



# Navitas

*Energy • Efficiency • Sustainability*



## ***Sustainability Report 2021***

***Electrify Our World™***

***GaNFast Power ICs Accelerate the Transition to Net Zero***

*February 2022*

# Electrify Our World™



Gene Sheridan, CEO & Co-Founder

The world today is powered by fossil fuels. Over 80% of our energy sources are based on fossil-fuel power plants and over 80% of our energy requirements are gas- or oil-powered across transportation, heating, cooling, cooking and so many industrial, commercial and consumer applications. Fossil fuels have a limited and finite supply and are damaging our planet with over 30 Gtons of CO<sub>2</sub> emitted every year, destroying our natural habitat and disturbing weather patterns around the world.<sup>1</sup>

It's time for a change. Electricity is the answer. Electricity can be created from renewable sources like solar and wind, which have an unlimited supply to power our world. Electricity can be used for all energy applications, powering virtually everything we do. Electricity is clean, emitting no CO<sub>2</sub> and limiting the damage to our planet.

*“Navitas will enable energy and emission reductions in every major market segment”*

Our mission is to become the next-generation power semiconductor leader and Electrify Our World™. Navitas GaN power ICs make electricity more efficient, more reliable, lower cost and faster charging. Navitas has the opportunity to accelerate our world's transition to an electricity-based society. Our GaN technology can address and accelerate virtually all electric applications: enabling more efficient and lower cost renewable energy, faster and more efficient charging of all mobile devices and energy storage systems, extending the range and lowering the cost of electric vehicles, and creating energy-saving data centers and 5G base stations to power data processing and communications.

2021 was a milestone year for Navitas; doubling shipments and revenue, opening new market-centric design centers, growing the team by 70%, and completing our IPO with a listing on Nasdaq. Even with this aggressive growth, we have achieved a 5% reduction in total scope emissions per unit shipped for 2021.

As each GaN power IC shipped saves 4 kg CO<sub>2</sub>, and with up to 30% CO<sub>2</sub> footprint reduction in the end application, Navitas can also increase our customers' ability to achieve their CO<sub>2</sub> emissions targets by reducing the energy consumption of their products.<sup>2</sup> We will enable energy and emission reductions in every major market segment across mobile, consumer, industrial, communications and transportation, and strive to be a critical enabler of electrification and energy efficiency to meet the challenges highlighted in the IEA's World Energy Outlook 2021 report.

We hope you will join us in our commitment to **Electrify Our World**.

**Let's Go GaNFast!**



## Executive Summary

# Accelerating the Path to Net Zero

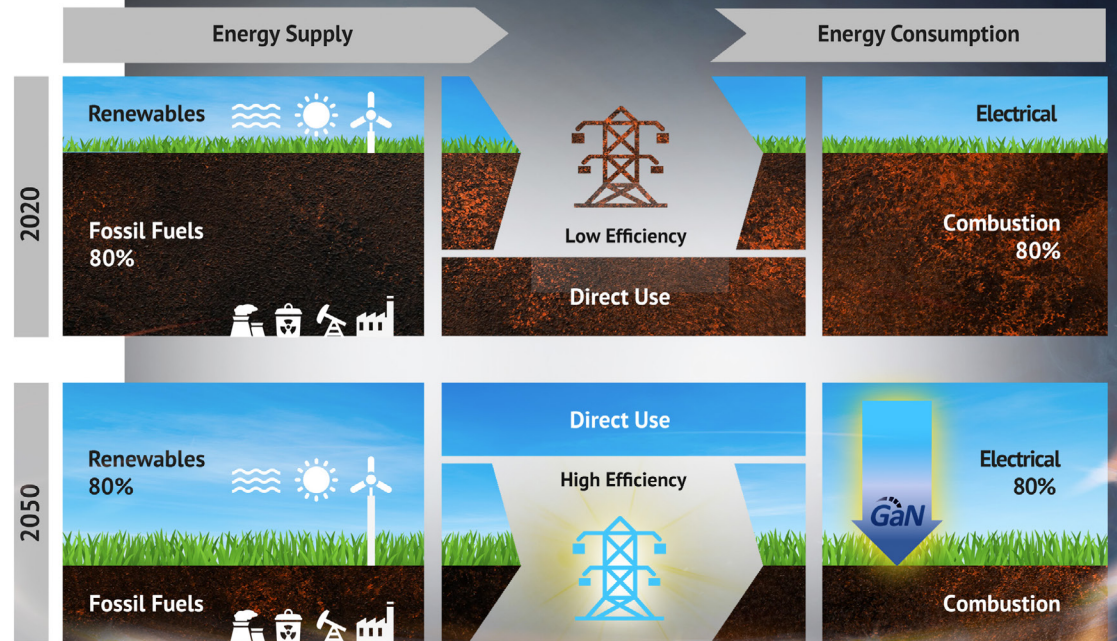
The transition from silicon chips to gallium nitride (GaN) will play a vital role in enabling & accelerating a variety of industries to achieve the goal of net zero carbon emissions by 2050.

GaN is a next-generation semiconductor, replacing legacy silicon chips in power conversion and battery-charging applications. GaN power ICs are efficient, cost-effective and enable up to 3x more power and 3x faster charging in half the size and weight of old silicon solutions. Gallium metal is a non-toxic, non-conflict, readily-available byproduct from aluminum smelting.

The CO<sub>2</sub> footprint to manufacture and ship GaN is up to 10x lower than silicon and reduces end application footprint by up to 30%. Improvements in the performance of electric vehicles (EVs) could accelerate worldwide EV adoption by three years and save up to 20% of road-sector emissions by 2050.<sup>3</sup> Each GaN power IC shipped saves net 4 kg CO<sub>2</sub>, and GaN offers the potential to address a reduction of 2.6 Gtons CO<sub>2</sub>/year by 2050 – equivalent to the CO<sub>2</sub> generated by over 650 coal-fired power stations, over six billion barrels of oil, over 560 million ICE passenger cars - or the annual electricity use of over 470 million homes.<sup>4,5</sup>

Founded in 2014, Navitas Semiconductor (Nasdaq: NVTX) is the industry leader in GaN power ICs. These ICs integrate GaN power with drive, control and protection to enable faster charging, higher power density and greater energy savings for mobile, consumer, enterprise, eMobility and new-energy markets. Over 145 Navitas patents are issued or pending, and over 35 million GaNFast power ICs have been shipped with zero reported GaN field failures. Navitas rang the opening bell and started trading on the Nasdaq exchange on October 20th, 2021.

*“GaN could save annual emissions of up to 2.6 Gtons - the equivalent of 650 coal-fired power stations”*



# What is GaN, and How Does it “Electrify Our World™”?

Combining gallium and nitrogen, gallium nitride (GaN) is a ‘[wide bandgap](#)’ semiconductor material with a hard, hexagonal crystal structure with a 10x stronger electric field and 2x higher electron mobility than silicon. Gallium does not exist in elemental form in nature but is a by-product from the smelting of bauxite ore into aluminum, so is readily available, low cost and has a very low extraction and refinement carbon footprint – and nitrogen is in the air we breathe.



GaN enables up to 3x more power or 3x faster charging, with up to 40% energy savings in half the size and weight of legacy silicon. Navitas’ GaNFast power ICs integrate GaN power and drive plus protection and control to deliver the simplest, smallest, fastest and highest performance.

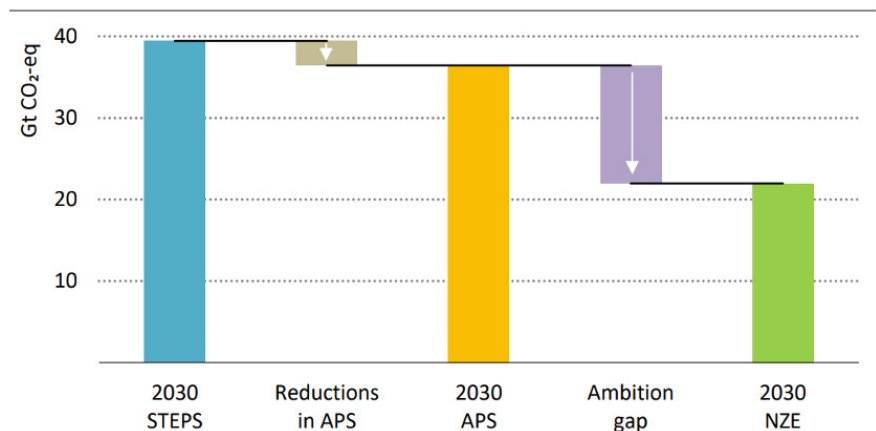
The International Energy Authority (IEA) has defined an ‘ambition gap’ between nations’ public commitments and the target required for us all to meet the maximum 1.5°C rise in global temperatures per the Paris Accord. <sup>1</sup>

GaN is a critical enabler to address the ‘ambition gap’ as we transition from majority fossil fuel to majority renewable, electricity-based energy sources and uses.

*“GaN accelerates the evolution from fossil fuels to renewable energy sources and electricity-based applications”*

GaN makes electrical energy more efficient and lower cost, all of which will serve to accelerate the world’s move from coal-fired power plants to solar- and wind-based energy sources and to evolve energy applications from gas-powered transportation, buildings and industrial factories to clean, electricity-based energy.

## CO<sub>2</sub> and methane emissions from energy and industrial processes in the three scenarios, 2030



IEA. All rights reserved.

Announced pledges would close less than 20% of the gap between the STEPS and NZE

Note: STEPS = Stated Policies Scenario; APS = Announced Pledges Scenario; NZE = Net Zero Emissions by 2050 Scenario.

Definition of CO<sub>2</sub> reduction ‘ambition gap’, from IEA’s World Energy Outlook report 2021.

# Progressive Partnerships

**Navitas is part of a world-wide eco-system dedicated to sustainability. References, memberships, commitments, auditors and partners include:**



**Greenhouse Gas (GHG) Protocol** - establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains and mitigation actions. Protocol defines Scope 1, 2 and 3 emissions on a corporate basis. Navitas corporate reporting uses GHG Protocol standards.



Navitas supports the **UN Framework Convention on Climate Change's (UNFCCC) Sustainable Development Goals (SDGs)**. This sustainability report specifically targets goals on clean, affordable energy, industry innovation and infrastructure, and climate action.



**Science-Based Targets Initiative (SBTi)** - in July 2021, Navitas committed to the Business Ambition for a maximum 1.5°C rise in global temperatures by the 2050 deadline set by the 2015 Paris Accord.



**Earth-Shift Global (ESG)** - respected, third-party organization for independent life-cycle assessments (LCA, estimate of CO<sub>2</sub> footprint from product design to disposal / recycling), per ISO14040/14044. assessments of GaNFast power ICs and 65W mobile charger baselines, per ISO14040/14044. Partnered with Navitas for GaNFast power IC and 65W laptop adapter LCAs.



**Det Norske Veritas (DNV)** – respected, independent expert in assurance and risk management, including collaborations to assess and forecast benefits of next-generation GaN power ICs across worldwide, multi-market opportunities.



**Natural Capital Partners (NCP)** – third-party advisors on sustainability, CarbonNeutral®



**The Paris Agreement** is a legally binding international treaty on climate change, adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016. Its goal is to limit global warming to well below 2, preferably to 1.5°C, compared to pre-industrial levels.



**TSMC** – world-class wafer manufacturing partner, with clear commitments to sustainability.



## Aggressive Reduction in Corporate Emissions

CO<sub>2</sub> emissions are grouped into 'scope' categories per the Greenhouse Gas (GHG) Protocol. As Navitas operates a 'fabless' manufacturing model, partnering with world-class companies such as TSMC for wafer/chip manufacturing, and with no company-owned facilities or vehicles, Scope 1 (direct) CO<sub>2</sub> emissions are zero. Scope 2 (energy purchases) and Scope 3 (up-stream activities, waste, etc.) are shown below. On a per-unit basis, emissions were reduced in 2021 by 5%, with a goal to reduce emissions in 2022 by an additional 3% or more.

Navitas uses a comprehensive life-cycle assessment (LCA) approach to determine CO<sub>2</sub> footprint and report based on GHG protocols.

### Navitas Semiconductor GHG Emissions Summary, 2020-2022

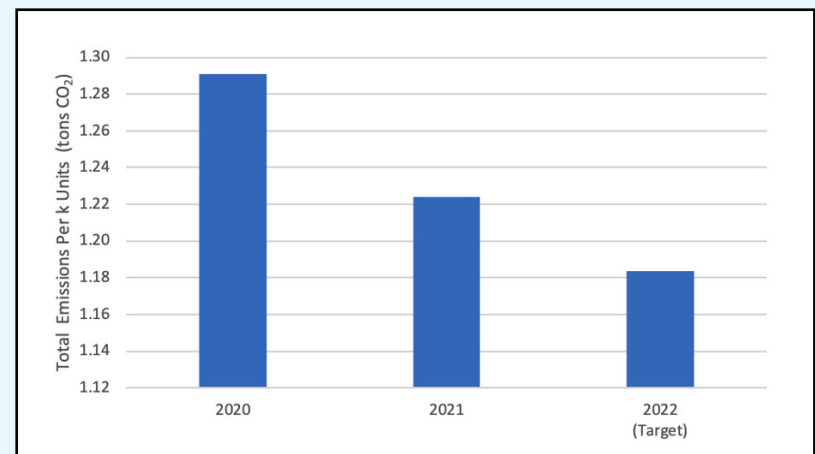
tons CO <sub>2</sub>	2020 Corporate	2021 Corporate	2022 Corporate (Target)	tons CO <sub>2</sub>	2020 Per k Units	2021 Per k Units	2022 Per k Units (Target)
Scope 1	0	0	0	Scope 1	0	0	0
Scope 2	143	336	789	Scope 2	0.01	0.01	0.01
Scope 3	14,315	28,871	64,311	Scope 3	1.28	1.21	1.17
<b>Total</b>	<b>14,458</b>	<b>29,207</b>	<b>65,100</b>	<b>Total</b>	<b>1.29</b>	<b>1.22</b>	<b>1.18</b>

### Navitas Semiconductor Corporation GHG Emissions

	(kg CO <sub>2</sub> )	2020 Corporate	2021 Corporate	2020 Per k Units	2021 Per k Units
Scope 1	Company Facilities	0	0	0	0
Scope 1	Company Vehicles	0	0	0	0
Scope 2	Purchased Energy	143,007	336,485	0.013	0.014
Scope 3	Purchased Goods & Services	115,000	415,639	0.010	0.017
Scope 3	Capital Goods	55,072	119,440	0.005	0.005
Scope 3	Waste Generated in Operations	1,293	5,823	0.000	0.000
Scope 3	Business Travel	310,454	81,404	0.028	0.003
Scope 3	Employee Commuting	122,157	55,527	0.011	0.002
Scope 3	Leased Assets	116,361	187,079	0.010	0.008
Scope 3	Processing of Sold Products	2,571,250	4,622,864	0.229	0.194
Scope 3	Use of Sold Products	11,024,053	23,382,751	0.980	0.980
Scope 3	Product EoL	45	132	0.000	0.000
Scope 3	<b>Total</b>	<b>14,315,684</b>	<b>28,870,659</b>	<b>1.27</b>	<b>1.21</b>

Part of Navitas' commitment to Environmental, Social and Governance (ESG) is the Navitas Net-Zero Initiative which includes annual measurement and reporting of our corporate carbon footprint, product- and system-level life-cycle assessment (LCA), focused improvement initiatives internally, with our customers and our suppliers and investment to support Sustainable Development Goals.

### Navitas Total Scope 1, 2 & 3 Emissions Per k Units (tons CO<sub>2</sub>)



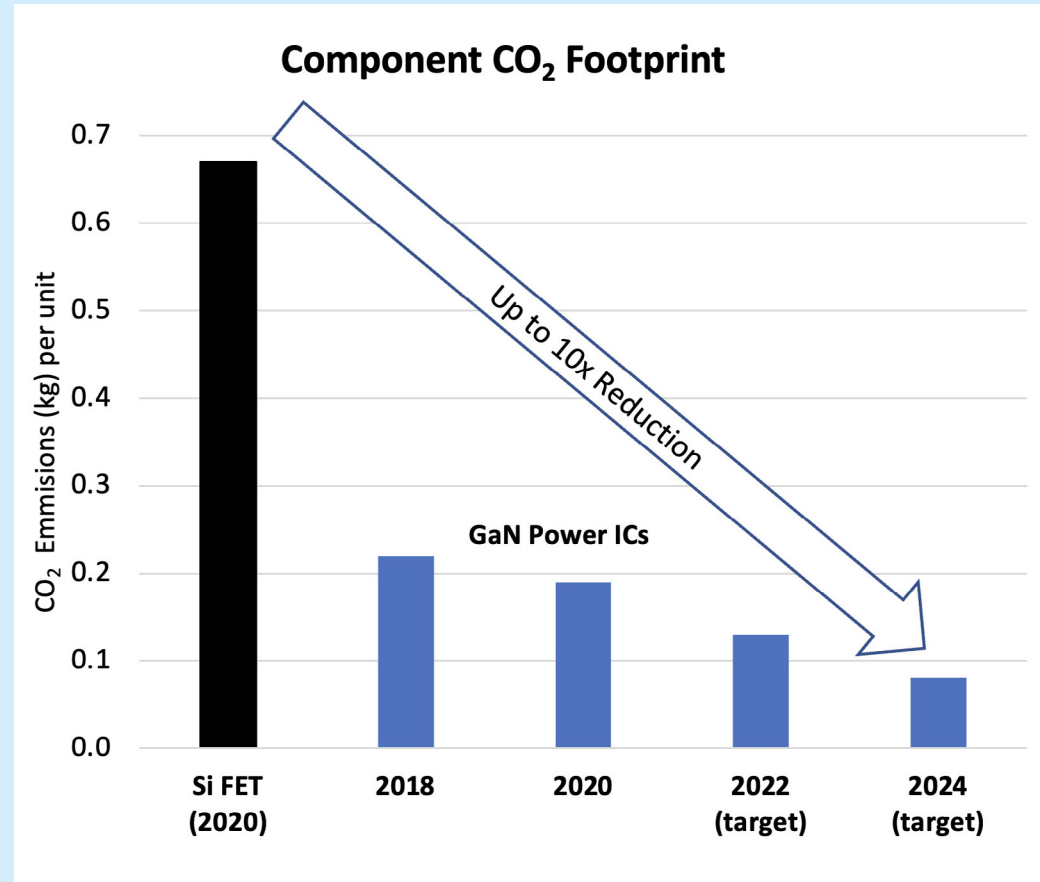
# GaN: Up to 10x CO<sub>2</sub> Reduction vs. Legacy Silicon

As a 'wide bandgap' material, GaN is much more efficient than silicon, so the essential die size ('chip') is much smaller for a given power or current capability. Smaller chips mean more units per wafer, so lower per-chip footprint for the same amount of energy / CO<sub>2</sub> and chemicals used in wafer processing.

In 2020, a GaN power FET had a 4x reduction in CO<sub>2</sub> versus a legacy silicon FET. When Navitas' proprietary lateral GaN integration is considered (including the critical monolithic integration of GaN power and GaN drive) the equivalent features and functionality increase this to a 5x benefit.



As Navitas introduces a new generation of GaNFast power ICs every 10-12 months, and as GaN power ICs increase production volume and move from 150mm (6") to 200mm (8") diameter wafers, the benefit is expected to further improve to 10x.



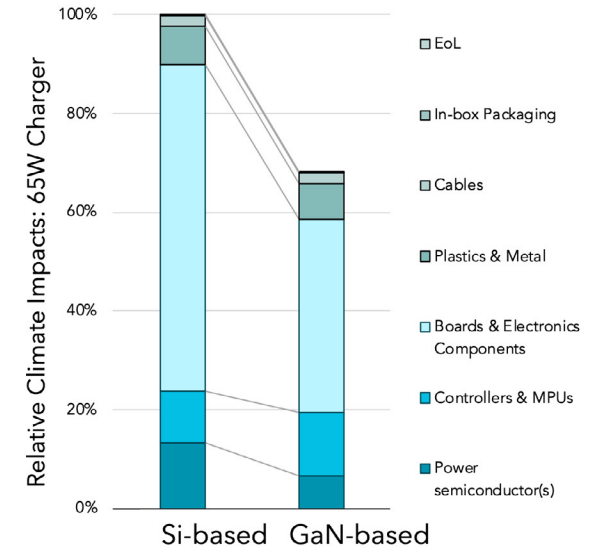
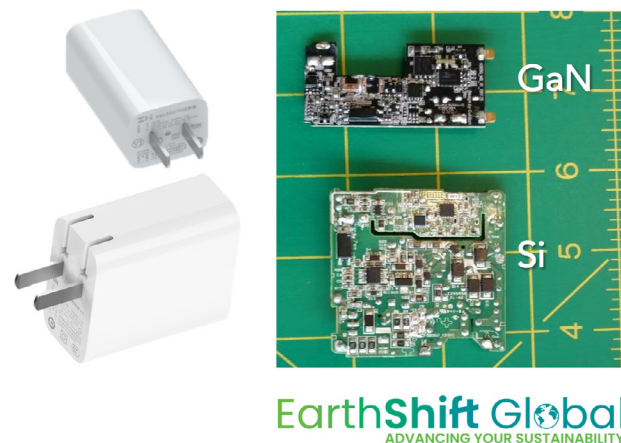
New GaN IC generation released every 10-12 month

## Helping Customers Meet CO<sub>2</sub> Goals

GaN power ICs enable power and charging systems to operate at up to 20x higher frequency than legacy silicon, which means up to 3x higher power, or 3x faster charging in half the size and weight, and with up to 40% energy savings 'in use'. These application benefits bring commercial benefits to Navitas customers and end users and deliver positive environmental benefits. Examples include:

- High efficiency means lower-temperature operation, minimizing or eliminating the need for heatsinks and larger cases.
- Higher-frequency GaN operation translates into fewer, smaller passive components (magnetics, filters, capacitors, etc.) and mechanical components (PCB, housing, heatsinks, etc.) reducing oil/refinement demand and lowering shipping costs and CO<sub>2</sub> footprint.
- Higher-efficiency operation reduces in-use energy consumption.

Third-party total life-cycle analysis of 65W charger upgrade from silicon to GaN power ICs.



### Market Catalysts for Change

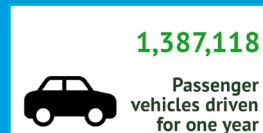
In addition to a like-for-like reduction, there are several market-driven catalysts that help to reduce CO<sub>2</sub> footprint. Universal Serial Bus (USB) 'Type-C' connectors and the Power Delivery (PD) protocol standardize charging and enable a mix-and-match of chargers and mobile devices.

Mobile suppliers can now ship their mobile devices without a custom, dedicated charger in the box, which allows consumers to use an existing charger or purchase a small, lightweight, fast & efficient charger ... both eliminating material and energy waste."

Another change accelerated by GaN is the introduction of higher power multi-port chargers - for example, a 65W 3-in-1 (2x Type-C, 1x Type-A) charger that can fast-charge three independent mobile devices (phone, tablet, laptop or earbuds) simultaneously at a third the size, weight and retail price of separate chargers.



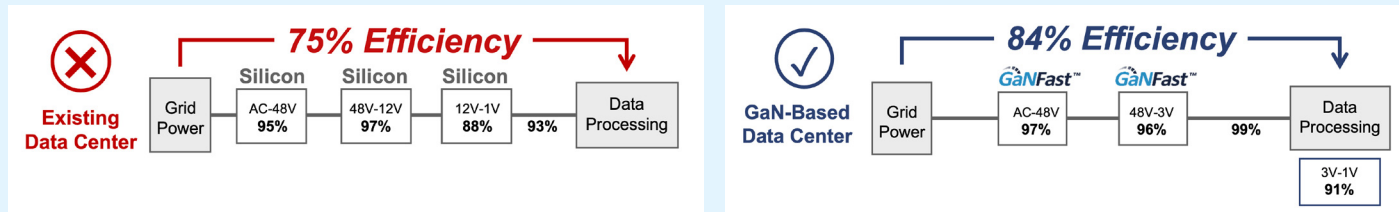
Applying GaN to every mobile application would save over 9 billion kWh and over 6 billion kg of CO<sub>2</sub> by 2025, equivalent to 1.3 million ICE passenger vehicles or almost 14 billion barrels of oil. <sup>6</sup>





# Data Centers: Save Over 10 million tons CO<sub>2</sub> and \$1.9 billion per year

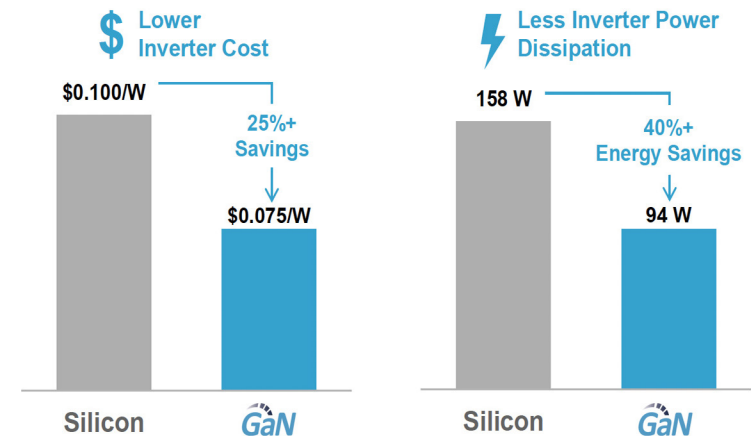
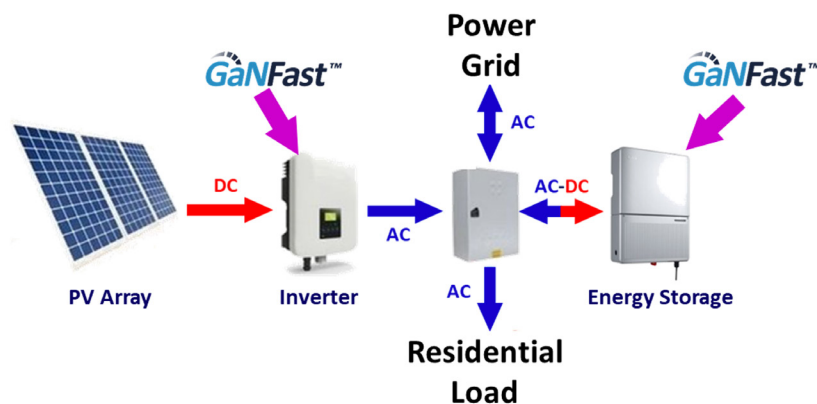
Upgrading from legacy silicon to high-efficiency GaN in the data center industry has the potential to reduce electricity use by up to 10% - an improvement that if applied across all data centers could reduce energy demand by over 15 TWh, save \$1.9B in annual electricity costs and reduce CO<sub>2</sub> by 10 Mtons – or the equivalent annual emissions of over 2 million gas-based passenger vehicles.<sup>7,5</sup>



In support of climate action, the European Union has passed legislation (Directive 2009/125/EC, 2019 Annex) which states that new data center power supplies must meet the extreme 80 Plus 'Titanium' level of efficiency from January 1st, 2023. [Compuware](#), the leader in high-efficiency server power has stated that "Navitas GaN is a breakthrough new technology that is enabling dramatic reductions in size, energy savings and power density."<sup>2</sup>

## 25% Cost Reduction Accelerates Residential Solar Adoption

GaN power ICs drive down cost-per-watt of energy conversion and storage to support cost reductions of up to 25% - reducing payback periods and accelerating adoption of solar energy. <sup>8</sup> [Enphase Energy](#), the leader in residential solar has declared that their next-generation micro-inverters will upgrade from silicon to GaN, citing GaN's ability to increase micro-inverter speeds by 10x and enable a significant reduction in cost.



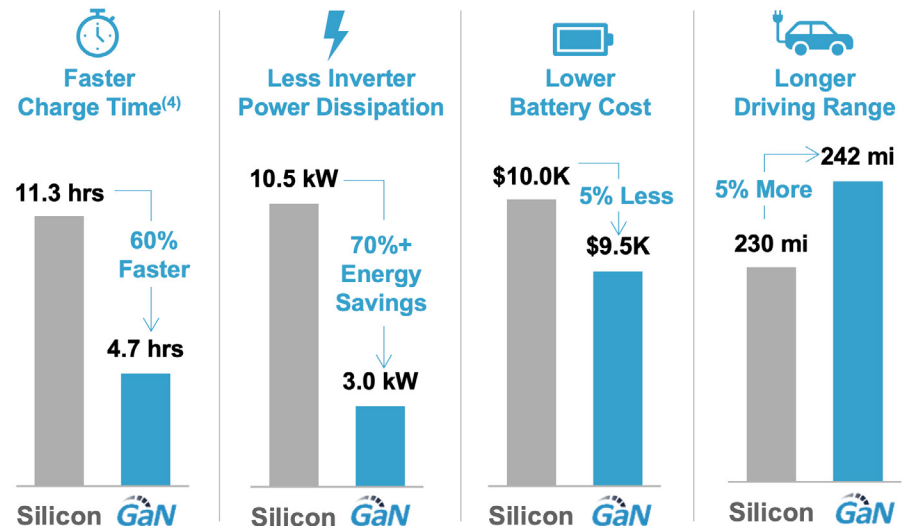
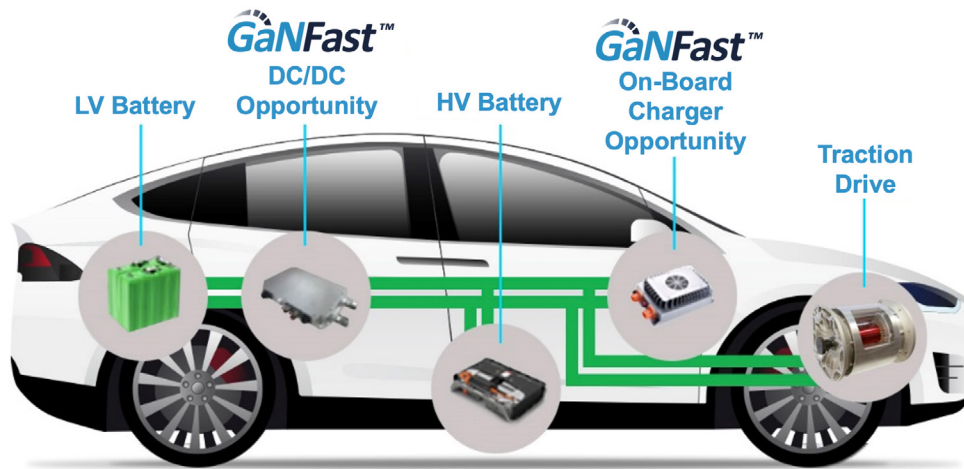
## Accelerating EV Adoption by Three Years, Reducing Road-Sector Emissions by 20%

GaN technology is critical to addressing the design and sustainability challenges facing eMobility manufacturers and to driving the mass uptake of EVs. There are three major EV power applications which benefit from GaN: on-board charging (OBC), DC-DC conversion, and traction drive.

Silicon Carbide (SiC) is another 'wide-band-gap' material like GaN, and around 15 years more mature in the market, so has some adoption in the eMobility market, especially for very high-power traction drives in trucks and buses. However, SiC's slower switching speed and lack of integration potential means it cannot achieve the system speed, efficiency and density delivered by GaN.

For passenger vehicles, EV companies such as [Brusa](#) have stated that they have made a transition from Si to SiC, but will move to GaN to achieve higher efficiency, smaller size and lower system costs.<sup>10</sup> The evolution in EVs from single-motor to in-wheel motors demands the high-efficiency, small-size benefits of GaN.

A transition from silicon to GaN power ICs could accelerate world-wide adoption of EVs by three years and reduce road-sector emissions by 20%/year by 2050.<sup>3</sup>



# Every GaN IC Shipped Saves 4 kg CO<sub>2</sub>

When we consider both the greatly-reduced manufacturing and transportation footprint, and the significant savings both to manufacture downstream products, and 'in-use' efficiency benefits, then we can present a per-unit net-benefit of upgrading from silicon to GaN power ICs.

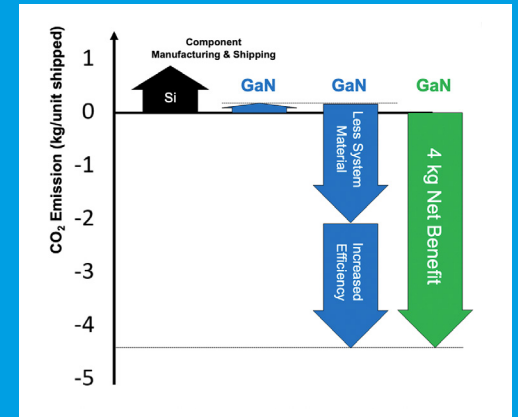
Based on 2020 figures, every GaN power IC shipped reduces CO<sub>2</sub> emissions by over 4 kg versus legacy silicon chips.<sup>2</sup>

Navitas is committed to corporate and industry-wide electrification innovations and reductions in CO<sub>2</sub>, as we strive to achieve the goals set out by the Paris Accord. Navitas tracks GaN

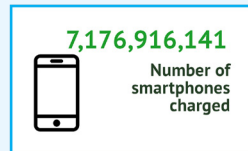
IC shipments and estimates hours of usage to calculate a running total of CO<sub>2</sub> reductions.

By the end of December 2021, over 35,000,000 GaN power ICs had been shipped into the mobile fast charger market, achieving over 12.6 GWh energy saved and over 9,000 tons CO<sub>2</sub> reduced in use, plus 50,000 tons from dematerialization.

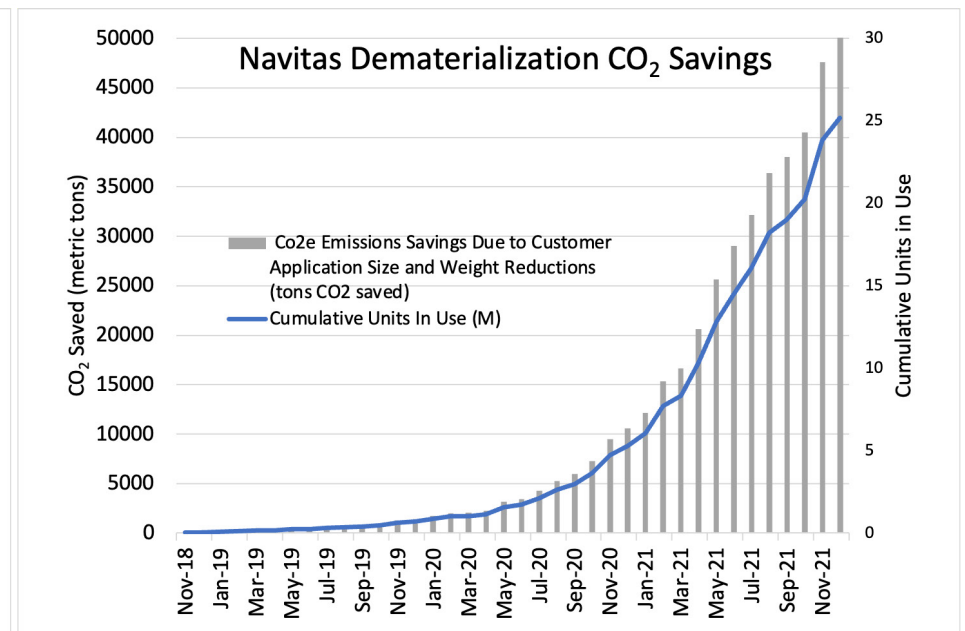
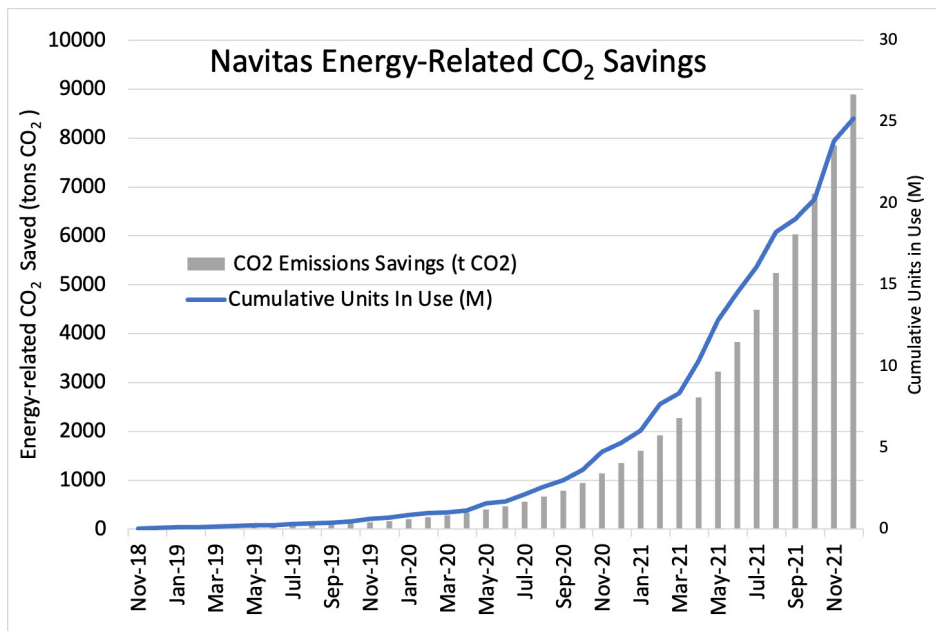
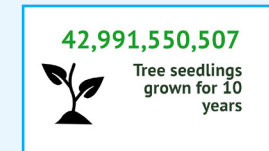
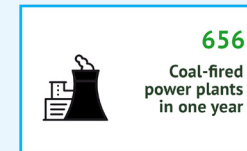
Navitas' expansion into the higher power markets of data center, solar and electric vehicles will accelerate these energy and CO<sub>2</sub> savings.



**By December 2021:**  
Navitas GaN had saved  
**>59,000 tons CO<sub>2</sub>**



**By 2050: Estimated**  
GaN could save  
**2.6 Gtons/yr CO<sub>2</sub>**



As of December 2021, over 35 million GaN ICs had been shipped. The calculations and charts above assume a 6-month lag between shipment date and operation by the end user, so show only ~25 million 'in use'.



## References and Citations

<sup>1</sup> The International Energy Agency's (IEA's) 2021 "World Energy Outlook" provides an indispensable guide to the opportunities, benefits and risks ahead at this vital moment for clean energy transitions. <https://www.iea.org/reports/world-energy-outlook-2021> "Energy Efficiency 2021" is the IEA's annual update on global developments in energy efficiency. The 2021 edition explores recent trends in energy efficiency markets at the economy-wide and sectoral levels, including developments in policy and investment. <https://www.iea.org/reports/energy-efficiency-2021>

<sup>2</sup> Up to 10x lower footprint: Navitas and Earth-Shift Global analysis. 4x lower for 2021, 10x lower by 2022 per life-cycle analysis. Up to 30% per Navitas and Earth-Shift Global estimated based on 65W charger per life-cycle analysis

<sup>3</sup> DNV estimate for 75%-adoption milestone pull-in, total road sector benefit

<sup>4</sup> From Navitas information, DNV GL, EPA, IEA, International Renewable Energy Agency (IRENA). Derived from demand and energy efficiency CO<sub>2</sub> reduction of 1.4 Gt; assumes a \$0.12 / kWh cost of electricity and a carbon to energy ratio of 0.00071 tons / kWh, aligned with the EPA's marginal emission rate.

<sup>5</sup> Per EPA equivalencies calculator: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

<sup>6</sup> This sustainability report is part of Navitas' overall Environmental, Social and Govern

<sup>7</sup> Navitas estimate based on a) Navitas server/datacom forecast & AAAS data, b) \$0.12/ kWh, c) Si vs. GaN \$/W and d) data centre loading profile.

<sup>8</sup> Navitas est. vs. Si-based 6.2kW residential inverters assuming GaN-based inverter enables 40% reduced power loss and 25% lower inverter costs

<sup>9</sup> Enphase Energy video testimonial at Navitas New York Investor Day, July 26th, 2021: <https://navitassemi.com/enphase-customer-testimonial-navitas-semiconductor-investor-day-july-26th-2021-at-nasdaq-new-york/>

<sup>10</sup> Brusa video testimonial, Navitas NY Investor Day: <https://navitassemi.com/brusa-goes-ganfast-to-reduce-the-co2-footprint-in-their-electromobility-charger-products/>

This sustainability report is part of Navitas' overall Environmental, Social and Governance commitment. For more information, refer to [ESG](#) on the Navitas website.

This report uses the term 'CO<sub>2</sub>' as an umbrella term for 'CO<sub>2</sub> equivalents' (or CO<sub>2</sub>e) as defined by the EPA.

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