COLUMBIA CLIMATE SCHOOL
COLUMBIA CENTER ON SUSTAINABLE INVESTMENT

CARBON TRUST

Tools to Make Metals-as-a-Service Work

Outcomes from the MaaS Community of Practice webinar, July 9, 2026

What we set out to show

Metals-as-a-Service (MaaS) rents metal instead of selling it. The owner keeps title to the metal, the user pays for its use or performance over a set period, and the metal comes back at the end for another cycle of use. The idea is sound, but a fair question keeps coming up: how do you actually build and price such a business? **This session showed that there are already usable tools and frameworks for it, and that the point is to adopt and adapt them rather than reinvent the wheel by building everything from scratch.**

The webinar presented 5 different but interrelated Tools.

Tool 1 — Stock-and-flow models: turning material data into a business case

A stock-and-flow model (built with Dynamic Material Flow Analysis) is an accounting method for materials. It tracks how much metal is sitting inside the economy (the “urban mine” of buildings, infrastructure, and wind turbines) and how fast it moves in and out through production, wear, and recycling. Because nothing vanishes, what goes in must either pile up or come back out.

For a MaaS business, this answers the practical questions that make or break a deal:

- How much recoverable metal is out there, when it will return, and from where.
- How big to size the “metal bank” (the pool of metal the business owns and brings back to the loop for multiple cycles).
- Whether the metal comes back in good enough condition to rent again, which is what the residual value, and therefore the pricing, rests on.

The team illustrated this with the steel-to-wind value chain, chosen not because it holds the most metal (construction does), but because wind is the most predictable and observable place to prove the model.

An honest caveat was included in the presentation: today, these models rely on assumptions and borrowed averages because real measured data on what is in the “urban mine” and how it is moving are scarce.

Tool 2 — Create a feedback loop between MaaS and Stock-and-flow models

The data gap in stock-and-flow models is also the big opportunity: a live MaaS model, by tracking metal across its life, generates the very data that makes the stock-and-flow models sharper. The two reinforce each other in a feedback loop.

One way for MaaS to do this is to engage with the pitfalls of standard accounting and flip the lens from top-down to bottom-up. Standard accounting depreciates equipment to a book value of zero at the end of its “useful life,” but the metal is still physically there and still worth something; it has a residual value. That gap is an opportunity: by screening company balance sheets — firms heavy

in plant and equipment, low on liquid assets, or in financial distress — a MaaS business model can identify and acquire this overlooked metal cheaply, as a ready-made urban mine. Stock-and-flow data helps spot where that embedded value sits, and a live MaaS model then supplies the tracking to turn rough estimates into verifiable quantities.

Tool 3 — A pricing ladder: from selling volume to selling performance

The bigger shift is charging for what the metal does, not how much it weighs — moving from dollars-per-ton to performance-based pricing. Dynamic Material Flow Analysis, combined with sensors, digital twins, and simple tracking, makes performance measurable, and this was the part of the session that resonated most in the room. The reason is that it reframes metal as the source of a service rather than a simple commodity. A concrete example raised by participants: copper transmits electricity better than aluminum, so instead of selling the copper, a business can charge for that superior performance over time. The same logic already runs the aviation industry, where engine makers sell "power by the hour", where the airline pays for thrust, efficiency, and reliability, not for the engine itself. MaaS applies that proven idea to the metal inside the asset.

The session laid out three pricing options a MaaS business model can grow into, each shifting more risk away from the user:

- **Performance-based contract:** the user pays purely for the service delivered, and if performance drops, payments drop with it. The owner bears all the risk that the metal will wear out. Best for mature, well-monitored markets.
- **Volume renting plus a performance "swap":** a familiar per-ton rental with an "insurance" layer on top: the user pays a small premium, and the owner guarantees a baseline performance, stepping in to recover and replace the metal if it falls below the floor of agreed performance. A bridge for markets still used to volume-based contracts.
- **Add a "swaption":** an extra layer that offers protection against future price hikes, like a cap on the rent when a lease renews. It shields the user from paying more in subsequent cycles if conditions worsen. Useful where the environment is volatile, and deployments are long-term.

Tool 4 — The Levelized Cost of MaaS (LCOM)

A companion metric, the Levelized Cost of MaaS (whose concept is borrowed from the Levelized Cost of Energy LCOE in the energy sector), lets a company check whether the model beats the linear one, and shows the levers to pull: keep less metal idle, redeploy it faster, sequence high-grade metal to the uses that need it, and build a track record that lowers financing costs over time.

The LCOM metric is computed from data provided by the stock-and-flow models, and enhanced with modern tools such as digital twins and AI-based tracking, among others.

Tool 5 — A market discovery framework: where to even start

The last tool is a light-touch framework (a work in progress, deliberately shown early for feedback) to identify where MaaS is worth pursuing before investing in deep analysis. It works like peeling a

seven-layered onion. Seven questions from the outside in: is there a growing market for the metal, does the metal hold durable value, can the loop be closed, is the value chain mappable, is it ready for circularity, is there an entry point (leasing, renting, performance-based payments), and does MaaS unlock genuinely new value. *It is a conversation-starter, not a verdict,* and it flexes for corporates, entrepreneurs, and investors alike.

What practitioners took away

- **The toolkit is real and adaptable.** Stock-and-flow models and performance-based pricing are already used in adjacent industries — jet engines and aerospace have sold "power by the hour" for years — so MaaS builds on proven ground.
- **Keep asking for the simplest version.** Several participants pushed for a stripped-down starting point that any actor could try and that clearly beats the linear model, alongside the sophisticated version.

  The research team provided the baseline analysis, and participants had the opportunity to discuss and exchange on it during two previous convenings. Please find resources pertaining to those convenings here.
- **Financiers need familiar proof.** Lenders will adopt these tools once they are shown real precedents and shared pilot results, which argues for pre-competitive knowledge sharing across the community.
- **Don't lose the social purpose.** MaaS was conceived a decade ago by some practitioners to make value chains fairer, and participants urged keeping that central. Resource-rich countries and local communities could hold seats or equity in the SPV's metal bank. One striking model: a mining country charges lower upfront royalties in exchange for a small "perpetuity" tax payment every time its metal is reused anywhere in the world — so copper mined once in Chile or Peru keeps paying back as it moves through turbines, vehicles, and data centers over decades. Multiple opportunities for social and positive externalities exist when implementing MaaS, which the team would map out with further funding.
- **Bridge theory to practice.** A closing challenge asked the team to reconcile the conceptual tools with the concrete practical implementation opportunities, and to show plainly who benefits and who does not. Worked examples — including cases where a host country or community gains, and cases where it is purely a downstream play — would help surface the real trade-offs needed to get started. The team would explore these avenues with additional funding to continue the research.

Next steps:

The conversation continues at a planned New York Climate Week event on financing and de-risking circularity. Both reports and all webinar resources are public at https://ccsi.columbia.edu/metals-service-maas/.