TRANSFORMERS MAGAZINE'S
INDUSTRY NAVIGATOR

INVESTMENTS, ARTIFICIAL INTELLIGENCE AND SUSTAINABILITY

CONFERENCE 2024

SETTING NEW BENCHMARKS IN SUSTAINABLE TRANSFORMER PRODUCTION

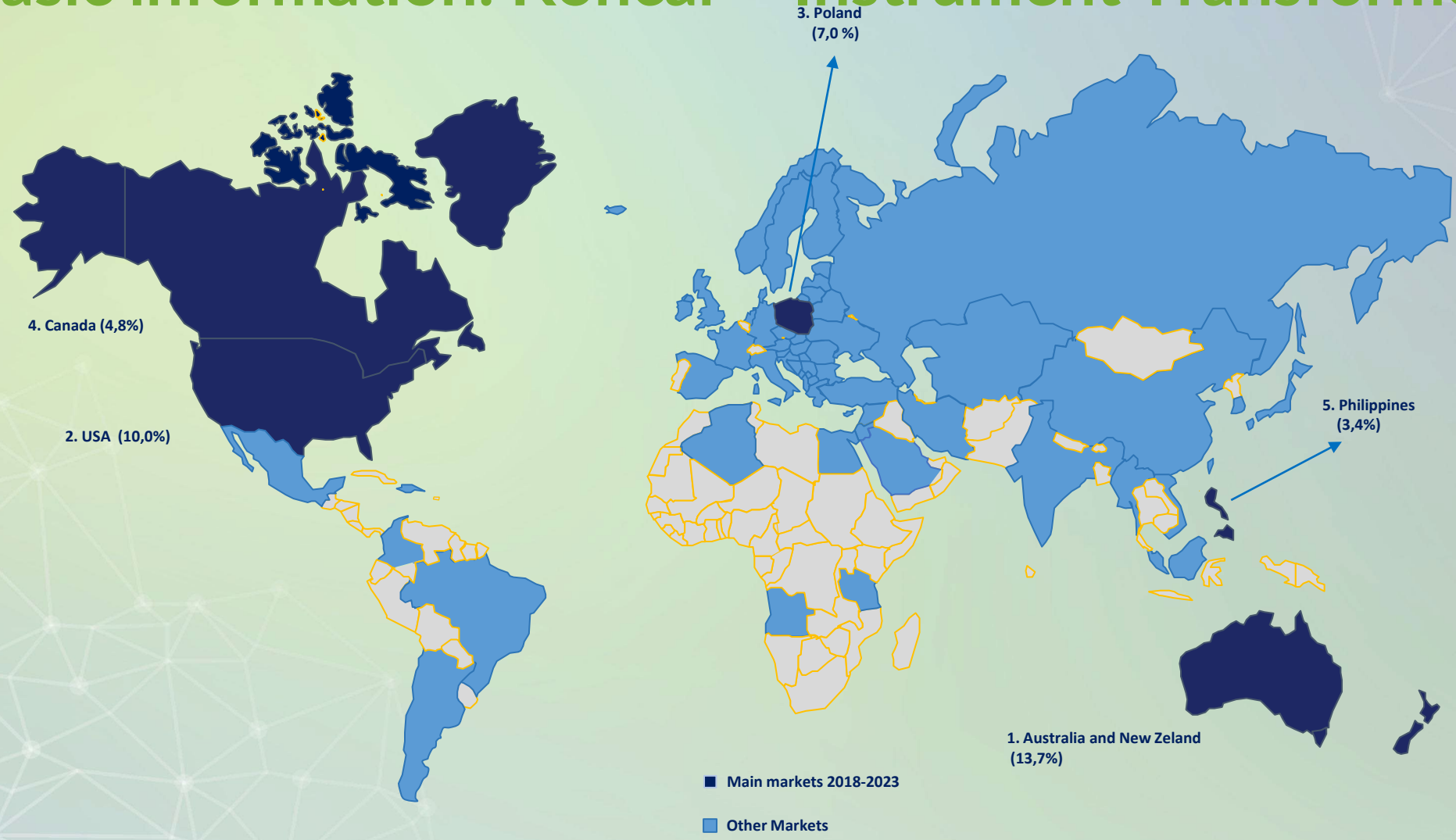
Luka Kovačić

06 / 2024

Basic information: Končar – Instrument Transformers Inc.

- Part of Končar – Electrical Industry Inc. group
- 300 Employees
- Average working experience - 19 years
- PRODUCTION CAPACITY:
- 4000 HV transformers per year
- 10000 MV transformers per year
- Planned 60% increase in production capacity by 2027.

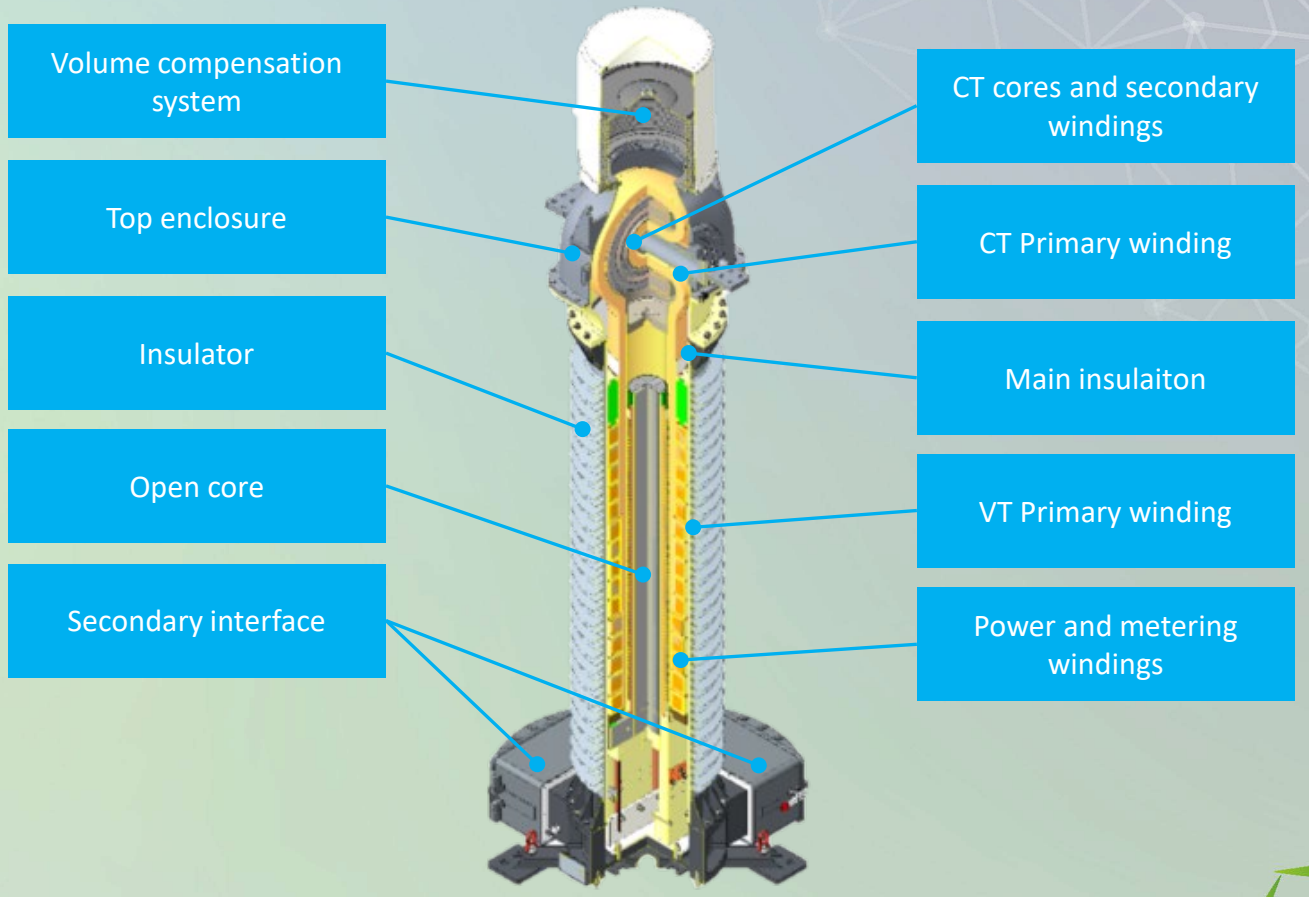
Basic information: Končar – Instrument Transformers Inc.



Introducing the SVE transformer

- A combination of combined transformers type VAU and station service voltage transformers type VPT

- Allows simultaneous current metering, voltage metering and power delivery



SVE - Setting performance benchmarks

- Design capabilities

Current Part

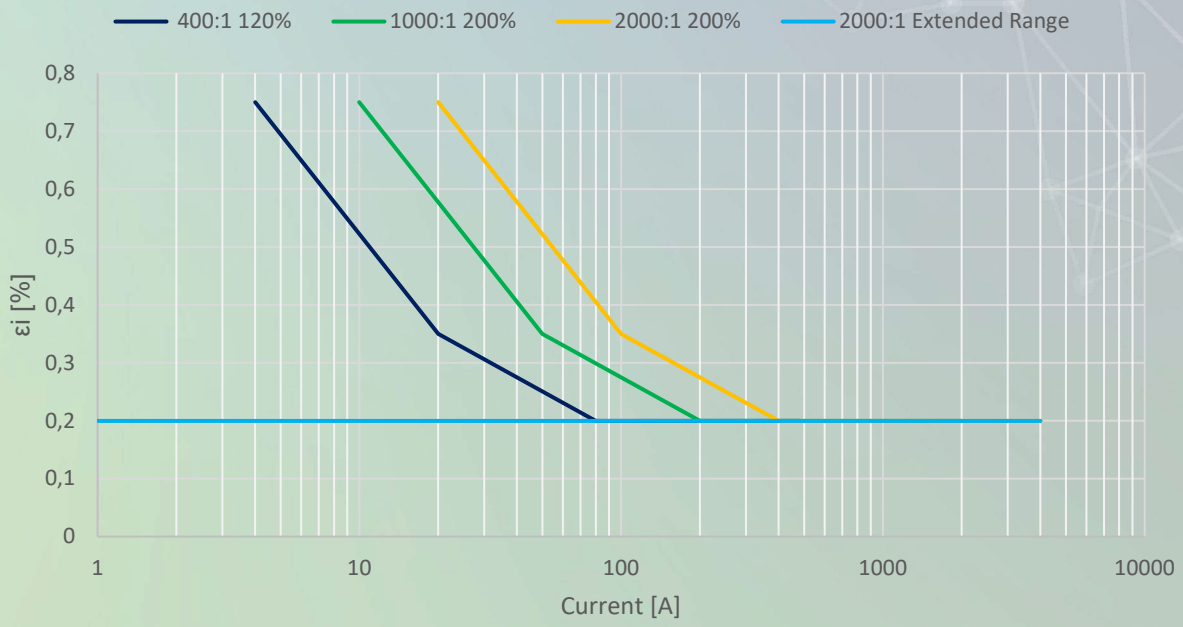
- Primary current – **up to 4000 A**
- Thermal current – **up to 4800 A**
- Short-time current – **up to 80 kA – 1s / 200 kA**
- Metering accuracy – **0,1 or 0,2 s**
- Relaying accuracy **5P20** or **5PR20**, class **PX** possible
- Transient performance classes (**TPX, TPY, TPZ**) possible
- **Extended range** possible

Voltage Part

- Simultaneous Accuracy and Power delivery
- Power winding - **up to 100 kVA @ 120 V** single phase
- Medium seceondary voltage possible **– 7,2 kV**
- Metering winding:
  - Class 0,2 **up to 25 VA**
  - Class 3P **up to 100 VA**

SVE - Setting performance benchmarks

- Extended range performance – beyond 0,2S
- 0,2 accuracy class guaranteed from 0,5% rated current up to RF
- Allows for much higher degree of standardization – design choices not as reliant on electrical parameters as with fixed ratios



SVE - Setting performance benchmarks

Most importantly, all design features Končar is renowned for are retained in this product:

- Ferroresonance immunity
- Fault energy limiting design
- Capacitive discharge capabilty
- Inusceptibility to high frequency transients
- Limits transmitted overvoltages
- Simple monitoring possible (overpressure switch, neutral current monitoring, tgδ monitoring)

SVE - Summary

- A never-before seen collection of features in a single unit.
- An evolution of proven, road-tested designs
- A novel, future-proof approach for many applications:
  - Rural electrification
  - Station service
  - Renewables
  - GIS implementation

Turning production sustainable – CFP calculation of SVE and related takeaways

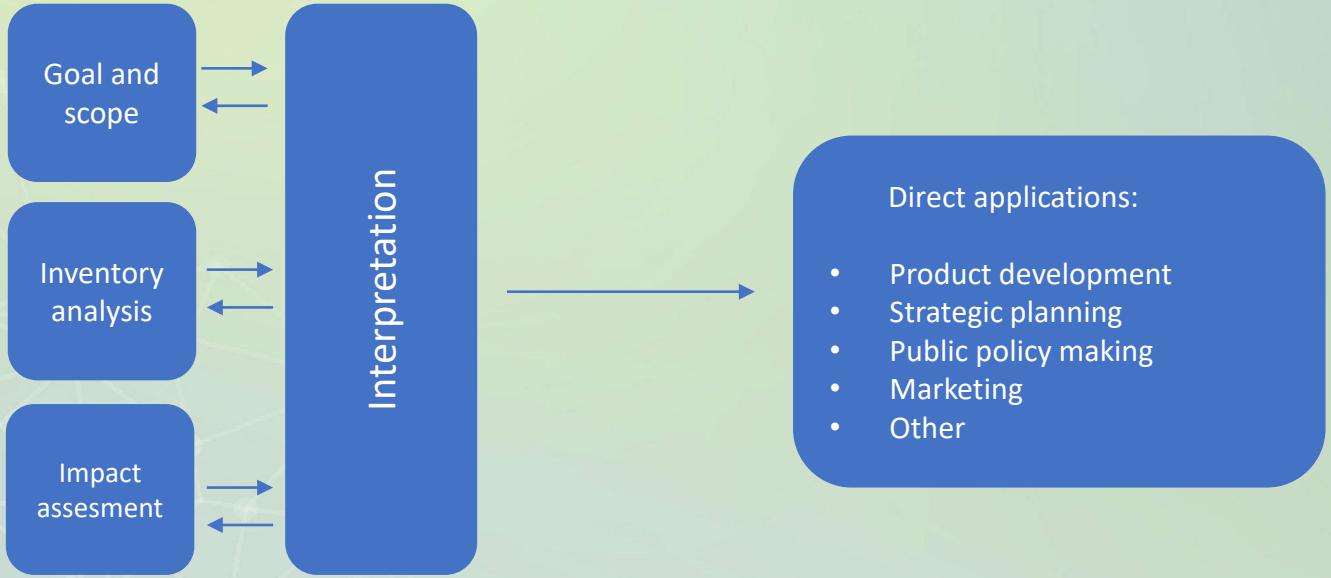
- Climate change and global warming a paramount issue
- CO2 emission reductions are an obligation by the Paris agreement
- Fighting climate change is one of the primary goals and responsibilities in all areas of human activity

What can we do?

- Optimize production through finding and adressing hot-spots in GHG emissions
- Research and invest in more efficient production processes
- Manage supply of materials and components, use sustainable materials where possible

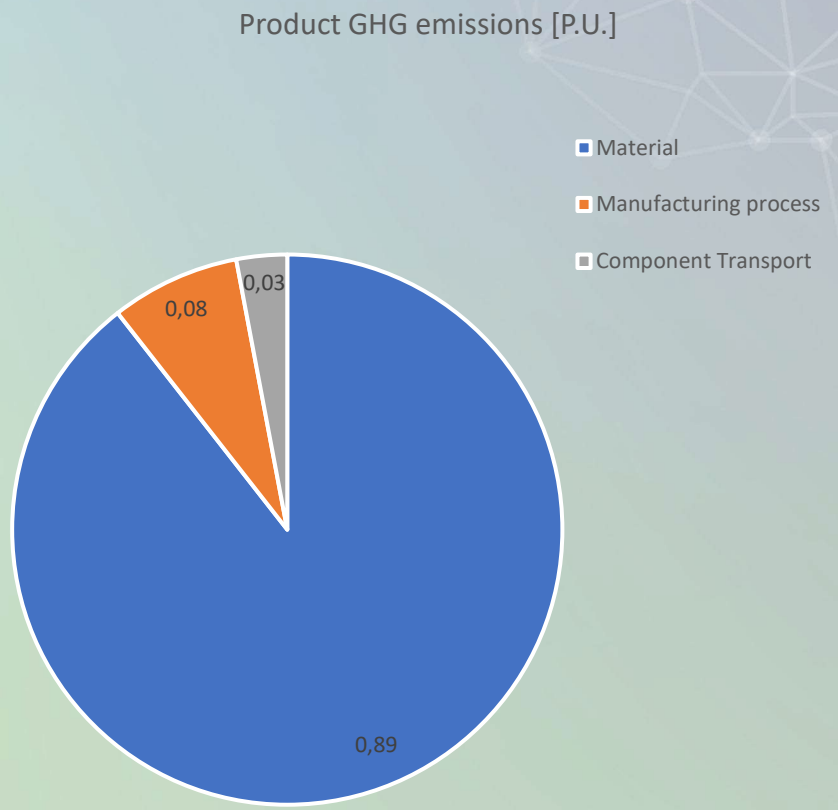
Turning production sustainable – CFP calculation of SVE and related takeaways

- Assesment of GHG emissions necessary in order to start reduction
- Carbon footprint assesment: sum of GHG emissions and removals
- LCA – Life cycle assesment – Quantification of the enviromental impacts of individual product



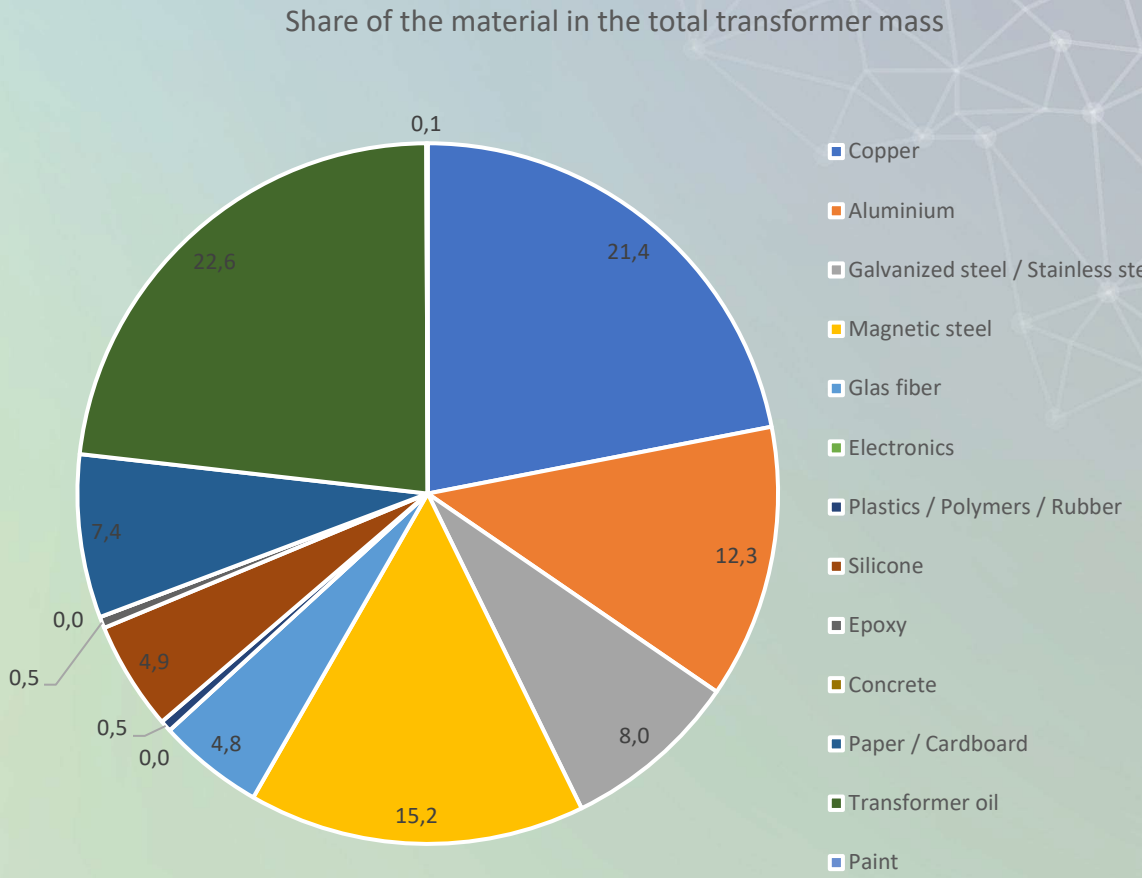
CFP calculation of SVE - baseline

- CFP calculated using LCA method, with cradle-to-gate approach
- Baseline CO2 emissions identified for 100% virgin material, with process and transport energy consuption as-is



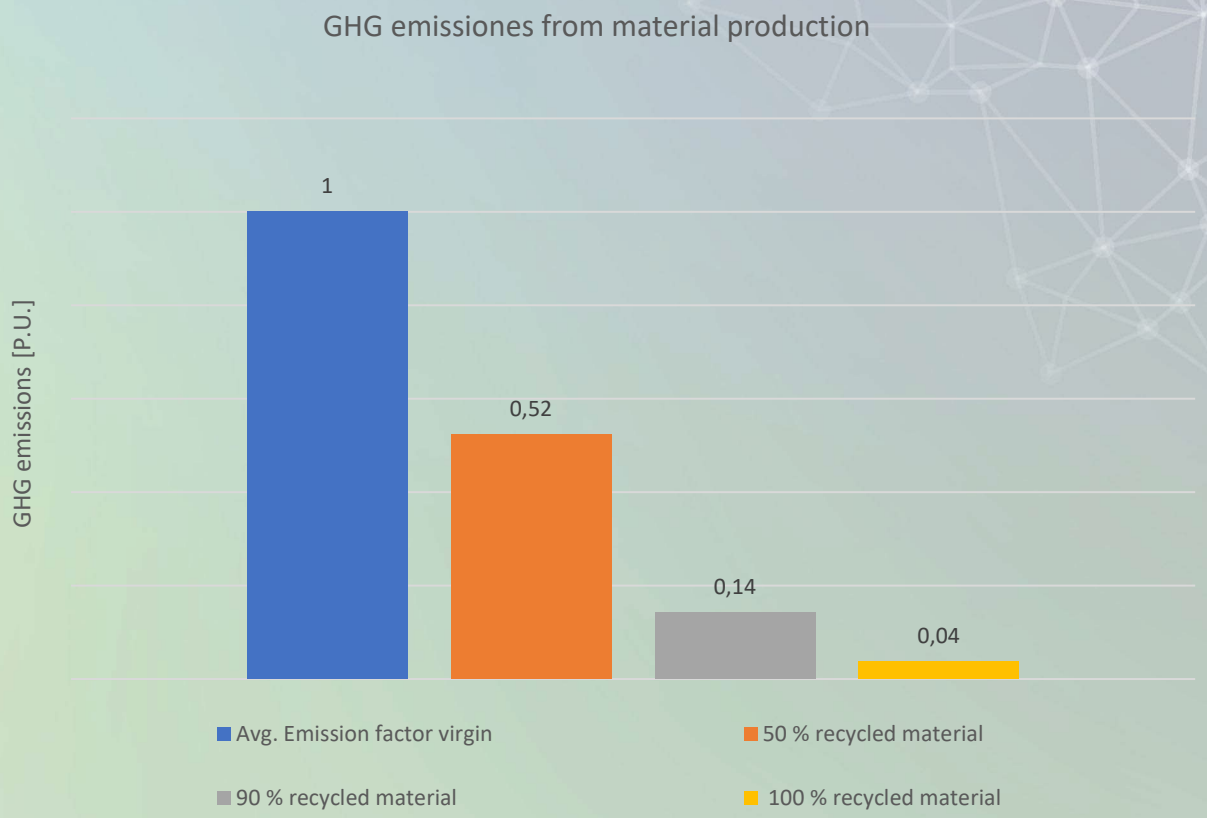
CFP calculation of SVE - Upstream

- Material inputs identified for 97,6% of total transformer mass
- Emission factor coefficients are associated with each material, depending on the percentage of recycled material used by total mass
- Average emission factors were obtained from the end users



CFP calculation of SVE - Upstream

- Emission factors per percentage of recycled material used – Worst (0%) to best (100%) case scenario
- Impact of using biodegradeable oil over conventional mineral oil: GHG emissions 6 times lower
- Values given per product total oil quantity



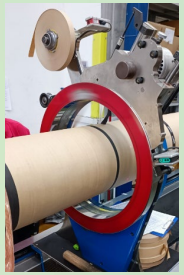
CFP calculation of SVE - Core

Cores production

Proces duration: 8 h
Electricity consumption: 0,015 MWh
Embedded GHG emissiones in process: 0,003 tonCO2eq

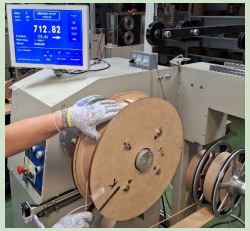
Paper insulation production by machine

Proces duration: 10 h
Electricity consumption: 0,009 MWh
Embedded GHG emissiones in process: 0,002 tonCO2eq



Voltage primary winding production

Proces duration: 26 h
Electricity consumption: 0,011 MWh
Embedded GHG emissiones in process: 0,0026 tonCO2eq

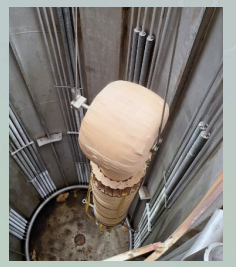


Voltage secondary winding production

Proces duration: 3 h
Electricity consumption: 0,003 MWh
Embedded GHG emissiones in process: 0,0006 tonCO2eq

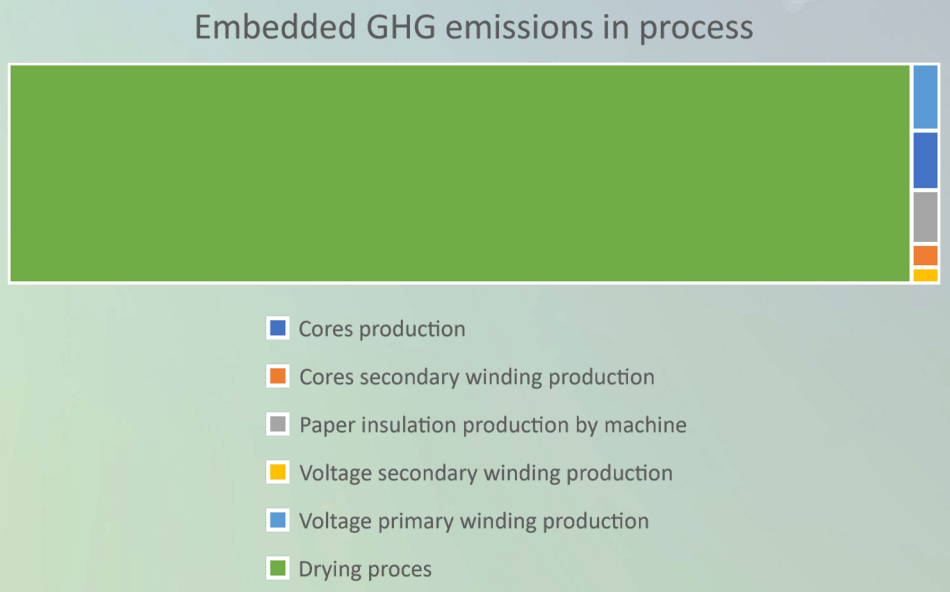
Drying proces

Proces duration: 152 h
Saturated steam consumption: 1,4MWh
Embedded GHG emissiones in process: 0,245 tonCO2eq



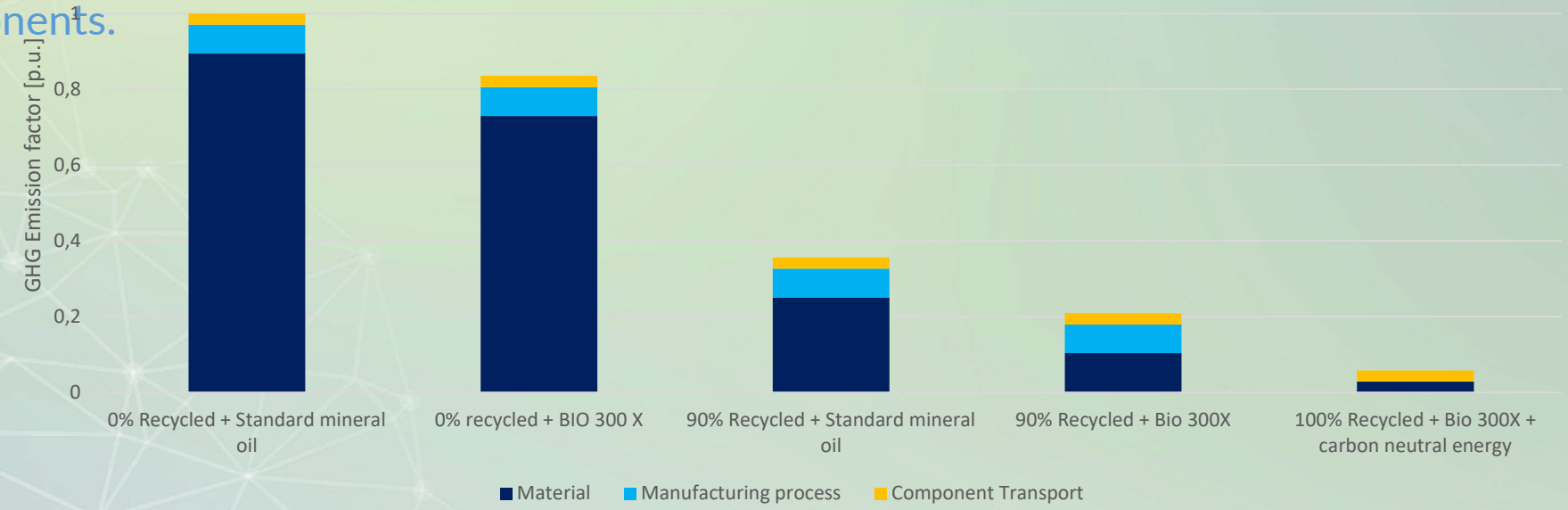
CFP calculation of SVE - Core

- Drying by far most energy intensive process (accounting for over 96% total CO2eq)
- Efforts being undertaken to optimize the process with a view of reducing the total drying time



CFP calculation of SVE – Summary

- Key takeaway: With carbon-neutral sources of power for the production processes, using near 100% recycled materials alongside biodegradeable insulating liquid, the main source of GHG emissions becomes the component transport itself.
- The impact of transport can be lessened by supply chain optimization and supply planning.
- The key prerequisite to do that is the ability to reach a high level of standardization within the transformer components.



Conclusion

- New SVE combined power transformer prototype produced and tested
- SVE ready for commercial deliveries
- Carbon footprint analysis and calculation succesfully undertaken
- Supply chain optimization crucial for building sustainable products – component standardization necessary
- Biodegradeable insulating liquids an optimal choice in terms of both performance and sustainability
- With an optimized supply chain, using predominantly recycled materials and biodegradeable insulating liquids, it is possible to deliver a carbon neutral product out of the gate

TRANSFORM EVERYDAY

Thank you for your attention!