

VERSION 1.0

IC FOOTPRINT WHITEPAPER

Energy Management And Sustainability On ICP





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Introduction

IC Footprint is the native energy management and sustainability protocol for the Internet Computer (IC) network, supporting decentralised applications (DApps), Service Nervous Systems (SNSs), Utopias, and node operators in measuring, reporting, and reducing their environmental impact. IC Footprint is an infrastructure play, deploying the foundational technologies to advance the IC's green compute capabilities and create a climate tech industry on the network.

Our Mission

Accelerate protocol-wide decarbonization through data and tokenomics, simplify environmental compliance for network stakeholders and advance the IC's energy management capabilities to make the network more competitive.

Decentralised Innovation

Pooling Expertise To Accelerate Innovation, Build Commercially Viable Products And Achieve Climate Targets Faster.

Key Trending Tailwinds

- 1. Surging electricity demand from data centres, driven by Al and blockchain.
 - Data centre driven electricity demand to triple in from 2.5 7.5% of US total by 2030 according to BCG
- 2. Growing renewable energy in grids increases variability of tariff, grid load and grid carbon intensity, creating opportunities for optimisation and arbitrage.
 - <u>Energy Management Software</u> is increasingly important for managing variability and is a rapidly growing vertical with an estimated market size of £40+ billion.
- 3. Environmental regulations impacting enterprise cloud procurement requirements.
 - <u>EU Corporate Sustainability Reporting Directive</u> came into force in January, 2023.
- 4. The unfolding global climate crisis is influencing <u>consumer</u> <u>behaviour</u> and buying preferences.

Key Takeaways

- 1. Compute networks are intimately linked to the energy industry, which is digitising, expanding and becoming renewable simultaneously. Huge opportunities exist for cloud networks that can foresee and adapt to these changing fundamentals.
- 2. Implementing energy management systems and highfidelity energy data analytics at the protocol level will reduce the cost of network operation, create revenue generating products and enable network decarbonisation.
- 3. The IC technology stack can exploit new use cases to create novel products for commercialisation. IC Footprint is designed as a protocol in order to supercharge the development of IC native climate technology solutions, which can be commercialised within the ICP ecosystem, cross-chain, on Web2, and even with non-digital companies.

IC Footprint 2.0

A new version of IC Footprint launch in April 2024, meaning the product to date can:

- monitor all ICP Greenhouse Gas (GHG) emissions in near real-time
- attributes emissions proportionally to network users based on network activity by tracking emissions on a per-canister basis
- stores all emissions data on-chain in client specific ESG Wallets
- enables network decarbonisation by linking user ESG Wallets to environmental commodity exchanges

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Advantages Of Building On ICP

Traceability & Democratisation

Blockchain technology introduces a level of traceability that tackles the credibility problem facing climate monitoring software and reporting. All transactions and activity are tracked in an on-chain ledger, creating a continuous, tamperproof audit trail from resource consumption, to climate impact, to climate action. Developing climate tooling on ICP confers these benefits to IC Footprint products.

Further, IC Footprint products are designed to enable coordinated climate action between different parties. In addition to viewing a client's impact on their ESG wallet, any actor can directly participate in the decarbonisation of that client by, for example, making a renewable energy purchase through the platform on the client's behalf. Achieving this democratised approach to climate action can be achieved with credibility thanks to blockchain technology.

Flexibility

ICP canisters support complex code and provide on-chain storage, enabling the implementation of nearly any form of software-based climate or energy technology. Use cases such as grid balancing, compute load shifting, energy trading and automated reporting could alraedy be developed leveraging the current IC Footprint product. Further, algorithms or even sophisticated AI models could be hosted in canisters and autonomously optimise compute/energy usage, or execute transactions on an exchange to green electricity supply or offset emissions.

In short, ICP canisters open up a new frontier of programmable climate action and climate technology implementations. Energy software is already the number one climate investment recipient, with >\$15bn invested in 2022 alone. This highlights the enormous potential of developing cutting edge climate technologies on ICP.

Tokenisation & Exchange

Case Study: Market-Based Decarbonisation

Market-based decarbonisation refers to the creation, transfer and consumption of certificates that represent some form of climate benefit. These certificates are consumed in order to confer that benefit to the consuming party. Renewable energy certificates (RECs) and carbon credits are good examples of these certificates, and are effective tools for incentivising and rewarding climate action.

To better understand the utility of the market-based approach, consider a solar farm producing renewable energy. Large amounts of electricity cannot be stored, so as the solar farm produces electricity it is fed directly into the national grid. Once the electricity enters the grid, it's impossible to know where those exact electrons are consumed. An elegant solution is to award certificates to the solar farm for producing renewable electricity, and create a market for buyers (electricity consumers) to purchase those certificates, thereby 'claiming' the use of that renewable energy.

In this simplified example, we see how a market-based approach improves efficiency by removing the need to understand exactly where renewable electricity is consumed in real-time: an impossible task at a national grid scale

- The above case study highlights the utility of tokenization in environmental markets. The process of creating, trading and retiring environmental commodity certificates fits remarkably well with generic Web3 actions, illustrating the utility of Web3 in improving efficiency and transparency in environmental markets.
- 1. A renewable power plant records the electricity generated for a national grid (Ledger)
- 2. Certificates are created corresponding to the amount of renewable energy generated (Minting fungible or non-fungible tokens)
- 3. Certificates are traded between various parties, fees are often charged by middle-men (Traders and Exchanges)
- 4. The final buyer retires the certificates to become the beneficiary (Burning tokens)

Incentivisation

A core component of the IC Footprint DAO will be the implementation of incentives that reward network users that act in ways that lead to network decarbonisation, and actively participate in DAO governance. By rewarding this behaviour, IC Footprint will use market-based mechanisms to drive the network towards zero emissions. 2.5% of the total token supply will be used for such activity, as well as participation in the DAO's governance. The specific formulas for deciding rewards will be decided post-SNS launch, meaning participants in the SNS Swap will have more influence over how these are formulated.

The SNS structure is unique in that it enables financial gain to be used as a force to drive organisations to decarbonise. This novel approach can be replicated in other organisations or even national governments, with the exact rewards mechanism adjusted in order to achieve the desired outcome. This illustrates the power of the SNS, and sets it up as a globally important experiment in distributed governance for positive climate action, a crucial component of current climate action.

Products & Services

IC Footprint 1.0 - Emissions Baselining, Real-Time Emissions Tracking

IC Footprint established baseline GHG emissions figures for the ICP network with the <u>2022</u> and <u>2023</u> reports. Baseline measurements are crucial to tracking any progress towards decarbonisation, and understanding the effectiveness of different decarbonisation tools. IC Footprint went on to codify the report methodology, which enabled dynamic data management. By integrating into national grids around the world and feeding real-time grid carbon intensity data into the methodology, IC Footprint 1.0 achieved real-time emissions tracking for the majority of the IC network. Real-time emissions tracking of all subnets provided a granularity of data unseen across the Web3 industry, and set a foundation for pursuing sophisticated and targeted decarbonisation.

IC Footprint 2.0 – Per-Canister Analytics, ESG Wallets, Environmental Commodity Exchange

Following on from the success of IC Footprint 1.0, the team embarked on an ambitious plan to build tooling that could use the real-time data for network decarbonisation. In May 2024, the team released the next version of the platform, which surpassed this objective.

<u>IC Footprint 2.0</u> aims to leverage the high-fidelity data to enable any kind of ESG activity from any network stakeholders. Stakeholders can assess their environmental impact, purchase renewable energy, compensate emissions with carbon credits, generate compliant reports for governmental regulation, program climate action into a smart contract to automatically meet their climate targets, and much more.

At the centre of these capabilities are ESG wallets. ESG wallets track canister electricity consumption, carbon emissions and will soon track water consumption, among other future environmental metrics. All SNS projects will have ESG wallets created for them automatically, and any network user can create an ESG wallet and add their canisters to it through a simple flow

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Section 2

Moreover, ESG Wallets have an 'action' panel in the top right, through which users can take any form of action to decarbonise their activity, compensate for historical emissions, or comply with governmental regulations in their regions. The action panel currently has four panels, each of which connects to a number of vendors that offer a specific product or service. For example, in the 'Offset Emissions' tab, the vendor <u>CAWA</u> is currently offering carbon credits. More vendors will be added over time, giving the users broader choice, and increasingly price and quality competitiveness.

IC Footprint completes due diligence on all vendors to ensure they are of high quality, and generates revenue by charging fees for the purchase of vendor products and services. IC Footprint has already begun generating revenue through these streams, and has a carefully considered go-to-market to increase revenue generation capabilities by expanding current channels, and adding new revenue streams. The following 'commercialisation' section will explore these in more detail.

Commercialisation

Go To Market

IC Footprint has positioned itself as the core, vertically integrated sustainability protocol on ICP. From carbon accounting, data analytics, compliance reporting to direct and market based decarbonisation. This tooling has been delivered over the past 2 years for the protocol as a whole, however, thanks to a recent breakthrough, is now available at the percanister level.

Soon, every SNS released on ICP will automatically receive an ESG wallet and real-time emissions analytics as standard. From day one, an SNS project can make a net zero commitment, run entirely on clean energy and be compliant with environmental regulation. The same functionality is true for any DApp, with a sign-up completed through a simple flow. We plan to provide the same seamless journey to all future Utopia instances.

Although IC Footprint is native to ICP, the tooling developed is attractive to markets beyond just ICP, and the platform has been designed with numerous on-ramps for non-ICP companies throughout the vertically integrated journey. For example, a fashion brand can create an ESG wallet using a measurement done by another carbon accounting firm, so long as IC Footprint validates the measurement. In another example, integrations with AWS, Azure and GCP allow projects to add emissions created on other clouds to an ESG wallet. Once added to an ESG wallet, these firms gain full access to all the tooling that is available on the ESG wallet.

The overarching strategy is simple. First, focus all technical development on a core ICP-based product, enriched with third-party integrations and a dynamic and competitive environmental commodity exchange. Second, expand the business development to high-growth markets in the broader Web3, Web2 and non-digital spaces based on market demand. The outcome is a flywheel effect.

As the pool of environmental metrics stored in ESG wallets grows, the attractiveness for vendors to integrate into the platform to offer their products and services to more clients increases. More vendors and integrations into a single, ICPnative platform increases the quality and price-point of services as competition increases, attracting more clients to create ESG wallets. IC Footprint can drive this flywheel with a lean ICPspecialised technical team and flexible business development arm.

Customer Segmentation

Node Operators, SNSs and DApps: As core network enablers and users become significant industry players, the need for quarterly and yearly environmental reporting to align with regulation will be required. This regulation came into effect in the <u>EU in January 2023</u>, and will soon be required in other global markets. IC Footprint is the only data source for these network actors, and will charge for providing this data. Web2 companies pay significant sums for this data, meaning IC Footprints simple process and competitive pricing should attract a broad and loyal customer base. European-based node operators are likely to be the first adopters, and with the reporting period kicking in later this year, we are maintaining contact wit the key players to help streamline their first reporting event.

Utopia Instance: Governments and enterprises are of particular interest to IC Footprint as they adopt the IC and launch Utopia sovereign clouds. Governmental and multinational enterprises have national or corporate climate targets that are legally binding. Due to this, environmental impact assessments are a core part of their procurement processes. IC Footprint will offer consulting services to assist with the procurement processes, and enable the IC Footprint platform as a plug-in for all future utopia instances.

Al and LLMs: Embedded sustainability monitoring and reporting will be crucial tools for attracting Al firms to ICP. Training and operating Al models is an energy intensive operation, and has an <u>outsized climate impact</u> in comparison to other compute activities. Due to this, regulatory scrutiny is increasing on Al activity, and becoming a must-have for their operations. IC Footprint predicts that as Al becomes a growing focus of the ICP network, Al use-cases will become a significant source of revenue.

Section 3 Hyperscalers & Cross-Chain: IC Footprint has been designed as a platform that can combine the emission measurement caused by operations across ICP, AWS, Azure and GCP. As such, projects that are using a combination of ICP and another hyperscaler, or even entirely run on another hyperscaler can create an ESG wallet and easily populate their data into it. The same functionality is also under development with other blockchains. The goal is to build a platform agnostic tool for all digital emissions tracking, and to attract a broad swath of digital-first business through superior transparency and functionality.

Revenue Streams

Environmental Asset Exchange			
Model	Transaction Fees		
Description	Environmental commodities, or environmental assets, are assets derived from sustainable practices that represent the environmental benefits of that practice. These assets generally take the form of certificates, which can be bought and consumed to confer that benefit to the user. Carbon credits and renewable energy certificates (RECs) are good examples. The former can be used to compensate for historical emissions, the latter to clean energy that is consumed. As businesses and governments set legally binding climate targets, demand for environmental commodities is souring. Further, commodity types are emerging as governments use regulation to create market-based decarbonisation mechanisms. For example, <u>biogas certificates</u> and <u>plastic credits</u> .		
Market Size	<u>RECs</u> : ~\$13.3 billion today, growing at ~26.5% CAGR, to reach ~\$87.2 billion by 2030. <u>Voluntary Carbon Market:</u> ~\$2.5 billion in 2022, growing at ~29.87% CAGR, to reach ~\$12.4 billion by 2030		

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Section 3

	Energy Management Systems
Model	SAAS, Trading, Margins, Consulting
Description	 High-fidelity emissions measurement Monitor energy consumption in real-time and offer energy-saving insights. Users can optimise consumption to reduce emissions, or consume energy when it is cheaper. This is already occurring in industries that buy electricity on wholesale markets, and will become increasingly common for consumers as supply variability increases and dynamic consumer pricing becomes the norm Asset performance management Provide ICP-based tools to manage efficiency and optimisation of node machines, electric vehicles, charging networks, loT device networks, buildings or other public infrastructure assets. Grid Optimisation and Demand Response Develop energy optimisation tooling, such as Virtual Power Plants (VPPs) by aggregating behind-the-metre energy generating assets (e.g rooftop solar, wind generating units.) These assets can be used to flow energy into the grids when demand is high, or absorb excess load to ensure grids do not melt at times of oversupply. Due to the fact that ICP manages its own hardware, it's in a unique postion to lead the development on these technologies by implementing them locally, before commercialsing them more broadly.
Market Size	<u>Energy Management Systems:</u> \$35.9 billion today, growing at ~15.3% CAGR, to reach \$112.32 billion by 2032

Section 3

	Security And Compliance
Model	SAAS, Fixed Cost, Consulting
Description	Cybersecurity Provide data security for energy management systems and critical energy infrastructure. ICP cryptography offers a level of security that is crucial for companies and countries running nationally critical energy infrastructure. Environmental Compliance Ensuring companies meet environmental regulatory requirements for to building and operating in certain geographies and industries
Market Size	<u>Cybersecurity:</u> \$8.6 billion in 2023, growing at ~11.3% CAGR, to reach ~\$21.8 billion by 2031 <u>Environmental Compliance:</u> \$2.5 billion today, growing at ~2.9% CAGR, to reach ~\$3,1 billion by 2031

Technical Architecture

Canisters

Node Manager:

The Node Manager canister is responsible for overseeing the network of nodes and their associated emissions data, as well as storing crucial information. The canister maintains a registry of nodes, tracks their individual and cumulative emissions, and provides functionality to offset these emissions. Additionally, it stores and manages important data in thread-local storage, including node information, and DApp details. This canister serves as a central point for managing both the environmental impact of the network's operations and key operational data for the DApp.

ESG Wallet:

The ESG (Environmental, Social, and Governance) Wallet canister serves as the financial and transactional hub for the client actions, once their emissions are calculated. It manages user payments, handles the purchase of carbon offset "tickets," and interacts with external systems to record and verify offset contributions. This canister processes transactions, maintains payment records, calculates pricing based on current rates, and facilitates the withdrawal of funds. It also interfaces with the Cawa API to register offset contributions and retrieve proof of offset. The ESG Wallet plays a key role in enabling users to financially contribute to carbon offset initiatives and tracking these contributions.

Cycles Assessment Manager:

The Cycles Assessment Manager canister focuses on monitoring and analysing the cycle usage of various canisters within the Internet Computer network. It tracks the cycle burn rates, calculates emissions based on cycle consumption, and provides data on the environmental impact of canister operations. This canister interacts with SNS (Service Nervous System) canisters to gather cycle usage data, computes emission rates, and maintains historical records of cycle consumption and associated emissions. It plays a crucial role in enabling the assessment of the ecological footprint of the network's computational resources.

Off-Chain

Currently, the majority of data analytics is completed off-chain, for various reasons. As one of the first steps following the completion of the SNS swap, an analysis of what sections of the data analytics can be achieved on-chain with performance and price parity will be completed. Based on the findings of this research, the technical roadmap will be updated to include a migration of the data analytics on-chain. All off-chain code is currently managed by Carbon Crowd, and will be maintained by the Carbon Crowd team as part of their role within the IC Footprint ecosystem. The operational costs of this will be covered by the DAO, with all proposals governed hypertransparently by treasury proposals.



IC Footprint DAO

TOKENOMICS And IC FOOTPRINT SNS

IC Footprint will launch a standard ICRC token, known as Footprint Token (FOOTPRINT), at the creation of the SNS. FOOTPRINT tokens will serve as both governance and utility tokens, and are designed to reward user activity, reward the actors in network decarbonisation, and incentivise participation in the IC Footprint community and SNS DAO. The distribution mechanism and allocation strategy are outlined below.

Total supply: 100,000,000 FOOTPRINT

Voting and Activity rewards: The SNS is designed to generate an annual final reward rate of 2.5%, dropping from an initial rate of 3.0% over 30 months. The distribution will directly reward actors that take action to decarbonise the network, through:

- purchase of environmental commodities through ESG wallets
- participation in the community and governance of IC Footprint
- Development of technology leveraging the IC Footprint protocol, or integrations into the IC Footprint platform

The reward rates for the outlined activities will be defined in more detail with community input post-SNS in order to give swap participants influence over the reward mechanisms and thus the outcomes being optimised for. l

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Total Distribution	Token %	Token Amount	Vesting Terms
Team	15.5%	15,500,000	Each member of IC Footprint team founding team will receive tokens in the form of a basket of 4 equal-value neurons. These neurons will have a dissolve delay of 1 month. They will have vesting periods of 1, 12, 24, 36 mozznths after the SNS swap. The team will not receive any FOOTPRINT tokens at the SNS swap
Advisors	2.5%	2,500,000	The IC Footprint advisors will receive tokens in the form of a basket of 4 equal- value neurons. These neurons will have a dissolve delay of 1 month. They will have vesting periods of 1, 12, 24, 36 months after the SNS swap. The advisors will not receive any FOOTPRINT tokens at the SNS swap.
SNS Swap	25%	25,000,000	25% of the total supply will be put up for swap to decentralise the governance and raise funds for the SNS.
Treasury	57% (5%NFT Holders)	57,000,000	After the decentralised swap, SNS will retain the remaining 57% of the FOOTPRINT tokens as the treasury. All these tokens will be allocated through decentralised proposals. (Immediately after the completion of the SNS Swap, a proposal to distribute 5% of the treasury to reward IC Footprint NFT holders will be made.

Total Distribution	Token %	Token Amount	Vesting Terms
Treasury	57% (5%NFT Holders)	57,000,000	The founding team strongly feels the early supporters should be rewarded, and will likely continue to be engaged members of the IC Footprint community and journey. At the moment of SNS Swap, the principal IDs of all IC Footprint NFT holders will be taken. 5,000,000 FOOTPRINT, 5% of the total supply, will be distributed to these principles. The tokens will be available immediately after the SNS sale, and will be sent in separate, equal transfers to the principal holding the NFT. The reason this approach is a cap on the number of neurons that can be created at a swap.)

* Please note: If a neuron has a "vesting period" it cannot be touched until the period is over (and this period includes increasing/reducing the dissolve delay)

SNS Swap

To enhance decentralised governance and secure essential funding for the SNS, 25% of the total ICF supply will be allocated for swap during the SNS Swap event. Participants, including those from the Neuron Fund, will receive their tokens in a structured portfolio comprising 4 equal-value neurons. These neurons feature staggered dissolve delays of 0, 6, 12 and 18 months. The distribution is designed to promote a sustained commitment and engagement from the stakeholders, thereby supporting the long-term objectives of the IC Footprint initiative

IC Footprint Swap SNS Treasury

Following the successful completion of the SNS swap, the IC Footprint SNS-DAO treasury will hold an estimated 57,000,000 FOOTPRINT tokens, or 57%, alongside the accumulated ICP from the swap. The deployment of any funds in the treasury will be strictly governed by DAO-approved proposals.

Among the first proposals will be a treasury proposal to transfer 5,000,000 FOOTPRINT, or 5%, to IC Footprint NFT holders. As early, long term backers of IC Footprint, they are valued members of the IC Footprint community.

After the SNS swap, the IC Footprint team plans to propose the allocation of a percentage of the FOOTPRINT tokens and corresponding ICP tokens from the treasury to designated decentralised exchanges (DEXs), initiating the trading of the FOOTPRINT token. This initiative is aimed at enabling community members to actively participate in or exit the IC Footprint DAO as desired.

The treasury's ICP holdings can be directly utilised through proposals, and the FOOTPRINT tokens can be swapped for ICP on Plug Wallet via proposals. These funds are earmarked for various purposes, including but not limited to covering canister cycle costs, incentivising certain activities, such as vendor onboarding or decarbonisation activity, driving user engagement, business development, platform development bounties, marketing. Each of these expenditures will require a formal proposal for approval utilisation.

In an effort to further engage with the broader IC ecosystem, a portion of the ICP tokens in the treasury, pending community approval, is intended to be allocated for NNS neuron staking. This action will establish an IC Footprint beacon neuron that will be named and participate in NNS voting. The objective is to stand as the voice leading the climate discussion in all NNS topic in order to contribute to IC ecosystem DAO governance. Voting rewards from these activities will also enhance revenue for the treasury.

Dissolving, Vesting And Voting Power

Neurons with a 'vesting period' remain untouchable until the designated period concludes, and no alteration can be made to the dissolve delay, In the case of IC Footprint, the team and advisors have been set a dissolve delay that is fixed and cannot be extended before the end of the lock-up period.

This structure is designed to ensure that these neurons possess diminished voting power compared to those held by the broader community. This ensures a more decentralised governance structure, so that the power remains balanced and the community has a significant and influential role in the technologies that are developed, and the overall direction of the DAO.

Token Utilisation And Value Enhancement Mechanisms

FOOTPRINT tokens are utility tokens that control the governance of IC Footprint DAO. Footprint tokens will have a wide range of utility that will likely evolve over time. Below, the initial use-cases are outlined.

- As a governance token, for voting on proposals in order to define the technical and commercial direction of IC Footprint
- To be distributed to network actors that are actively driving network decarbonisation, such as through node operators sustainability incentives or rewards for SNSs that decarbonise their activities.
- To cover operational costs, including cycles and providing liquidity to exchanges
- IC Footprint's trading and ledger fee income will be used through the burning canister to repurchase and burn Footprint tokens. Footprint tokens may be systematically burned to decrease the total supply.

Initial SNS Configuration

Initially, the SNS will be set up with parameters as detailed in the following tables. However, it is important to note that all these initial settings can be adjusted later through the community-driven, SNS DAO proposals.

Transaction free in FOOTPRINT tokens paid for ledger transfers	0.001
Number of FOOTPRINT tokens that rejected proposals cost the proposer	1000
Minimum number of FOOTPRINT tokens that can be staked in a neuron	5
Maximum voting period for a proposal	4 days
Minimum neuron dissolve delay to vote	1 month
Maximum neuron dissolve delay	2 years
Maximum dissolve delay bonus	100%
Maximum age for age bonus	6 months
Maximum age bonus	25%
Percentage of total supply that will be generated annually for rewards	2.5%

SNS Decentralisation Sales Configuration

The decentralisation swap will be configured with the values shown below.

The total number of FOOTPRINT tokens to be sold in the SNS Swap	25,0000 25% of the whole
The maximum ICP to be raised	250,000
The minimum ICP to be raised (otherwise sale fails and ICP returned)	50,000
The ICP to come from the Neuron Fund	Min: 49,955 ICP Max: 94,937
End date of sale (unless maximum ICP raised sooner)	31/07/2024
Minimum number of sale participants	50
Minimum ICP per buyer	1
Maximum ICP per buyer	50,000

Valuation Range

The implementation of a maximum target provides participants with a minimum guaranteed amount of ICF tokens in return for their ICP investment. By setting a minimum of 99,955 ICP and a maximum of 344,937 ICP (including Neuron Fund participation) for the 25% token allocation, the IC FOOTPRINT DAO is initially valued between 399,821 and 1,379,748 ICP, which equates to approximately 3,2M USD to 27,59496 11.0M USD. Fluctuated according to the ICP prices, estimated at the current rate of 11CP = 8 USD, subject to the actual SNS swap). Consequently, the initial worth of 1 FOOTPRINT token will range from 0.0039821 ICP to 0.00374 to 0.01380 ICP. This structure ensures participants have a clearer understanding of their investment's value and the DAO's initial financial parameters.

Regarding A 51% Attack On The SNS-DAO Treasury

(Update: With the mechanism update of the neuron fund, the fund has transitioned from the previous fixed ICP amount to a more dynamic model that scales. Therefore, the ICP amount contributed by the neuron fund for subsequent SNS Swaps cannot be determined until the culmination of the SNS-DAO launch. The following 51% attack simulation is provided as a theoretical reference of a minimum commitment, in conjunction with the SNS Tokenomics Analyzer released by the DFINITY team.)

Theoretically, the DAO mechanism does allow for the possibility of a single entity amassing more than 51% of the voting power, posing a risk of a treasury takeover and unauthorised fund transfers. Nevertheless, the Neuron Fund is strategically designed to act as a formidable line of defence against such adversarial scenarios in IC Footprint DAO. This significantly diminishes the chances of any single attacker wielding disproportionate influence over the governance decisions and financial assets of the IC Footprint SNS treasury. This precautionary measure plays a crucial role in bolstering the security and stability of the entire ecosystem.

At the swap, the community and neuron fund hold 37.2% and 22.8% of the voting power respectively. Further, the team and advisors hold 40% of the voting power, establishing a solid foundation for the complete decentralisation of IC Footprint.

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We have also contemplated an extreme case where a malevolent entity acquires 75% of the FOOTPRINT tokens available from the SNS swap and then attempts to maximise its voting power by prolonging the dissolve delay of all their neurons. Even under these circumstances, the malicious attacker would only command 47.0% of the voting power, falling short of the 51% needed for a majority takeover. Moreover, the financial and logistical barriers to orchestrating such an attack are prohibitively high, with no guarantee of 100% success. Furthermore, drawing on the successful precedents of SNS projects, the probability of a 51% attack materialising is exceedingly rare, adding an additional layer of security and assurance for the stability of the ecosystem

Legal Umbrella

To ensure IC Footprint will operate within a legally sound framework, the DAO will be incorporated in the Marshall Islands. This jurisdiction offers an advanced legal environment specifically tailored to the needs of DAOs. Incorporating in the Marshall Islands will allow IC Footprint to obtain corporate personhood, enabling the execution of business operations, signing of contracts and other off-chain activities.

This incorporation model will be strategically chosen to mitigate liability risks for projects and their investors. Under this structure, IC Footprint DAO will be recognized as a DAO LLC, providing a legal buffer that will protect against personal liability. Importantly, this setup will support operational flexibility, recognizing blockchain operations and smart contract governance as legitimate under its laws.

Additionally, the Marshall Islands' legal framework will permit members holding less than a 25% share to maintain anonymity, eliminating the need for KYC procedures for these participants. This feature, combined with the legal recognition of smart contracts and DAO tokenomics, will provide IC Footprint with the necessary legal infrastructure to support its innovative approach to product development, while maintaining legal compliance and operational efficiency.

Technical Roadmap

Technical Development Themes And Explanations

Theme #1: Programmable Climate Action

Storing environmental metrics in a ledger, and connecting those metrics to an environmental asset exchange and other climate services via ESG wallets enables 'programmable climate action' on IC Footprint. ESG wallets can be programmed with rules to pursue certain decarbonisation strategies to reach climate targets. For example, a DApp that wanted to maintain net-zero operations could program their ESG Wallet to automatically offset emissions by purchasing carbon credits as soon as they have a non-zero emissions balance in the ESG wallet

Al controlled decarbonisation - An Al controlled ESG wallet references the users decarbonisation strategy can and automatically consume the appropriate environmental commodities or change compute patterns to reach climate targets in a price or time optimal fashion.

- Codify environmental commitments in smart contracts for automatic execution, create simply command line interface for clients to self-configure targets
- Develop or integrate Autonomous AI to set climate targets, enabling the AI model to adjust compute behaviour and environmental commodity purchases to achieve climate target

Theme #2: Environmental Commodity Exchange

Engaging sellers of environmental commodities such as RECs or carbon credits is vital for enabling decarbonisation, and enhancing the appeal of IC Footprint to users. To attract vendors, all documentation for integration of an environmental commodity will be open sourced, and a community led model where integrations are rewarded will be pursued. Further, a certain percentage of annual rewards may be assigned to integrations that are heavily used.

IC Footprint will reward developers or vendors that integrate environmental assets through bounties, revenue sharing opportunities and token rewards, provided the asset passes due diligence to ensure it aligns with the latest scientific standards. This is true even if the asset integrated is of the same type as a previously integrated asset. For example, two integrations allow the purchase of European RECs from different vendors. The reason for this is to encourage competition between the vendors, leading to the creation of a market price.

Ultimately, the goal is to increase utility for users of IC Footprint, while simultaneously ensuring that pricing is competitive. Conversely, the more users that sign up for IC Footprint, the more attractive integration becomes for vendors, creating the desired 'fly-wheel' effect outlined in the 'commercial' section of this document.

- Integrate Powerledger for Renewable Energy Certificate(REC)
- Develop self-serve REC and carbon credit integration Thallo pilot
- Integrate Chainkey environmental commodities (e.g. ckCHAR)

Theme #3: Climate Services Marketplace

The Footprint marketplace differs from the climate asset exchange in that it offers different environmental services, rather than environmental commodities. Any kind of service that relates to climate can be listed on the marketplace, and accessed from on-chain. In this manner, a full breadth of climate services will become available for IC Footprint users.

Technical deliverables

- Integrate NOVA Energy for streamlined regulatory reporting
- Conduct Scope 3 assessment for full life-cycle assessment of IC hardware
- Develop self-serve integration allowing any provider of climate services to integrate

Theme #4: Environmental Metric Tokens(EMTs)

Tokenising environmental metrics is the natural next step once environmental metrics are stored in an on-chain ledger. Environmental metric tokens, or EMTs, represent a quantity of metric and are stored in an ESG wallet corresponding to the user that has created or consumed that metric. A node provider, for example, that produces GHG emissions by operating a node will accumulate CO2 tokens in their ESG wallet

Tokenisation of environmental metrics supercharges potential environmental use cases by further standardising the metrics, and introducing seamless exchange. Automatic offsetting by linking CO2 tokens to tokenised carbon credits, sustainability incentives based on EMT quantities in ESG wallets, decentralised cap-and-trade schemes and climate finance all represent exciting use-cases

- CO2 tokens: 1CO2 token = 1KgCO2e emitted by the user
- WATT tokens: 1 WATT token = 1 Watt/hour of grey (non-clean) electricity consumed by the user

Theme #5: Data Provisioning & Analytics

At the core of climate technology application is data. Recognising this, IC Footprint has a clear roadmap of different data sources and analysis that will be integrated. These serve both to improve the quality of carbon accounting for ICP users, and to increase the servers that can be built on the IC Footprint sustainability protocol. These include but are not limited to, energy market spot pricing data to enable energy trading, grid load metrics for grid balancing, data sources required to develop energy management systems, weather forecasting for predictive management and metrics to support battery charge and discharge.

Technical deliverables

- 1. Implement per canister analytics with subnet baselining
- 2. Provide API access to ESG Wallets
- 3. Develop Utopia plug-in
- 4. Integrate new data sources, including:
- Energy tariff forecasts
- Weather forecasts
- Energy draw forecasts
- Grid substation metrics
- Battery state of charge + maximum draw

Theme #6: Hyperscale Integrations

IC Footprint is a ICP-native DApp, but acknowledges that not all users will have their entire tech stack on ICP, or for that matter, will have any of their tech stack on ICP. In order to serve these customers, integrations into Hyperscaler cloud providers have been scoped, and will be added to the ESG wallet creation flow. In this manner, no matter the technical stack, any project can track and mitigate all their digital emissions in a single place

- AWS integration
- Azure integration
- GCP integratio

Technical Development Timelines

2024

1. Environmental Commodity Exchange

- Integrate Powerledger for Renewable Energy Certificate(REC)
- Develop self-serve REC and carbon credit integration Thallo pilot

2. Climate Services Marketplace

• Integrate NOVA Energy for streamlined regulatory reporting

3. Data Provisioning & Analytics

- Implement per canister analytics with subnet baselining
- Provide API access to ESG Wallets

4. Hyperscaler Integrations

• AWS integration

2025

1. Programmable Climate Action

• Codify environmental commitments in smart contracts for automatic execution, create simply command line interface for clients to self-configure targets

2. Environmental Commodity Exchange

• Integrate Chainkey environmental commodities (e.g. ckCHAR)

3. Climate Services Marketplace

- Conduct Scope 3 assessment for full life-cycle assessment of IC hardware
- Develop self-serve integration allowing any provider of climate services to integrate

4. Environmental Metric Tokens

• CO2 tokens: 1CO2 token = 1KgCO2e emitted by the use

5. Data Provisioning & Analytics

- Integrate new data sources
 - 1. Energy tariff forecasts
 - 2. Weather forecasts
 - 3. Energy draw forecasts
 - 4. Grid substation metrics
 - 5. Battery state of charge + maximum draw

6. Hyperscaler Integrations

- Azure integration
- GCP integration

Technical Development Timelines

2026

1. Programmable Climate Action

• Develop or integrate Autonomous AI to set climate targets, enabling the AI model to adjust compute behaviour and environmental commodity purchases to achieve climate targets

2. Environmental Metric Tokens

• WATT tokens: 1 WATT token = 1 Watt/hour of grey (non-renewable or clean) electricity consumed by the user

5. Data Provisioning & Analytics

- Integrate new data sources
 - 1. Energy tariff forecasts
 - 2. Weather forecasts
 - 3. Energy draw forecasts
 - 4. Grid substation metrics
 - 5. Battery state of charge + maximum draw

4. Hyperscaler Integrations

• AWS integration



IC FOOTPRINT



