudzk>





THANK YOU!

Marta Woronowicz, trolley:motion, CE4CE project



Email: woronowicz@trolleyemotion.eu



<https://www.interreg-central.eu/projects/ce4ce/>



<https://www.facebook.com/Interreg.CE4CE>



https://twitter.com/Interreg_CE4CE



<https://www.linkedin.com/company/interreg-ce4ce/>



THANK YOU FOR YOUR ATTENTION!

Marta Woronowicz, Trolley:motion
Email: woronowicz@trolleyemotion.eu