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CIRCULARITY CONCEPTS IN FOREST-BASED INDUSTRIES

Future of forestry and forest-based industries in a sustainable bioeconomy

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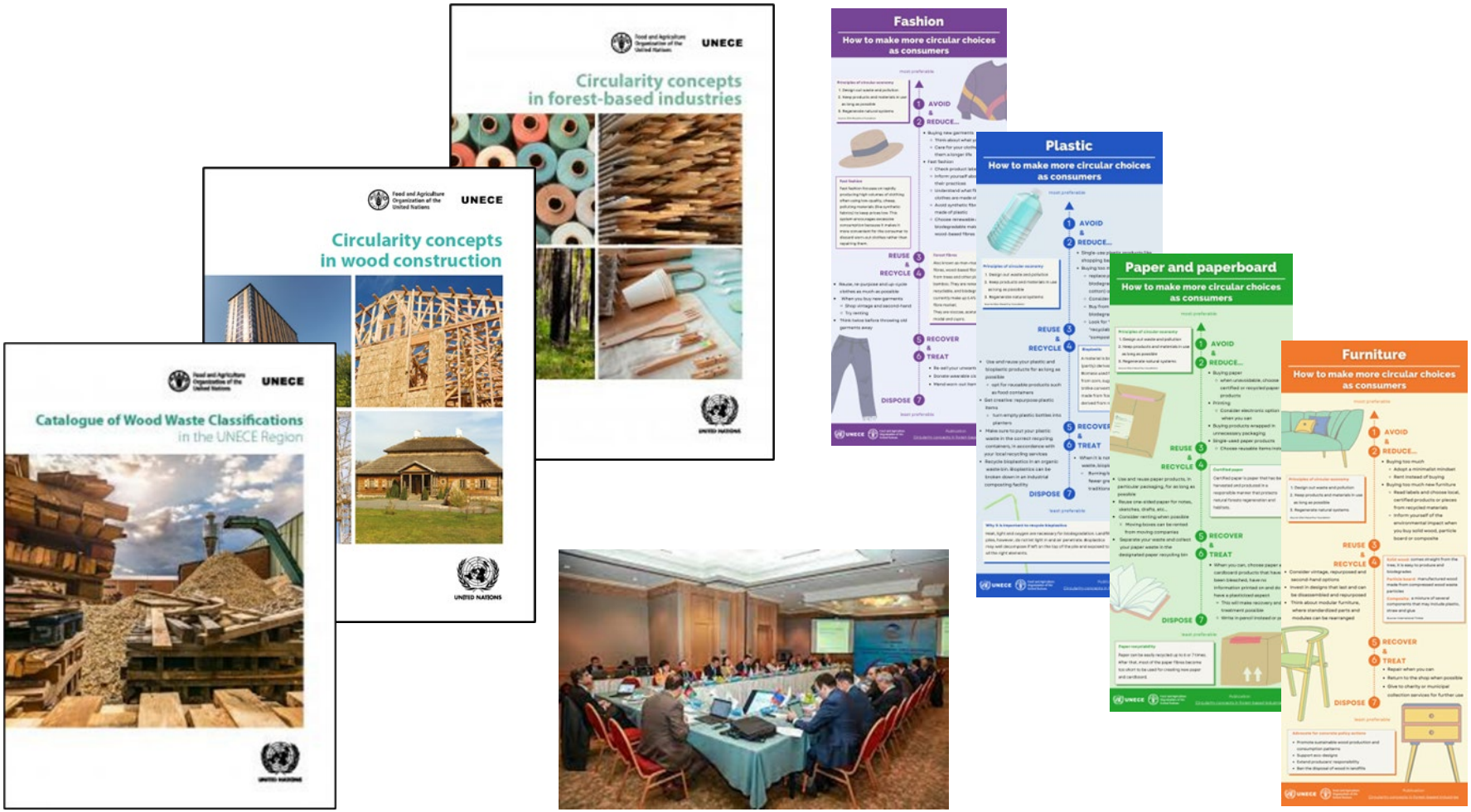
Circular Economy in Forest-based Industries



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TÜRKIYE

LEGAL BASIS

The basis for waste regulations in Türkiye is the Waste Management Regulation[439] (No. 29314, 2015). Annex 4[440] of the Regulation contains the European List of Waste (p. 6), aligning the Turkish to the EU classification. In the Waste List, hazardous waste, to which hazardous properties listed in annex 3 apply, is marked with an asterisk (*). In addition, waste which is considered hazardous, but to which the hazardous properties listed in annex 3 do not apply, is marked with an (A), while a hazardousness assessment is mandatory for waste marked with an (M). Moreover, the Regulation introduces an extended producer responsibility for several waste streams including packaging waste.

SECTORAL CLASSIFICATION

The hazardous waste classification guide[441] issued by the Ministry of Environment and Urbanization[442] distinguishes the categories A, B and C for wood waste (Table 14). All wood waste fractions marked with an asterisk (*) are considered category C wood.

TABLE 14: **Wood waste categories in Türkiye according to the hazardous waste classification guide**

Category	Definition	Examples of wood waste categories
A	Natural or mechanically processed wood waste	Pallets, shipping crates, untreated cable reels, furniture made of untreated wood, untreated wood used in construction
B	Painted, primed, glued wood waste without wood preservatives or halogenated compounds	Construction and demolition wood waste, floor and wall panels, wooden furniture, mixed bulky wood, coated wooden packaging
C	Waste wood treated with halogenated organic materials including PCB or other wood preservatives	Impregnated construction wood, impregnated furniture, industrial floors and work benches, railway sleepers, treated cable reels

Source: webdosya.csb.gov.tr/db/cygm/icerikler/c-lt3-20180201134617.pdf

Wood recycling options in Türkiye often depend on the size of wood-processing companies. Large companies are more likely to possess the necessary technology and infrastructure for wood recycling[443].

Structure

Circular economy concept

Wood in construction

Wood in furniture manufacturing

Paper manufacturing

Conclusions

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Circular Economy – why it matters

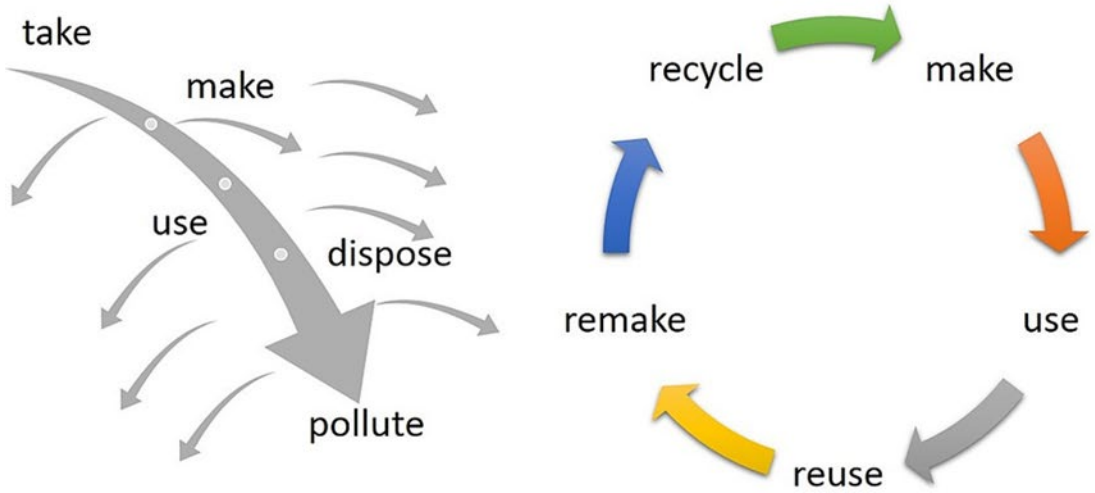
Urgent needs to address

- Increasing demand for raw materials
- Pressure on ecosystems
- Climate change
- Pollution and waste

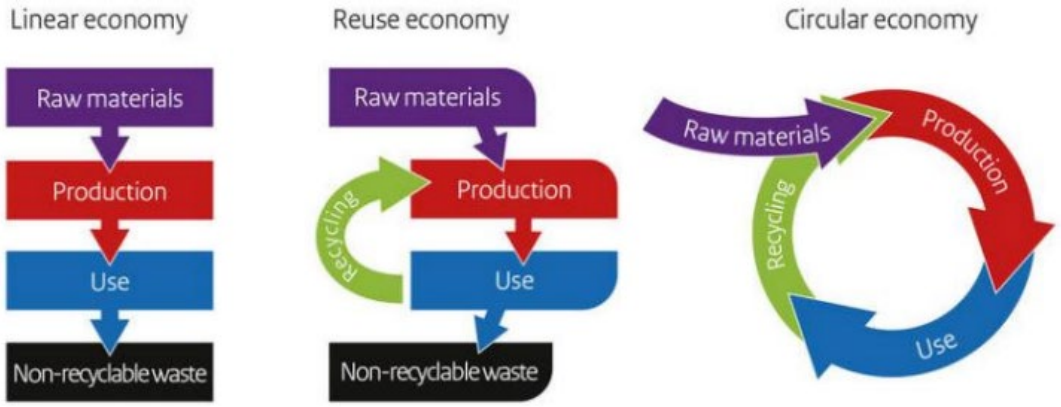
Circular Economy vs Linear Economy

- **The linear model** delivered high standards of living and wealth in some parts of the world - it has also been achieved at high socio-economic and environmental costs

- Agenda 2030 and SDGs
  - Post-COVID-19 reset
    - Green recovery
  - Nature based - solutions



Circular Economy Objectives



Source: Government of the Netherlands, https://www.government.nl/topics/circular-economy.

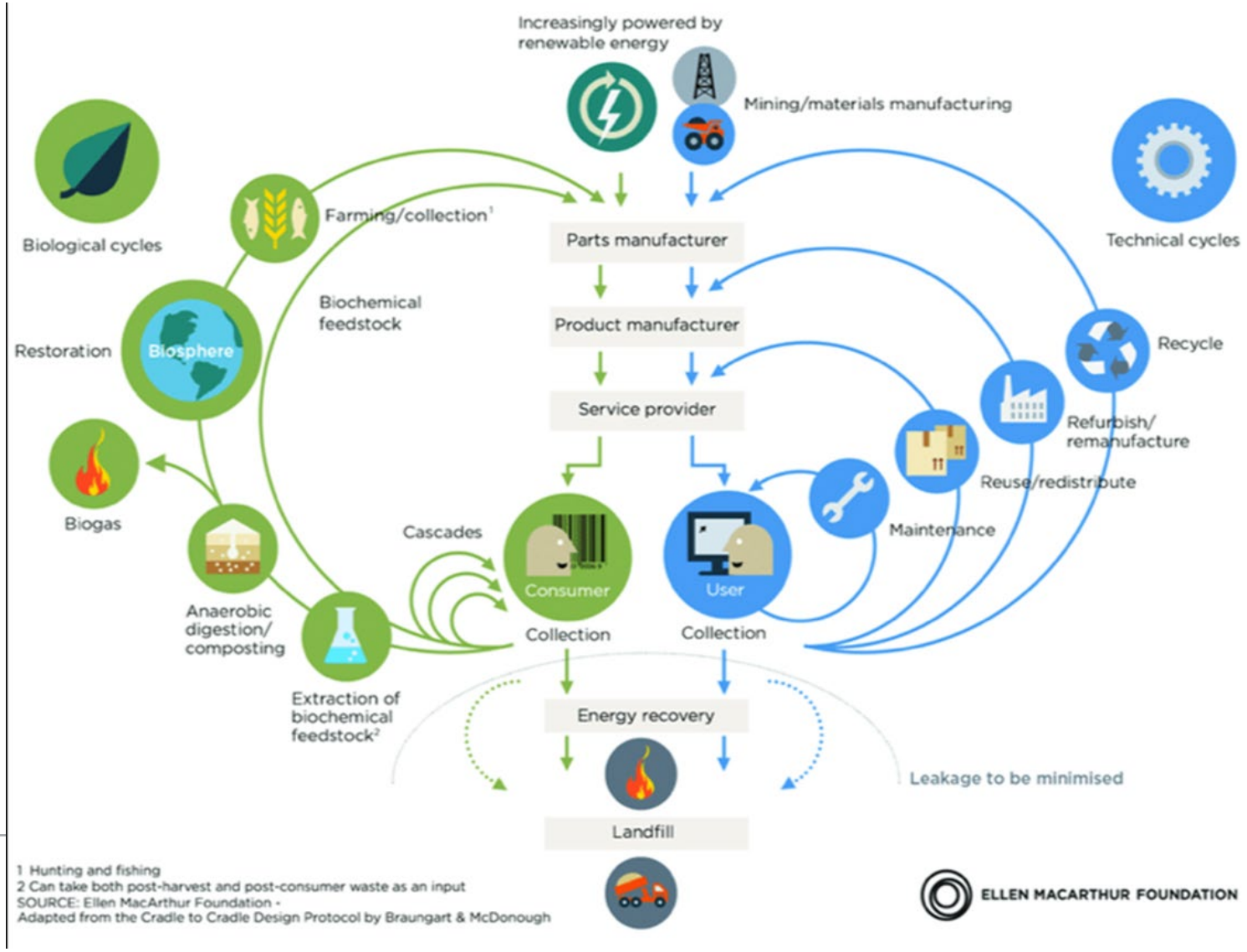
- design materials and products to minimize waste and pollution
- keep products and materials in use as long as possible
- regenerate natural systems

Circular economy – guiding principles

Smarter product use and manufacture	**R0 Refuse**	Make product redundant by abandoning its function or by offering the same function with a radically different product.
	R1 Rethink	Make product use more intensive (e.g. by sharing product).
	R2 Reduce	Increase efficiency in product manufacture or use by consuming fewer natural resources and materials.
Extend lifespan of product and its parts	**R3 Reuse**	Reuse by another consumer of discarded product which is still in good condition and fufils its original function.
	R4 Repair	Repair and maintenance of defective product so it can be used with its original function.
	R5 Refurbish	Restore an old product and bring it up to date.
	R6 Remanufacture	Use parts of discarded product in a new product with the same function.
Useful application of materials	**R7 Repurpose**	Use discarded product or its parts in a new product with a different function.
	R8 Recycle	Process materials to obtain the same (high grade) or lower (low grade) quality.
	R9 Recover	Incineration of material with energy recovery.

Source: Ellen MacArthur Foundation

Circular economy model



Circular Economy in Wood-based Industries

Wood - biodegradable resource, by principle used in a circular manner, as nutrients return to the biosphere
Cascading use of wood rather than circular use. Wood is first made into products of a higher added value.
Wood-based circular value chains involve material flow but also carbon and energy cycles
Good practice, existing in manufacturing processes, is resource efficient thus aligned with circular economy
All value chains start in forests so no circularity without Sustainable Forest Management

Transition to a bio-based circular economy
Opportunity for forest-based industries…

1. Source of renewable, bio-degradable materials

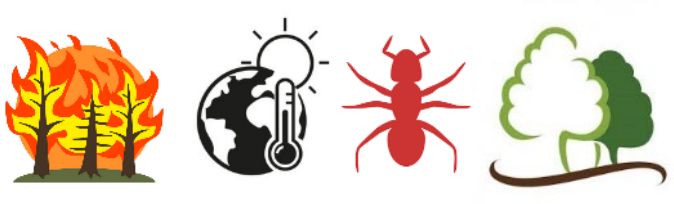
2. Low carbon impact

3. Can prompt transition in strategic sectors

Transition to a bio-based circular economy
…but also a challenge

Sourcing → **Production** → **Consumption**

1. Regeneration of resource vis-a-vis pressures on ecosystems



2. Sustainability of supply amid increased demand

3. Economic viability of post-consumer wood waste management

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Circularity Potential

INNOVATIVE CONSTRUCTION

RENOVATION & DECOMISSIONING

Wood – modern and sustainable material

- **SAFETY FIRST**
  - Stability
  - Fire resistance
  - Earthquake resistance
- **CIRCULARITY AND SUSTANABILITY**
  - Non-toxic
  - Biodegradable & renewable
  - Natural carbon sink
- **INNOVATION**
  - New products e.g., CLT
  - Hybrid construction (wood + other materials)

Circular and Sustainable Wood Construction

- **MASS TIMBER**
- **PANELIZED CONSTRUCTION**
- **MODULAR CONSTRUCTION**
- **OFF-SITE CONSTRUCTION**
  - Digital precision
  - Less waste & energy
  - Speed & efficiency

WOOD RECOVERY

Market development barriers

No standards on quality

No producer responsibility

Weak collection infrastructure

No automatized sorting

Low value feedstock

Highly fragmented markets

Transport costs

Labor hazards

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Design for Sustainability

- Stronger collaboration in industrial ecosystems is needed (e.g., municipalities, architects, designers, builders and end-users) to visualise the product at all stages.
- “Design for disassembly” to ensure that buildings can be dismantled for recovery of systems, components, and materials.
- Off-site wood construction, with a digitally precise design and assembly of elements which offer a promising optimization of value chains with minimum waste.
- **Limitations to circularity** - wood treatments for prolonged use contribute to pollution and may affect the prospects of its reuse and recycling.
- **Recommendation** – some materials used for treatment of wood in construction are already renewable, this trend could be scaled up where economically viable

Waste Management

- Policies banning wood landfilling to provide framework for reuse of waste streams (e.g., EU countries).
- Today, high demand in wood panel and energy sectors do not encourage development of other markets.
- **Limitations to circularity** - Infrastructure surrounding the recovery process is not well developed, mainly because it is not economically viable. Many recovery operations require manual work.
- In the future, optimization of collection strategies could improve reuse for other purposes, but likely only a fraction of waste will be of good-enough quality for further processing.
- **Recommendation** – international wood waste classification could improve data collection and trade of waste streams.

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Recommendations

Furniture industry today

Furniture manufacturing

- Sustainable sourcing of raw material is the starting point
- from recycled wood (should be increased)
- from virgin wood (from sustainably managed forests).
- Product design to keep the wood in the loop as long as possible e.g., modular furniture
- Or design for dismantling and recyclability - avoiding contamination by non-recyclable and non-biodegradable materials.
- Recommendation extended producer responsibility could address some of these issues

Management of furniture waste

Limitations to circularity

- End-users are not given guidance on how to repair furniture nor do they have access to spare parts or repair services provided by the producer.
- Repair or refurbishment services and recycling of discarded furniture could be put in place, however, there is limited infrastructure for reuse, repair and recycling.
- The demand for second-hand furniture is low, due to availability of low-cost products, which are easy to transport, assemble and dispose of.
- Market drivers for the collection, reuse and furniture takeback are weak. Transport and labor costs make repair and refurbishment expensive.
- Wood waste streams are often contaminated with hazardous substances such as glues, nails, and varnish. This generates hazardous labor conditions for recyclers.

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Circular paper production

Recommendations

- Water and energy are the two biggest resource inputs into the papermaking process, aside from pulp. Increased resource efficiency can include the use of renewable energy and reusing water in multiple production cycles or, under certain conditions (e.g. non-toxicity, geographic proximity, economic viability), sourcing it from other industries.
- The paper and pulp sector could partner more with related actors (e.g., the ink, dyes and glue industries) to co-design additives that are easier to separate from paper.
- Policy measures that encourage reuse of paper will succeed only if the markets for recycled paper products function well and if the segregation and disposal can be done in a cost-efficient manner.

Paper recycling

- Paper recycling is already relatively well implemented thanks to existing automated sorting processes and collection infrastructure.
- High rates of recycling are not driven by circularity but rather the interest to improve profit margins, where possible.
- Despite high recycling rates, reducing paper waste remains an important objective e.g., in the packaging industry.
- **Limitations to circularity** paper and paperboard are commonly printed on - and coated by a variety of chemicals which damage the fibers and limit their recycling.

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- Although, the focus of the circular economy is often on the material flow, a transition to a circular economy, requires systemic transformation across entire value chains and taking into account
  - Forest regeneration cycle
  - Carbon cycle
  - Energy cycle
- Circularity also requires new business models, connections across sectors and companies, redefining of product design, manufacturing, and consumption.
- Each value chain represents its own set of limitations, challenges, and opportunities. They can be identified further only based on case studies analysis.

Circular economy and wood – how to do it right

- **FORESTS HEALTH AT THE CORE**
  - Sustainable forest management
  - Reforestation & ecosystems restoration
- **INNOVATIVE DESIGN**
  - Longevity
  - Recyclability & cascaded use
- **INCREASED RECOVERY**
  - Retrofitting & disassembly
  - Material & energy efficiency
- **COOPERATION**
  - From sectors to value chains
- **ECONOMIC VIABILITY**

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THANK YOU

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