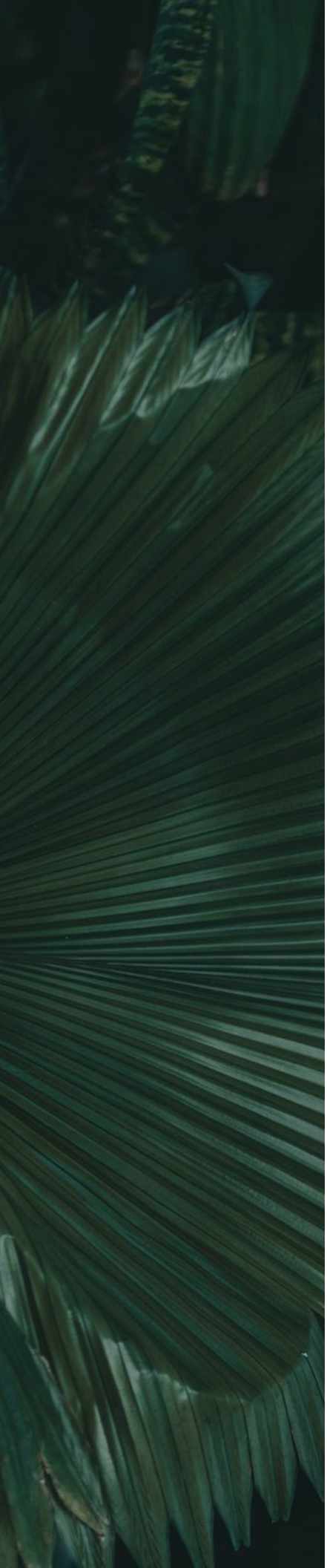


GALVORN

PROSPECTIVE
LIFE CYCLE ANALYSIS

dexmat.com



A win-win for the ages

OUR MISSION

To accelerate the next industrial revolution with high-performance, commercially competitive, and sustainable materials.

Let's make dirty metals and materials obsolete.

Galvorn® is an advanced carbon material that delivers a multi-property advantage, which outperforms incumbent materials. Galvorn's production roadmap is fundamentally more efficient, while embodying carbon into a platform material that has a clean energy byproduct—hydrogen.

This study analyzes Galvorn's CO_2e impact today and considers the gigaton climate-positive opportunity ahead.

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Metals production is energy intensive and environmentally destructive

Metals production requires mining ore, which results in the broad destruction of land and ecosystems, in addition to the massive amounts of energy and water required to process the ore into usable metal.



Escondida Mine moves 1.5M tonnes of rock per day

The Escondida copper mine in Chile is the world's largest (3.9km x 2.7 km), with industrial operations moving roughly 1.5 million tonnes of material—combined ore and waste rock—per day. Escondida consistently produces more copper than any other mine globally.



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Highlights

The net impact of Galvorn® improves over time

2031 — 2035 — 2050 *(Medium Case)*

-0.1 tonnes
Galvorn achieves net negative CO_2e impact

-3.6 tonnes
net CO_2e impact per tonne Galvorn

-21 tonnes
net CO_2e impact per tonne Galvorn



Biggest Driver: Metals Displacement

Displacing dirty incumbent materials is the biggest driver of impact—abating emissions through the use of Galvorn, whose production has far fewer, and potentially negative, emissions.

Potential net impact of displacing steel, aluminum, and copper

-1 gigaton
CO_2e per year

by 2050

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About this study

This prospective CO_2e life cycle analysis was done in collaboration with Shell, the Grantham Foundation, Rice University, and ARPA-E to evaluate the carbon-reduction opportunity that Galvorn represents. We thank them for their support and guidance.

Efficient Galvorn® production

A fundamentally efficient process with the potential to be CO_2e negative.

Gigaton impact via metals displacement

Galvorn can do the same work of incumbents with far fewer emissions.

Bigger outcomes with RNG

Galvorn can be fully sustainable with renewable natural gas as feedstock.



DEXMAT

Galvorn® CO_2e impact has five components

Each component influences Galvorn's CO_2e impact to varying degrees. This study considers each component across best, medium, and worst-case scenarios.

GALVORN® PRODUCTION

Methane Feedstock

Today multiple sources offer the methane feedstock which undergoes pyrolysis. In the future, Galvorn could be made from captured CO_2e.

- CO_2e from NG
- CO_2e from RNG
- NG/RNG Mix %

CNT Synthesis

Carbon nanotubes (CNTs) can be made from hydrocarbons, capturing the carbon (abating CO_2e) and co-producing clean hydrogen.

- CO_2e from electricity
- Synthesis efficiency

Galvorn Fiber Spinning

DexMat processes raw (and recycled) carbon nanotubes to produce high-performance Galvorn. Electricity powers the machinery.

- CO_2e from spinning

GALVORN® UTILIZATION

Displacement of Metals

While Galvorn can be sustainably produced, its gigatonne impact is achieved by displacing dirty incumbent materials. The biggest emitters are:

- Steel
- Aluminum
- Copper

Lightweighting Transportation

When Galvorn displaces many times its mass in dirty incumbent materials, the applications also benefit from lightweighting and more efficient use of fuel/energy.

- CO_2e reduction from lower fuel consumption

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GALVORN® PRODUCTION

Offering a pathway to gigaton CO_2e-negative impact

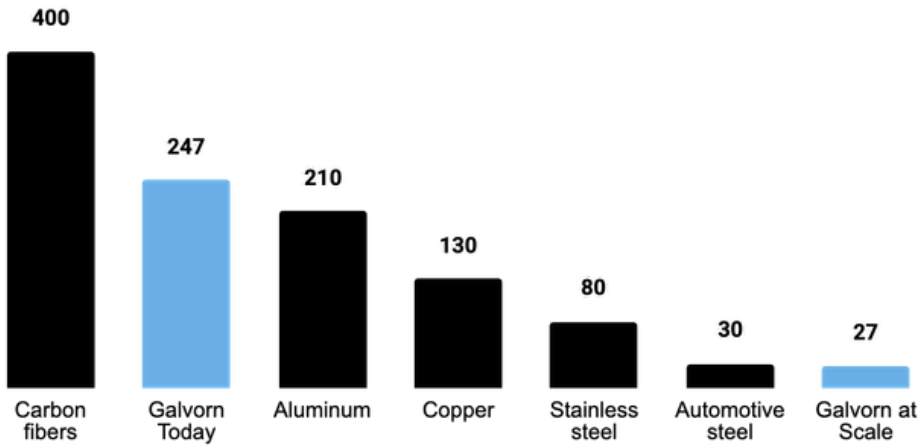


GALVORN® PRODUCTION

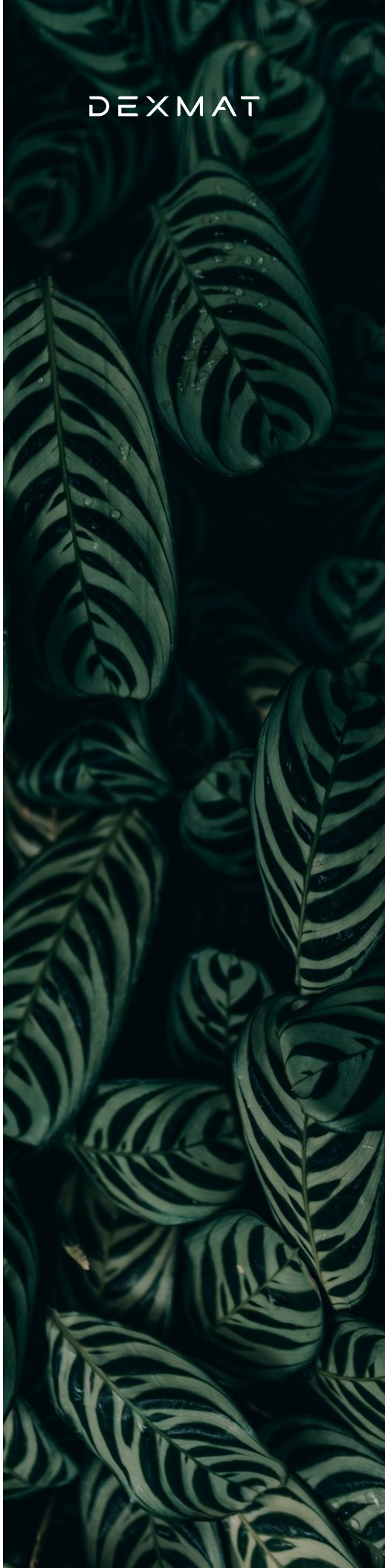
Galvorn production has significant efficiency advantages

Offering a pathway to gigaton CO_2e-negative impact

Incumbent materials production involves massive physical footprints, and significant mass loss. By contrast, Galvorn production at scale has a near 1:1 feedstock-to-product conversion, while the process is fundamentally less energy intense with a clean energy byproduct, hydrogen.



Energy Intensity of Materials (MJ/kg)
Galvorn's energy intensity is higher today because of its small scale (typical of materials production). At scale, process efficiencies improve and significantly reduce the energy required to produce it. Automotive steel appears lower here, but Galvorn is many times stronger than steel such that it can do more with less material.



GALVORN® PRODUCTION

Galvorn production has low energy intensity with a clean energy byproduct—hydrogen

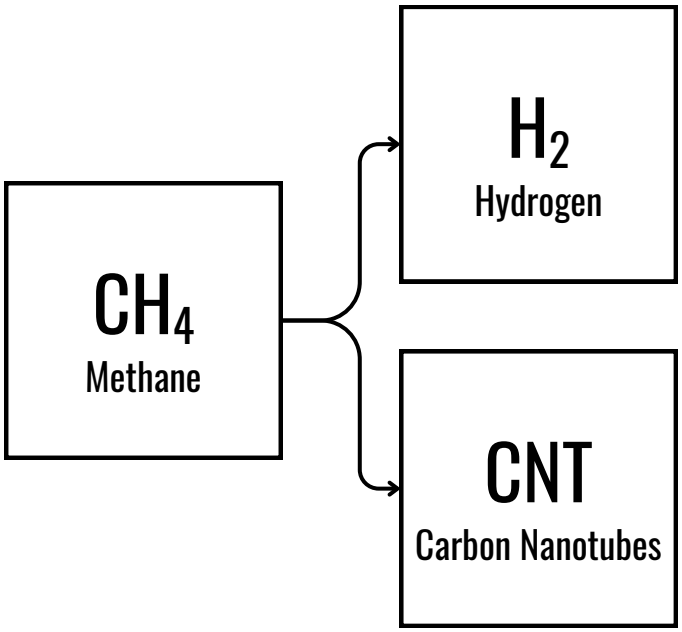
Metals production requires mining ore, which results in the broad destruction of land and ecosystems, in addition to the massive amounts of energy required to process the ore into usable metal. By contrast, with Galvorn we produce materials not by emitting carbon, but capturing it into a high-value advanced carbon material. Clean hydrogen is a byproduct.

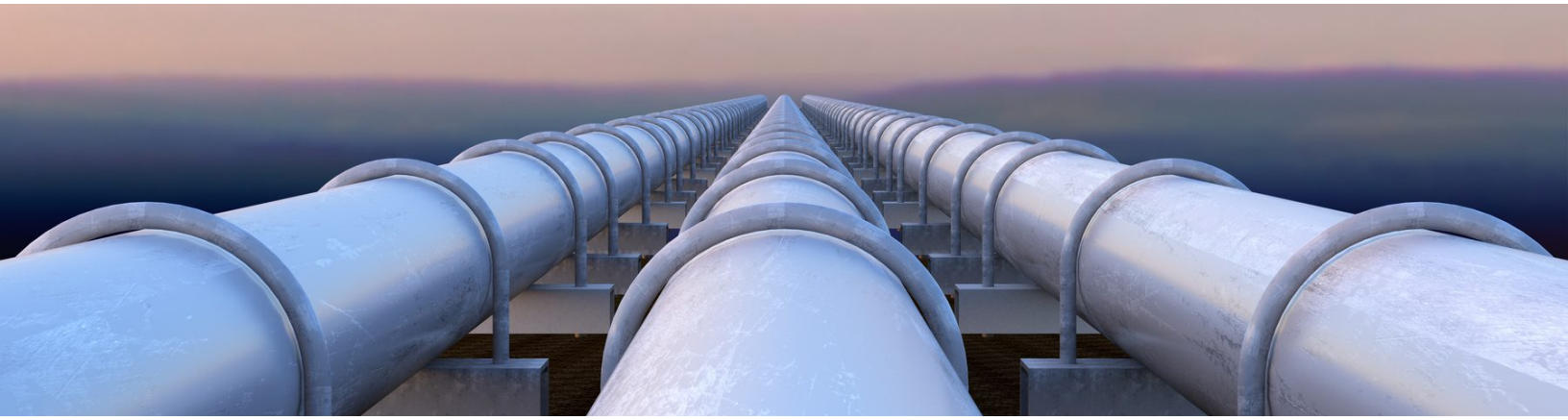
Methane pyrolysis produces hydrogen and carbon nanotubes

Methane pyrolysis can be used to simultaneously produce carbon nanotubes and clean turquoise hydrogen, by splitting the methane (CH_4) into hydrogen (H_2) and carbon nanotubes (CNTs).

This method of hydrogen production is four times more efficient than green hydrogen production.

CNTs are the feedstock required to produce Galvorn.





GALVORN® PRODUCTION

Galvorn's feedstock is carbon nanotubes

DexMat has a scalable process to produce Galvorn with unmatched properties, using carbon nanotubes (CNTs) as the feedstock.

OUR FEEDSTOCK

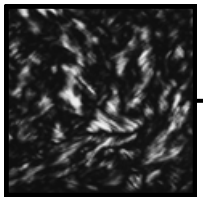
CNTs



DexMat processes CNTs from a growing list of approved suppliers.

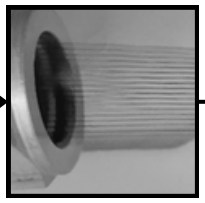
OUR PATENTED PROCESS

Dissolve CNTs



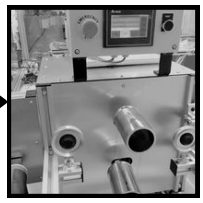
CNT solutions are liquid crystalline; CNTs spontaneously align.

Align & Pack CNTs



Aligned CNTs are extruded to form solid fibers; thousands of fibers can be processed in parallel.

Fiber Wet Spinning



Fiber wet-spinning technology is already commercially proven at 100kt scale(e.g., Kevlar, Rayon).

OUR PRODUCTS

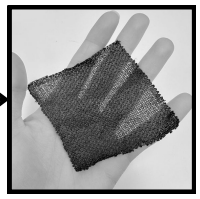
CNT Fiber



CNT Wire / Yarn



CNT Mesh / Fabric



Our wet-spun Galvorn fibers can be constructed into wire / yarn, and subsequently formed into mesh / fabric, depending on application needs.

CNT Film



The same wet-spinning process can be adjusted to cast Galvorn into a film form factor, to support EMI shielding applications.

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GALVORN® PRODUCTION

Galvorn's CO_2e impact starts with its production

Methane Feedstock	CNT Synthesis	Galvorn Fiber Spinning	SCENARIOS & ASSUMPTIONS
-3.93 tonne CO2e	+0 tonne CO2e	+0.01 tonne CO2e	**BEST** **-3.92 tonnes CO_2e** per tonne of Galvorn produced by 2050 • 100% Renewable Gas • 100% Renewable Electricity **Reaching -2.51 by 2035**
-1.52 tonne CO2e	+0.13 tonne CO2e	+0.22 tonne CO2e	**MEDIUM** **-1.17 tonnes CO_2e** per tonne of Galvorn produced by 2050 • 9% RNG for feedstock • Texas renewables mix for CNT synthesis electricity • Modest efficiency improvements in fiber spinning during scaleup **Reaching +2.90 by 2035**
+0.65 tonne CO2e	+1.64 tonne CO2e	+2.77 tonne CO2e	**WORST** **+5.06 tonnes CO_2e** per tonne of Galvorn produced by 2050 • 100% fossil gas • Low renewables grid uptake **Reaching +7.50 by 2035**

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GALVORN® PRODUCTION

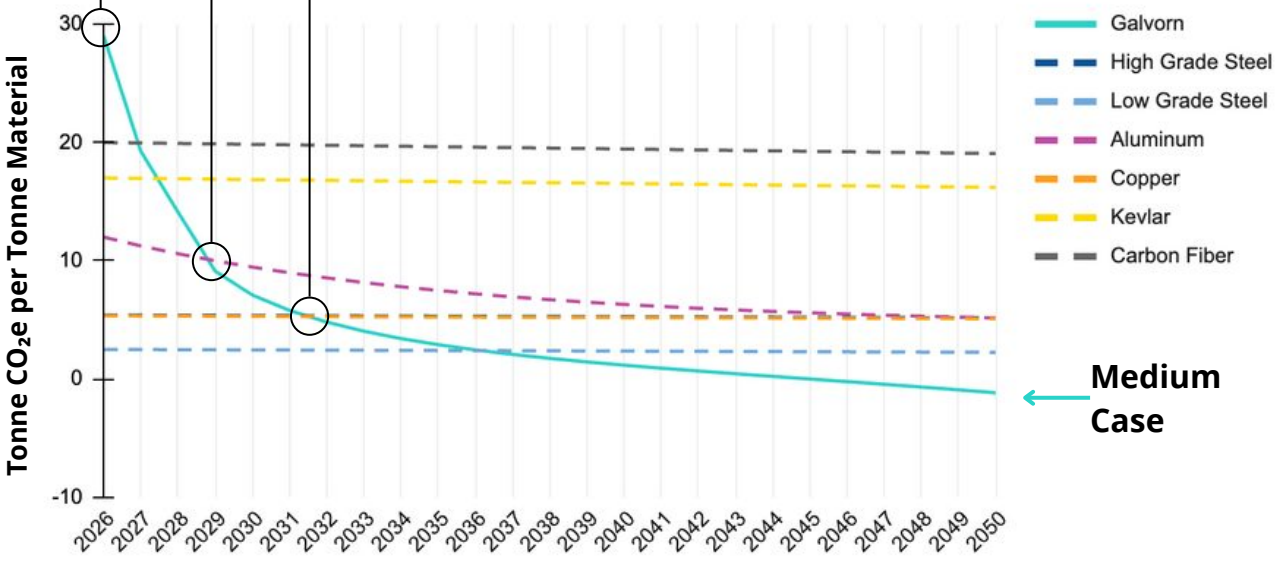
Galvorn's production footprint beats metals within 3-6 years

High CO_2e per unit of Galvorn initially because of small scale and process inefficiencies.

Galvorn beats aluminum production by 2029: 9.12 CO_2e / tonne Galvorn vs. 10.02 CO_2e / tonne aluminum.

Scaling annual capacity from 0.3 tonne in year 1 to 3000 tonnes in 2031 increases efficiency, achieving lower CO_2e footprint than copper and steel.

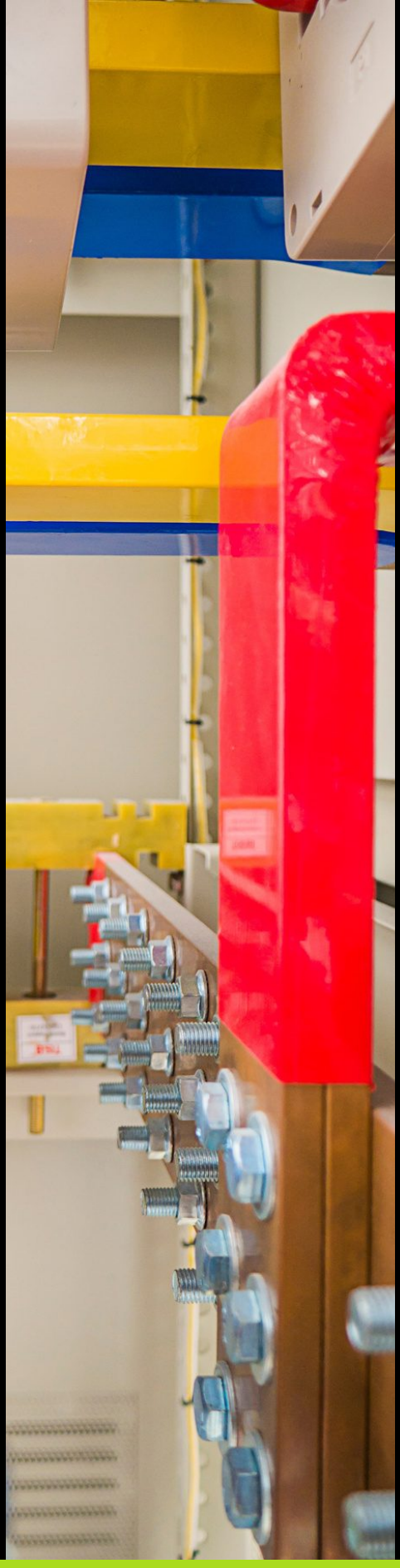
Note: High-Grade Steel is not as visible because it follows the same trend line as copper.



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GALVORN® UTILIZATION

Mitigating the need for energy-intensive metals production

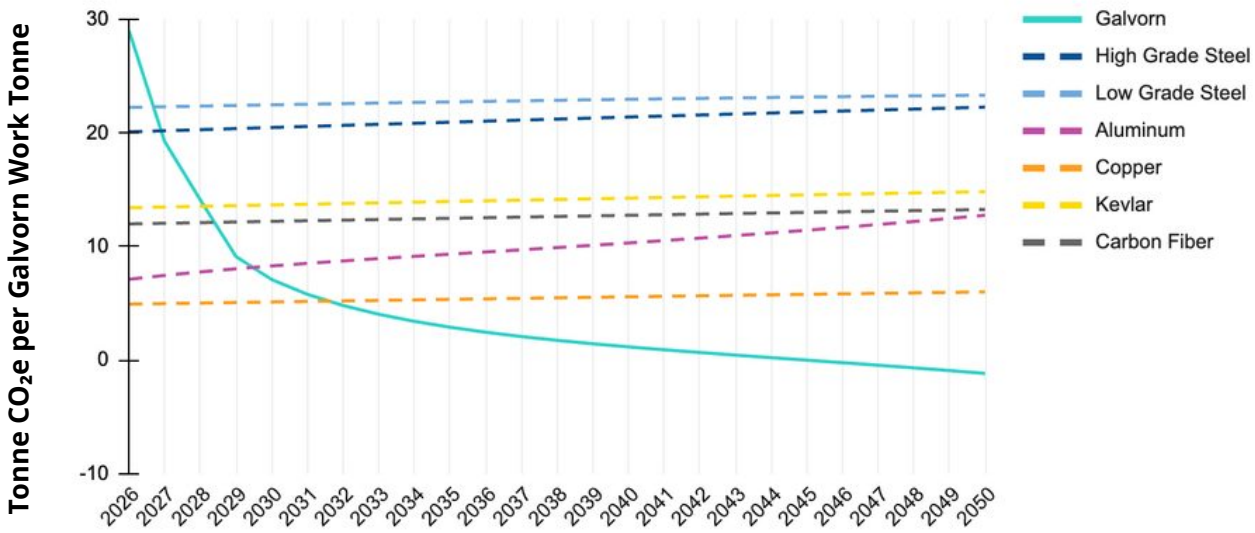


GALVORN® UTILIZATION

Galvorn can do the same work with fewer emissions

This advantage grows over time as production scales and processes mature.

CO_2e emissions to do the same amount of work as 1 tonne of Galvorn



Assumptions

- CO_2e for Galvorn and metals all assumed to decrease over time.
- Amount of metals that can be displaced per tonne of Galvorn assumed to increase over time.
- With improving Galvorn properties, 2050, 1 tonne of Galvorn can displace:
  - 4.3 tonne high grade steel
  - …**OR** 10.3 tonne low grade steel
  - …**OR** 2.5 tonne aluminum
  - …**OR** 1.2 tonne copper

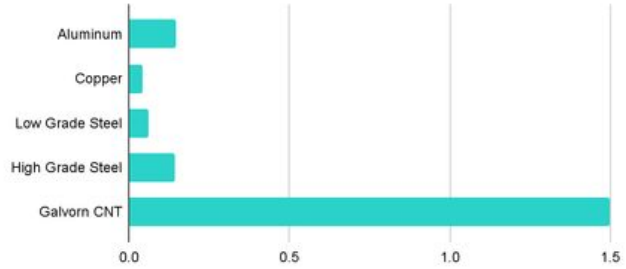
GALVORN® UTILIZATION

By 2035, Galvorn production is projected to have lower CO_2 emissions than aluminum, copper, and steel to do the same amount of work

It's time to re-think how materials get the job done. Galvorn can do the same work as incumbent materials with a lower emissions footprint

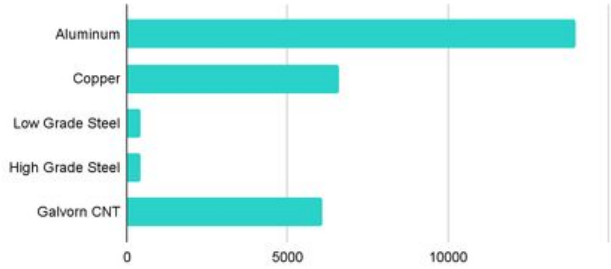
This is accounted for in the analysis.

Specific Strength



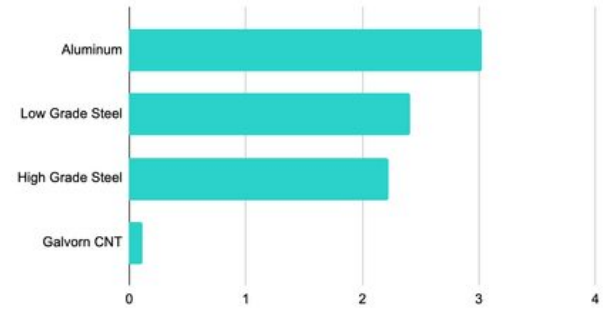
Specific Strenth (N/tex)

Specific Conductivity



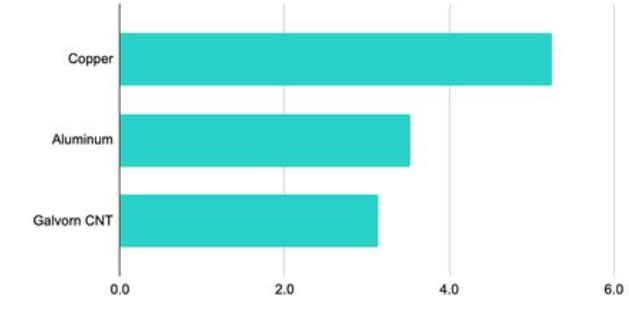
Specific Conductivity (Sm^2/kg)

Emissions to Support Same Weight
As 1 tonne of Low-Grade Steel



Emissions (Tonne CO_2e) | 2035

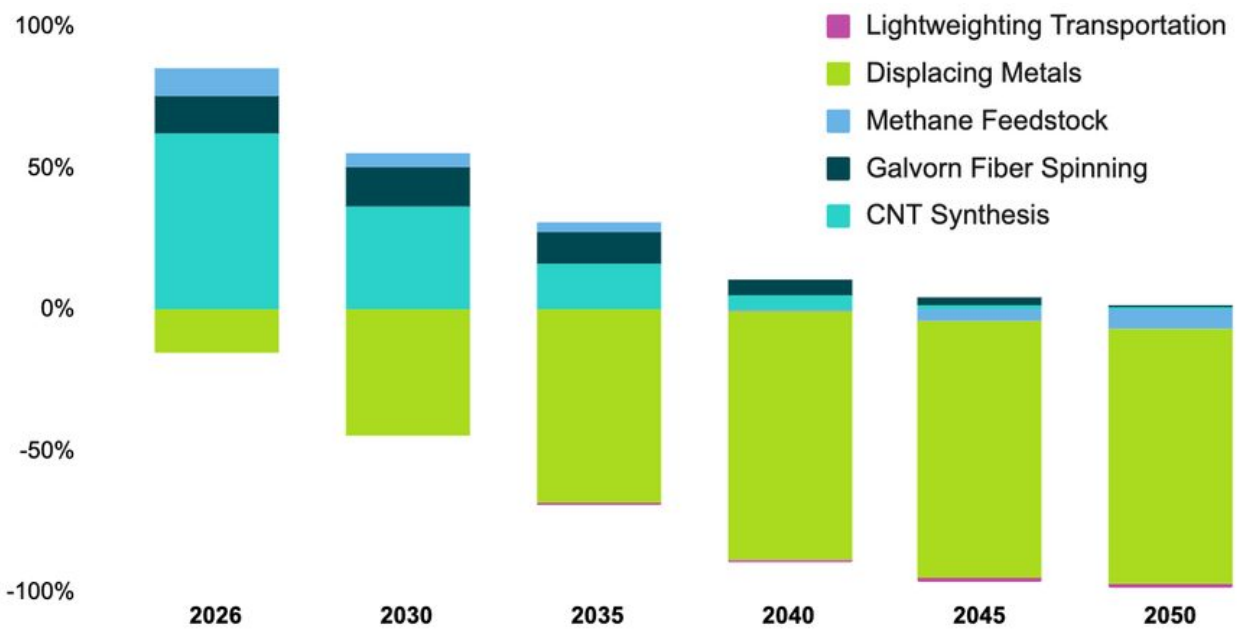
Emissions to Conduct the Same Amount of Electricity
As 1 tonne of Copper



Emissions (Tonne CO_2e) | 2035

GALVORN® UTILIZATION

Galvorn's displacement of metals drives its net CO_2e impact



Year	Net Annual CO_2e Impact (Mt)
2026	0
2030	0
2035	-0.07
2040	-13.5
2045	-355
2050	-976



GALVORN® UTILIZATION

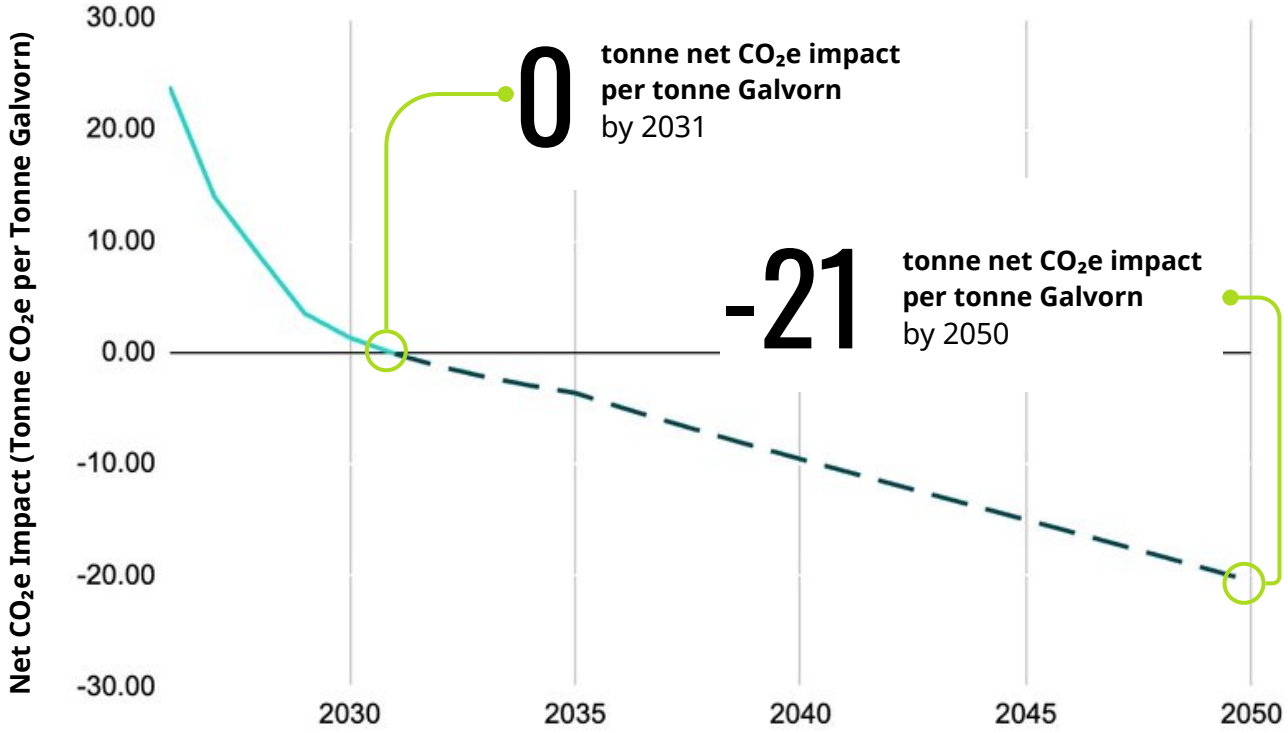
Galvorn's net negative impact increases with greater utilization

Galvorn's net CO_2e impact by 2035

Assumes we are:

- Using 9% RNG for CNT synthesis
- Using 1 tonne of Galvorn to displace any one of the following (on a performance levelized basis):
  - 4.0 tonne high-grade steel
  - …**OR** 9.4 tonne low grade steel
  - …**OR** 1.3 tonne aluminum
  - …**OR** 0.8 tonne copper

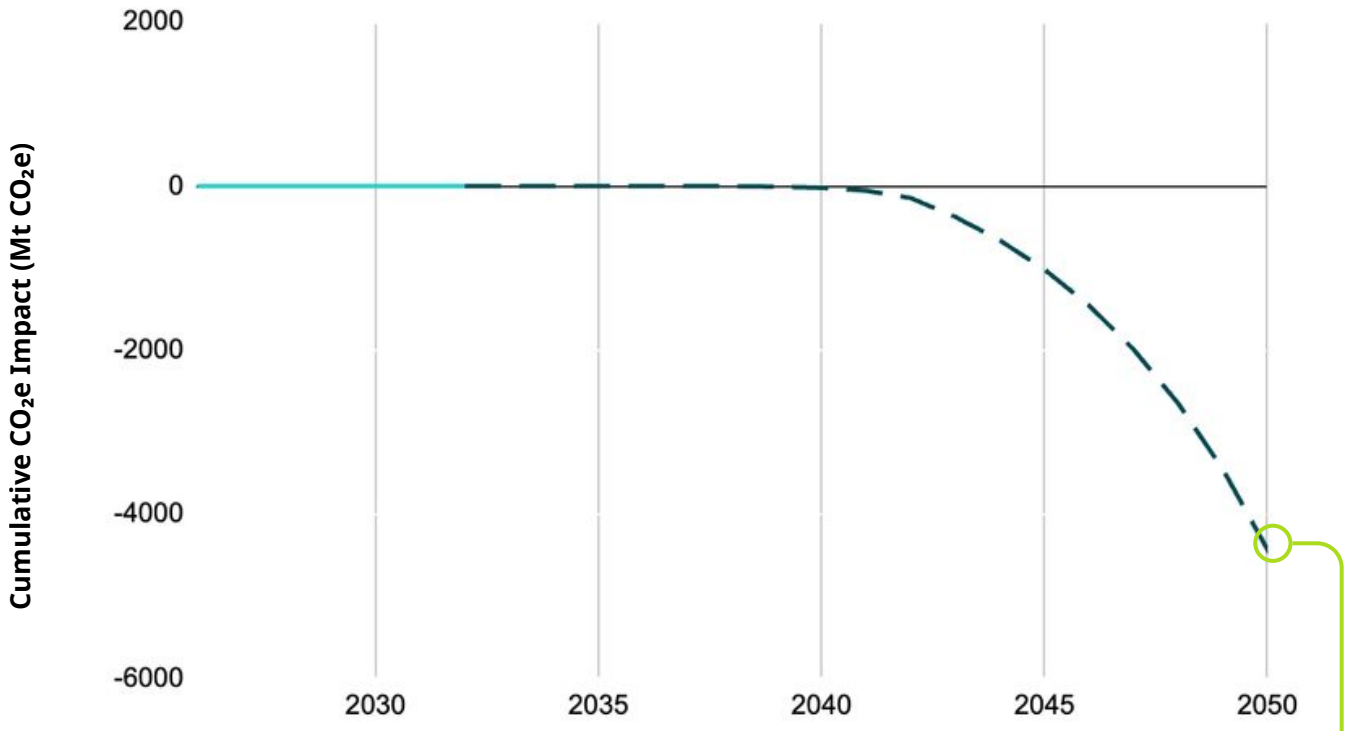
Impact varies based on which metal is being displaced. Regardless, Galvorn will reach price parity with high-grade steel by year four, in which case displacement makes sense economically–as well as environmentally.



GALVORN® UTILIZATION

Galvorn's cumulative net CO_2e impact can reach gigaton scale

Cumulative CO_2e Impact in Megatons



-4.4

Gt CO_2e
Cumulative Impact
@ -1 Gt / year by 2050

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GALVORN PRODUCTION

Future pathways to more impact

DexMat has future pathways to improve Galvorn production LCA, noted below. But, conservatively, these pathways have **NOT** been included in this CO_2e impact model.



Co-producing H_2 during CNT synthesis



Utilizing captured CO_2 instead of methane as a feedstock



Utilizing recycled Galvorn instead of new CNTs



Unlocking energy transition technologies



DexMat is supported by visionaries and industry leaders

DexMat has a bold vision and we appreciate the support of our investors and advisors as we create the building blocks necessary for a more efficient and secure economy.

non sibi ventures

Tailwind FUTURES

Shell Ventures

CAPITAL FACTORY

RICE

U.S. AIR FORCE

U.S. DEPARTMENT of ENERGY

NSF

NASA

QUESTIONS?

Our team is available to answer your questions.

Contact us at **dexmat.com**

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APPENDIX

DEXMAT



RNG

A pathway to Galvorn’s negative carbon footprint

DEXMAT

Renewable natural gas (RNG) provides a pathway to Galvorn's negative carbon footprint

-2.3 tonne CO_2 emissions per tonne RNG

GREET ascribes -2.3 tonne CO_2 emissions per tonne RNG when produced from landfill gas.

The negative footprint of RNG in the model is a sum of 3 factors:

01 CO_2 in landfill gas (LFG) is from biogenic sources (i.e. food)

02 Biogenic CO_2 emissions are carbon neutral

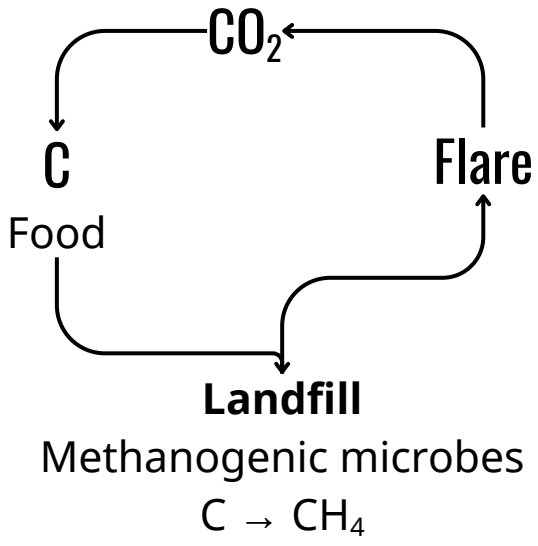
03 Capturing LFG and preventing its emission is a net negative change from status quo





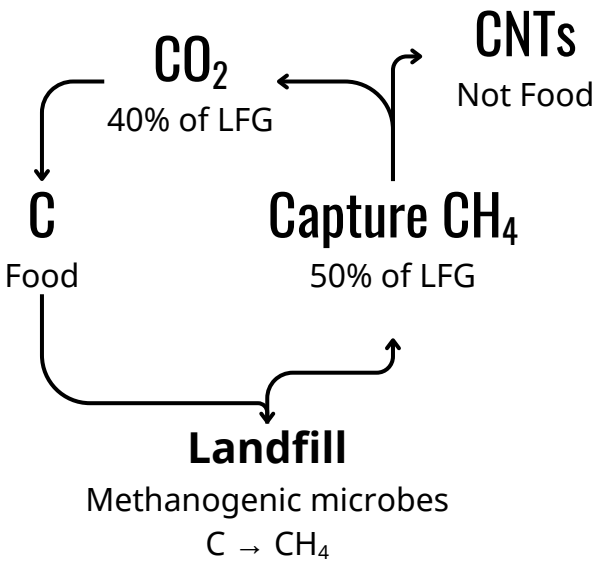
Biogenic CO_2 emissions are carbon neutral

Landfill Gas (LFG) is usually emitted or flared. It does not stay in the landfill.



...so capturing CH_4 is carbon negative

Using LFG prevents CO_2 (if flared, or CH_4 if not) from entering the atmosphere.





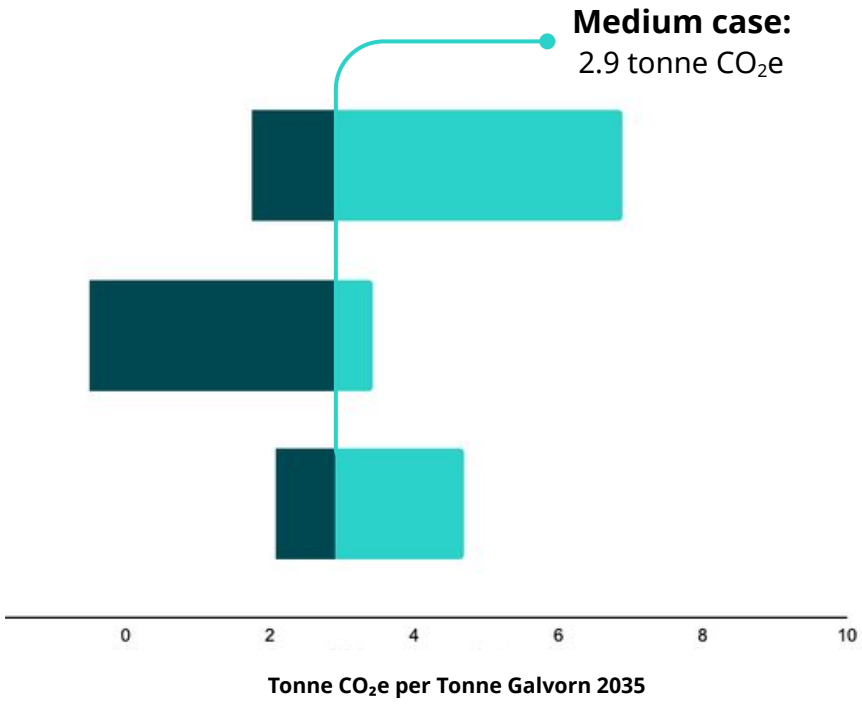


GALVORN® PRODUCTION

CO_2e of Galvorn® production is most sensitive to CNT synthesis

About CNT Synthesis

The process for making carbon nanotubes (CNTs), which are the feedstock for Galvorn, is pyrolysis. Electricity is used to split methane (CH_4) into hydrogen (H_2) and carbon (C). Most of the energy required to produce Galvorn today goes into CNT synthesis. Spinning the CNTs into fiber does not require as much energy. Galvorn production as a whole is thermodynamically efficient in terms of its chemical reactions. Powered by electricity, it can also have the benefit of being produced with renewable energy.





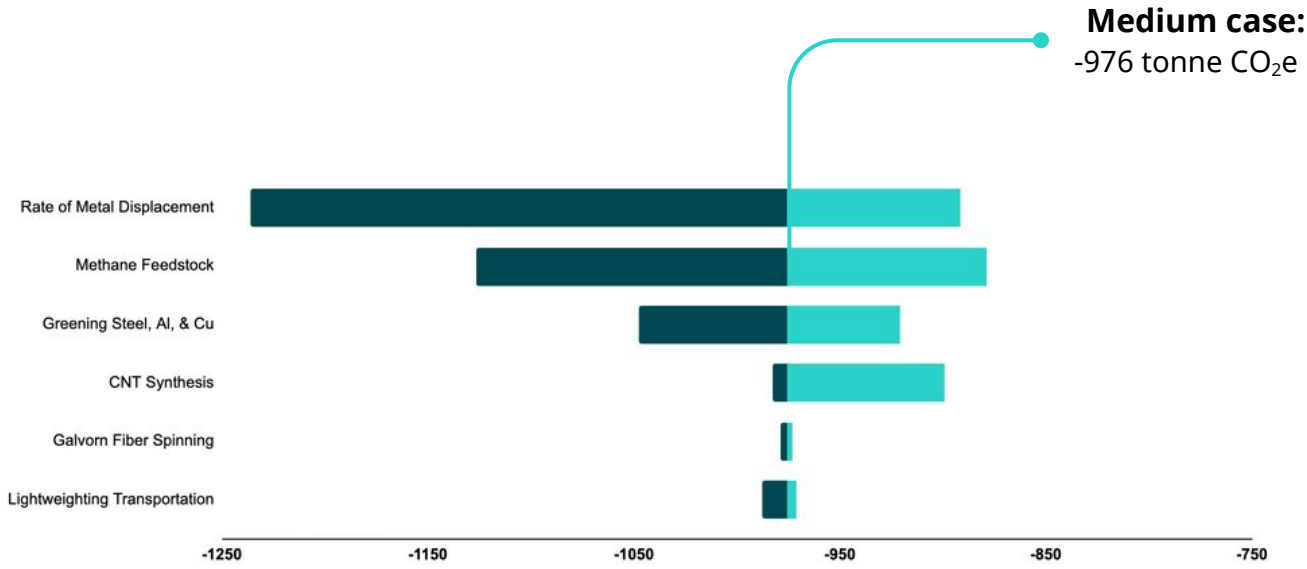
GALVORN® PRODUCTION

The total CO_2e of Galvorn® production is most sensitive to rate of metal displacement

Below, Galvorn's total CO_2e impact is most sensitive to:

- Rate of metal displacement from improving Galvorn properties
- Methane FeedStock
- Greening of Steel, Al, and Cu

SENSITIVITY ANALYSIS



Total Impact: CO_2e Tonne per Tonne Galvorn 2050

DEXMAT



Assumptions in this prospective life cycle analysis



Assumptions for CO_2e from Galvorn production

	Initial	Low Case	Medium Case	High Case
Renewable NG Mix (% RNG)	5%	0% always	+10% per yr	100% always
CO_2e Footprint Electricity (t CO_2e / MW-h)	0.39	-1% per yr	-10% per yr	-20% per yr
Galvorn Fiber Spinning (t CO_2e / t Galvorn)	4.4	-0.25 t CO_2e/t Galvorn/yr	-0.4 t CO_2e/t Galvorn/yr	-0.8 t CO_2e/t Galvorn/yr
CO_2e Footprint RNG (t CO_2e/ t RNG)	-2.2	-0.01 t CO_2e/t RNG/yr	-0.05 t CO_2e/t RNG/yr	-0.08 t CO_2e/t RNG/yr
CO_2e Footprint NG (t CO_2e / t RNG)	0.9	-0.01 t CO_2e/t NG/yr	-0.02 t CO_2e/t NG/yr	-0.03 t CO_2e/t NG/yr
CNT Synthesis Efficiency (% Efficiency)	0.80%	0.5% per yr	1% per yr	2% per yr



Sensitivity analysis assumptions for total CO_2e impact

	Units	Initial	Low Case	Medium Case	High Case
Galvorn Properties*	(N/tex); (Sm^2/kg)	1.5 N/tex ; 6100 Sm^2/kg	0.33%/yr ; 1.1%/yr	0.67%/yr ; 3%/yr	1.33%/yr ; 6%/yr
Greening Steel, Al**, & Cu	(t CO_2e / t metal)	Steel: 3.4, Al: 12.0, Cu: 5.34	-0.02 t CO_2e/ t metal/yr	-0.01 t CO_2e/ t metal/yr	-0.005 t CO_2e/ t metal/yr***
Renewable NG Mix	(% RNG)	5%	0% always	+2% per yr	100% always after 5 years
CO2 Footprint Electricity	(t CO_2e / MW-h)	0.39	-1% per yr	-10% per yr	-20% per yr
Galvorn Fiber Spinning	(t CO_2e / t Galvorn)	4.4	-0.25 t CO_2e/t Galvorn/yr	-0.4 t CO_2e/t Galvorn/yr	-0.8 t CO_2e/t Galvorn/yr
CO2 Footprint RNG	(t CO_2e / t RNG)	-2.2	-0.01 t CO_2e/t RNG/yr	-0.05 t CO_2e/t RNG/yr	-0.08 t CO_2e/t RNG/yr
CO2 Footprint NG	(t CO_2e / t NG)	0.9	-0.01 t CO_2e/t NG/yr	-0.02 t CO_2e/t NG/yr	-0.03 t CO_2e/t NG/yr
CNT Synthesis Efficiency	(% Efficiency)	2%	0.5% per yr	1% per yr	2% per yr
Lightweight Transportation	(t CO_2e / t Galvorn)	-0.01	-0.005 t CO_2e/t Galvorn/yr	-0.01 t CO_2e/t Galvorn/yr	-0.02 t CO_2e/t Galvorn/yr

* Metals displacement is calculated based on relative properties of Galvorn and metals.
** About 60% of aluminum footprint is due to electricity usage; grid greening impacts aluminum footprint accordingly.
***For the high case, copper's carbon footprint is assumed to increase +0.03 t CO_2e/t copper/yr due to declining ore grades.