



Sprint for

# Co-designing the Open Network for Carbon Markets (ONCM)

Technology Position Paper

27<sup>th</sup> April 2026

By





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## Foreword

The Open Network for Carbon Markets (ONCM) emerges from a timely recognition that carbon markets require more than fragmented digital platforms and isolated registries; they require an open, interoperable, and population-scale digital infrastructure approach capable of connecting diverse actors, standards, and market functions globally. The ONCM Position Paper sprint held at IIM Bangalore on 27<sup>th</sup> April 2026 was convened to engage potential consortium technology partners, assess demonstrated building blocks across carbon and adjacent sectors, identify new capabilities required for pilot infrastructure, and align design choices needed for collaborative deployment.

This paper therefore should be referred to as a co-designed foundation for development and implementation. The sprint process was structured around creating a practical capability inventory: identifying what building blocks already exist, with whom they reside, what aligns with the Networks for Humanity (NFH) fabric as the core infrastructure technology, and which components must be repurposed or built anew through consortium collaboration. In that sense, the paper reflects both a technology mapping exercise and a partnership foundation for pilot development.

A key insight from the Position Paper sprint is that ONCM need not build every layer from scratch. Foundational building blocks such as registries, catalogues, tokenization capabilities, schema browsers, verifiable credentials, and middleware accelerators are already available via NFH's offerings, while several consortium participants demonstrated complementary capabilities in onboarding, dMRV, dashboards, registries, analytics, data infrastructure, and trading support. The central task ahead is to assemble these capabilities into a coherent carbon-market network architecture that preserves interoperability while accommodating the distinct needs of project developers, resource owners, registries, dMRV agencies, buyers, financiers, and regulators.

The ONCM initiative is especially significant in the Indian context. As India develops its compliance-oriented carbon market architecture while also engaging with voluntary and cross-border carbon value chains, there is a clear need for digital infrastructure that can support discovery, trust, traceability, and coordinated value exchange without locking the ecosystem into proprietary silos. ONCM offers the possibility of such an approach by combining open protocols, modular building blocks, network-level governance, and extensible schemas that can evolve with sectoral and regulatory requirements.

This technology position paper is thus best understood as an invitation to build. We acknowledge that success will depend on open network design choices and building blocks, as well as on institutional coordination, governance design, and the willingness of ecosystem actors to take responsibility for specific pilot functions. The position paper sprint has clarified that the next phase must move from conceptual alignment to scoped execution, with ONCM serving as a shared digital backbone for inclusive and interoperable carbon market development.

- Chaitrali Bhoi & R Srinivasan, IIMB CDPG

# 1. Essential Components Provided by Networks for Humanity (NFH):

| Trust and Tokenization |                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Component              | Purpose                                                                                                                                                                                                                                                                                                                                                                                             | Capabilities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>DeDi.global</b>     | Decentralized directory that can create and verify public registries instantly—one endpoint for every registry, every jurisdiction. Built on the Decentralized Directory Protocol (DDP), an open standard under Linux Foundation Decentralized Trust (LFDT). Free to publish and query, sub-200ms API responses. Every record is anchored on the CORD blockchain (BLAKE2 H256) for tamper-evidence. | <p><b>- Workflows:</b></p> <ul style="list-style-type: none"> <li>Publish (create/manage namespace, registry, records);</li> <li>Lookup (retrieve by ID, returns data + cryptographic proof);</li> <li>Query (search/filter with pagination, returns proof).</li> </ul> <p><b>- Supports:</b> confirmed templates are Membership, Public Key, Revocation, Beckn, plus custom JSONs.</p> <p><b>- Flow:</b> publisher verifies namespace → publishes records → consumer calls Lookup/Query → gets JSON + on-chain proof, no contact with publisher needed.</p> |
| <b>OpenCred.global</b> | <p>Open-source credential infrastructure for issuing, signing, and verifying W3C Verifiable Credentials (Data Model 2.0). Ships as a Desktop app and self-hosted Docker image for issuer/verifier tooling, not a holder-wallet product.</p> <p><b>Principles:</b> user-centric, privacy-preserving, decentralized.</p>                                                                              | <p><b>- Process:</b></p> <ul style="list-style-type: none"> <li>Issue (three proof formats — VC-JWT default, Data Integrity/W3C with ECDSA or Ed25519, SD-JWT VC for selective disclosure).</li> <li>Verify (8 checks: signature integrity, temporal validity, DID resolution, cert chain, revocation status, schema compliance, context availability, key-rotation advisory).</li> <li>No holder-wallet component exists; "zero storage" refers to session data purged within a</li> </ul>                                                                  |

|                                                          |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                          |                                    | configurable TTL on the issuer/verifier side.                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>UNITS (Universal Information Tokenisation System)</b> | Programmable value infrastructure. | <ul style="list-style-type: none"> <li>- Provides tokenization of assets through token classes and token pools, with tokens as user-level containers for holdings and transactions.</li> <li>- Supports the creation and implementation of smart policies, hooks, and compliance rules.</li> <li>- Gradient guarantees and arbitration can be implemented via Pincer.</li> <li>- Purpose-bound digital value can be transacted via Vouch.</li> </ul> |

## 2. Existing Building Blocks of NFH fabric:

| Product/Tool                           | Full Description                                                                                                                                                                                                               | Key Features & Capabilities                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Beckn Protocol v2 Specification</b> | Open-source specification for peer-to-peer value exchange; powers discovery through post-fulfillment. The transport layer stays stable while business-payload schemas are tech-agnostic and domain-composable (JSON-LD based). | <p><b>- Transaction Lifecycle</b></p> <ul style="list-style-type: none"> <li>• <b>Discovery:</b> discover/on_discover;</li> <li>• <b>Contracting:</b> select/on_select, init/on_init, confirm/on_confirm;</li> <li>• <b>Fulfillment:</b> status/on_status, track/on_track, update/on_update, cancel/on_cancel;</li> <li>• <b>Post-Fulfillment:</b> rate/on_rate, support/on_support.</li> </ul> <p><b>- Transport:</b> one named endpoint per action; envelope fields are fixed and shared.</p> |

|                                   |                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                   |                                                                                                                                                                                                                                           | <p>- <b>Message Models:</b> business payload is JSON-LD, layered as transport envelope → core schema → domain extensions.</p> <p>- <b>Async by design:</b> forward action gets instant Ack; result arrives later via the matching on_ callback.</p>                                                                                                                                                                                                                                                                                                   |
| <b>Registry Service (REGISTR)</b> | <p>A self-service registry giving every network entity a resolvable, verified identity (keys, endpoints, roles) under its own domain. This registry is explicitly DeDi-compliant.</p>                                                     | <p>- <b>Flow:</b> Namespace Creation (verify domain ownership) → Registry Publication (add a registry under the namespace) → Subscriber Record Creation (callback URL, roles, domain codes, public keys) via DeDi's Lookup/Query APIs.</p> <p>- <b>Actors:</b> Network Facilitator Organization (NFO) sets up the network's namespace/registry; Network Participant (NP) self-publishes its own subscriber record under its own domain.</p> <p>- <b>Trust:</b> ONIX auto-resolves subscriber details during transactions, no manual key exchange.</p> |
| <b>Catalog Service (CATALG)</b>   | <p>A Catalog describes all resources and offers a provider node can fulfil. The CATALG service validates the catalogues published by the provider nodes, and indexes it with the DISCOVER service, enabling more efficient discovery.</p> | <p>- <b>Process:</b> Provider node publishes to CATALG (Catalog Service) → CATALG validates and forwards to DISCOVER (Discovery Service) → DISCOVER indexes and answers discovery requests via on_discover.</p> <p>- <b>Structure:</b> Providers, Categories, Items, Offers, Fulfillments.</p> <p>- The catalogues are provider node-owned, domain-extensible.</p>                                                                                                                                                                                    |

|                                     |                                                                                                                                                                                                   |                                                                                                                                                                                                             |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Verifiable Credentials (VCs)</b> | Network Participants (NPs) and/or Network Facilitator Organizations (NFOs) issue and verify W3C Verifiable Credentials locally via OpenCred, with DeDi handling key lookup and revocation checks. | <ul style="list-style-type: none"> <li>- NFOs issue network-level/reputation credentials, BPPs issue provider/operations credentials, BAPs issue demand-side credentials, depending on use case.</li> </ul> |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| <b>Accelerators &amp; Services</b>  |                                                                                                                                           |                                                                                                                                                                                                                                                                          |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Accelerator</b>                  | <b>Purpose</b>                                                                                                                            | <b>Capabilities</b>                                                                                                                                                                                                                                                      |
| <b>ONIX</b>                         | An open-source, plugin-based middleware adapter between provider nodes and seeker nodes handling signing, schema validation, and routing. | <ul style="list-style-type: none"> <li>- <b>Plugin Pipeline:</b> Router (YAML rules), SignValidator (Ed25519), Cache (Redis), Signer, SchemaValidator (local/URL), ReqMapper.</li> <li>- <b>Deployment:</b> minutes to a live network; hot-swappable plugins.</li> </ul> |
| <b>Discovery Service (DISCOVER)</b> | Edge caching and discovery                                                                                                                | <ul style="list-style-type: none"> <li>- Intent-specific queries across catalogues.</li> <li>- Reduces broadcast.</li> <li>- Personalization of discovery.</li> </ul>                                                                                                    |
| <b>Schema Browser</b>               | Interoperability                                                                                                                          | <ul style="list-style-type: none"> <li>- Sector schemas (including for carbon when it is built-out).</li> <li>- Domain-specific schema extensions.</li> <li>- Custodianship.</li> </ul>                                                                                  |

### 3. Existing Building Blocks and Tech Capabilities with TCS:

| <b>Core Platforms &amp; Building Blocks (By TCS)</b> |                     |                 |
|------------------------------------------------------|---------------------|-----------------|
| <b>Product/Capability</b>                            | <b>Capabilities</b> | <b>ONCM Fit</b> |

|                                  |                                                                                                                                                                                                |                         |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>Dashboard</b>                 | <ul style="list-style-type: none"> <li>- Stakeholder-centric views</li> <li>- Real-time monitoring</li> <li>- Progress/analytics tracking</li> </ul>                                           | Ecosystem oversight     |
| <b>Value Exchange Manager</b>    | <ul style="list-style-type: none"> <li>- Multi-actor orchestration</li> <li>- Friction/cost reduction</li> <li>- Automated lifecycle workflows</li> </ul>                                      | Core transaction engine |
| <b>Marketplace (Supply Data)</b> | <ul style="list-style-type: none"> <li>- Credit/project/data discovery</li> <li>- Dynamic pricing/forecasting</li> <li>- Exchange integration</li> <li>- Demand-response management</li> </ul> | Trading facilitation    |
| <b>Asset Tokenization</b>        | <ul style="list-style-type: none"> <li>- Fractional digital assets</li> <li>- Smart contract integration</li> <li>- Serialization/traceability</li> </ul>                                      | Credit immutability     |
| <b>Payments &amp; Settlement</b> | <ul style="list-style-type: none"> <li>- Physical/digital handling</li> <li>- Registry auto-updates</li> <li>- Compliance reporting</li> </ul>                                                 | End-to-end closure      |
| <b>Low Emission Design Hub</b>   | <ul style="list-style-type: none"> <li>- New asset sustainability MRV</li> <li>- Attribute validation</li> </ul>                                                                               | Pre-project assessment  |

| <b>Carbon Credit Lifecycle and Core Module (By TCS)</b> |                                                                                                                                                                                  |                        |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>Product/Capability</b>                               | <b>Capabilities</b>                                                                                                                                                              | <b>ONCM Fit</b>        |
| <b>Onboarding Management</b>                            | <ul style="list-style-type: none"> <li>- Partner registration</li> <li>- Carbon Passport issuance</li> </ul>                                                                     | Project/actor entry    |
| <b>Discovery &amp; Order Management</b>                 | <ul style="list-style-type: none"> <li>- Multi-X discovery (projects/suppliers/credits/buyers)</li> <li>- Product catalogue</li> <li>- Personalization/recommendation</li> </ul> | Supply-demand bridging |

|                                 |                                                                                                                                                                                                          |                           |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>dMRV Platform</b>            | <ul style="list-style-type: none"> <li>- Geospatial/IoT sensors</li> <li>- Continuous/near-real-time monitoring</li> <li>- Sky-earth data convergence</li> <li>- Baseline/boundary assessment</li> </ul> | Tamper-proof verification |
| <b>Unified Carbon Interface</b> | <ul style="list-style-type: none"> <li>- Standardized ecosystem access</li> <li>- Cross-module integration</li> </ul>                                                                                    | Interoperability gateway  |
| <b>Trading Platform</b>         | <ul style="list-style-type: none"> <li>- Quality rating engine</li> <li>- Discovery/settlement integration</li> </ul>                                                                                    | Secondary market          |

| <b>Advanced Tech Enablers (By TCS)</b> |                                                                                                           |                        |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------|------------------------|
| <b>Capability</b>                      | <b>Capabilities</b>                                                                                       | <b>ONCM Fit</b>        |
| Decentralized Carbon Ledger            | - Ownership/transfer tracking<br>- Audit trails                                                           | Anti-double-counting   |
| Recommendation Engine                  | - Analytics insights<br>- Personalized matching                                                           | Buyer optimization     |
| Data Fabric                            | - Global sources harmonization (WRI/ FAO/ IEA/ CDP)<br>- Agri/ forestry/ energy/ transport/ industry data | Baselines/value chains |

| <b>Sky-Earth Convergence for Digital MRV(By TCS)</b> |                                                                |                                   |
|------------------------------------------------------|----------------------------------------------------------------|-----------------------------------|
| <b>Capability</b>                                    | <b>Key Features</b>                                            | <b>ONCM Fit</b>                   |
| Geospatial Data Acquisition                          | - Satellite/drone imagery<br>- Project boundary assessment     | Precise site delineation          |
| Spatial Analytics Baseline                           | - Historical land/use data<br>- Carbon reference establishment | Additionality proof               |
| Absorption/Sequestration Calculation                 | - Biomass/soil modeling<br>- Potential quantification          | Credit volume determination       |
| Credit Issuance Determination                        | - Performance-based algorithms<br>- Standardized formulas      | Automated issuance                |
| Near Real-Time Monitoring                            | - Continuous IoT/geospatial feeds<br>- Performance dashboards  | Bottleneck reduction/auditability |

| <b>Blockchain Tokenization &amp; Traceability (By TCS)</b> |                                                                                                                                         |                      |
|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>Credit Feature</b>                                      | <b>Key Features</b>                                                                                                                     | <b>ONCM Fit</b>      |
| Digital Issuance                                           | <ul style="list-style-type: none"> <li>- On-chain minting</li> <li>- Registry integration</li> </ul>                                    | Instant creation     |
| Unique Serialization                                       | <ul style="list-style-type: none"> <li>- Immutable IDs</li> <li>- Provenance embedding</li> </ul>                                       | Individual tracking  |
| Programmatic Transfer                                      | <ul style="list-style-type: none"> <li>- Wallet-to-wallet</li> <li>- Ownership updates</li> </ul>                                       | Frictionless trading |
| Smart Contracts                                            | <ul style="list-style-type: none"> <li>- Auto-settlement</li> <li>- Rule-based retirement</li> <li>- Double-count prevention</li> </ul> | Market confidence    |

| <b>AI-Enabled Interoperability &amp; Automation (By TCS)</b> |                                                                                                                                               |                         |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>AI Capability`</b>                                        | <b>Key Features</b>                                                                                                                           | <b>ONCM Fit</b>         |
| Standards Alignment                                          | <ul style="list-style-type: none"> <li>- Partner onboarding</li> <li>- Evolving protocol sync</li> </ul>                                      | Ecosystem cohesion      |
| Market Insight/Risk Scoring                                  | <ul style="list-style-type: none"> <li>- Analytics dashboards</li> <li>- Credit quality models</li> </ul>                                     | Informed buying         |
| Document Verification                                        | <ul style="list-style-type: none"> <li>- Legal/ ownership/ compliance OCR/AI</li> </ul>                                                       | Automated due diligence |
| Anomaly/Duplicate Detection                                  | <ul style="list-style-type: none"> <li>- Pattern recognition</li> <li>- Fraud alerts</li> </ul>                                               | Integrity assurance     |
| Price Discovery/Analytics                                    | <ul style="list-style-type: none"> <li>- Dynamic pricing</li> <li>- Demand forecasting</li> <li>- AI agents (decisions/compliance)</li> </ul> | Efficient markets       |

| <b>Continuous Digital Monitoring Reporting Verification (dMRV) (By TCS)</b> |                            |                           |
|-----------------------------------------------------------------------------|----------------------------|---------------------------|
| <b>Detection Type</b>                                                       | <b>Key Features</b>        | <b>ONCM Fit</b>           |
| Canopy Loss Patterns                                                        | - Temporal change analysis | Deforestation alerts      |
| Burn Scars                                                                  | - Thermal/ NDVI signatures | Fire risk monitoring      |
| Selective Logging                                                           | - Tree crown disruption    | Illegal activity flags    |
| Vegetation Health                                                           | - NDVI/ health indices     | Degradation early warning |

#### 4. Existing Building Blocks and Tech Capabilities with Protean eGov Technologies:

| <b>Open Digital Ecosystem (ODE) &amp; Open Networks (By Protean)</b> |                                                                                                                                                                                                                                                                         |                                                                                                       |
|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| <b>Product</b>                                                       | <b>Capabilities</b>                                                                                                                                                                                                                                                     | <b>ONCM Fit</b>                                                                                       |
| <b>OpenAgriNet</b>                                                   | <ul style="list-style-type: none"> <li>- Beckn-based agri open network</li> <li>- ~10M+ farmer onboarding</li> <li>- Service discovery (inputs/services/MRV)</li> <li>- FPO aggregation</li> <li>- Sandbox testing (sandbox)</li> <li>- Architecture toolkit</li> </ul> | Core Agriculture layer:<br>Farmer>>MRV>>Carbon Credit and Project aggregator discovery & transactions |

|                                                                  |                                                                                                                                                                                                                                                                                  |                                                                                     |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>Protean Open Commerce (Open Network for Digital Commerce)</b> | <ul style="list-style-type: none"> <li>- Full-stack ONDC solution</li> <li>- Uniconnect: Universal ONDC connector</li> <li>- Buyer/Seller apps</li> <li>- RSP (settlement)</li> <li>- Cataloguing-as-a-Service</li> <li>- Grievance redressal</li> <li>- Merchant KYC</li> </ul> | Carbon marketplace: Credit trading, settlement, catalog discovery across registries |
| <b>RISE with Protean</b>                                         | <ul style="list-style-type: none"> <li>- Multi-sector API marketplace</li> <li>- Microservices/User Journeys</li> <li>- ONDC/ONEST integration</li> <li>- Agri/Education/Health APIs</li> </ul>                                                                                  | Ecosystem expansion: Cross-sector carbon co-benefits (water/biodiversity)           |

| <b>DPI in a box &amp; Infrastructure Stack (By Protean)</b> |                                                                                                                                                                                                                                            |                                                             |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| <b>Product</b>                                              | <b>Capabilities</b>                                                                                                                                                                                                                        | <b>ONCM Fit</b>                                             |
| <b>DPI-in-a-Box</b>                                         | <ul style="list-style-type: none"> <li>- Pre-integrated DPI starter kit</li> <li>- Automated workflows/dashboards</li> <li>- Digital credentialing</li> <li>- Open wallets (Inji-compatible)</li> <li>- Cloud-native deployment</li> </ul> | ONCM dashboards/workflows                                   |
| <b>ProteanX</b>                                             | <ul style="list-style-type: none"> <li>- Blockchain verifiable credentials</li> <li>- Digital wallet integration</li> <li>- Cross-sector credential management</li> </ul>                                                                  | Carbon Credit Passports: Immutable credit provenance proofs |
| <b>Consent Stack</b>                                        | <ul style="list-style-type: none"> <li>- Granular data permissions</li> <li>- India Stack compliant</li> <li>- Revocable consents</li> </ul>                                                                                               | Resource Owner data sharing: MRV consent management         |

| Identity and Verification Stack (By Protean) |                                                                                                                                                                                           |                                                                   |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Product                                      | Capabilities                                                                                                                                                                              | ONCM Fit                                                          |
| <b>Enrollment Services</b>                   | <ul style="list-style-type: none"> <li>-Digital ID enrollment and provision</li> <li>~43cr+ PAN applications processed</li> <li>- ~18cr+ e-PAN issued</li> <li>- ~73K+ centers</li> </ul> | Participant KYC: Universal business IDs for registries/buyers     |
| <b>e-KYC</b>                                 | <ul style="list-style-type: none"> <li>- Aadhaar-based verification</li> <li>- Video/biometric KYC</li> </ul>                                                                             | Resource Owner verification: Instant project developer onboarding |
| <b>C-KYC</b>                                 | <ul style="list-style-type: none"> <li>- Centralized KYC repository</li> <li>- Cross-sector reuse</li> </ul>                                                                              | MRV agency validation: Verifiers/auditors                         |
| <b>Aadhaar Authentication</b>                | <ul style="list-style-type: none"> <li>- OTP/biometric/fingerprint auth</li> </ul>                                                                                                        | Secure logins: resource Owner/ projects/ registries               |

| Digital Signing & Trust Layer (By Protean) |                                                                                                          |                                                        |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Product                                    | Capabilities                                                                                             | ONCM Fit                                               |
| <b>eSign</b>                               | <ul style="list-style-type: none"> <li>- Aadhaar eSign</li> <li>- Paperless contracts</li> </ul>         | MRV reports: Digital signing of verification documents |
| <b>eSignPro</b>                            | <ul style="list-style-type: none"> <li>- Enterprise signing workflows</li> <li>- Bulk signing</li> </ul> | Project contracts: Multi-party agreements              |
| <b>TSP (Trusted Signing Platform)</b>      | <ul style="list-style-type: none"> <li>- PKI-based digital signatures</li> </ul>                         | Credit issuance: Registry guarantees                   |

### Data & Compliance Stack (By Protean)

| Product             | Capabilities                                                                                                                | ONCM Fit                                         |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| <b>Data Stack</b>   | <ul style="list-style-type: none"> <li>- Secure data lakes</li> <li>- Analytics/AI enablement</li> </ul>                    | Carbon baselines:<br>Historical/project datasets |
| <b>GST Services</b> | <ul style="list-style-type: none"> <li>- GSTIN verification</li> <li>-Taxation</li> <li>- Invoice reconciliation</li> </ul> | Carbon tax compliance:<br>Domestic trading       |

### Sustainability & Citizen Platforms (By Protean)

| Product            | Capabilities                                                                                                                                                                                                                               | ONCM Fit                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>ProteanLife</b> | <ul style="list-style-type: none"> <li>- CSR/ESG project discovery</li> <li>- Partner matching (NGOs/projects)</li> <li>- Fund transfer/compliance</li> <li>- Monitoring/alerts</li> <li>- Central Registry for Documents (CRD)</li> </ul> | Carbon co-benefits:<br>Biodiversity/water credits |

### Cloud & Security Infrastructure (By Protean)

| Product                                | Capabilities                                                                                                                                | ONCM Fit                                            |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| <b>Protean Cloud</b>                   | <ul style="list-style-type: none"> <li>- Managed Kubernetes</li> <li>- Pre-configured instances</li> <li>- Managed databases/CMS</li> </ul> | ONCM hosting: Scalable<br>production infrastructure |
| <b>Information Security Consulting</b> | <ul style="list-style-type: none"> <li>- DPI security audits</li> <li>- Compliance frameworks</li> </ul>                                    | Regulatory compliance:<br>RBI/MoEFCC standards      |

| <b>International &amp; Specialized (By Protean)</b> |                           |                      |
|-----------------------------------------------------|---------------------------|----------------------|
| <b>Product</b>                                      | <b>Capabilities</b>       | <b>ONCM Fit</b>      |
| <b>Protean International UAE</b>                    | - Regional DPI deployment | Cross-border trading |
| <b>Indonesia Open Network</b>                       | -Regional DPI deployment  | Cross border trading |

## 5. Existing Building Blocks and Tech Capabilities with RenewCred:

| <b>Core Platform (By RenewCRed)</b>             |                                                                                                                                                                                                                                                                     |                                                    |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <b>Product</b>                                  | <b>Capabilities</b>                                                                                                                                                                                                                                                 | <b>ONCM Fit</b>                                    |
| <b>Net Zero Platform<br/>(Proprietary dMRV)</b> | <ul style="list-style-type: none"> <li>- Live data streams (IoT/sensors)</li> <li>- Scientific models (emission baselines)</li> <li>- Automated verification</li> <li>- Individual credit tracking</li> <li>- faster verification</li> <li>- lower costs</li> </ul> | Digital MRV backbone: Real-time project monitoring |
| <b>Digital Registry</b>                         | <ul style="list-style-type: none"> <li>- Real-time intelligence</li> <li>- Unified verification</li> <li>- Ownership transparency</li> <li>- Carbon Credit Lifecycle tracking (issuance to retirement)</li> <li>- Blockchain-linked wallet</li> </ul>               | ONCM registry: Anti-double-counting, audit trails  |

| <b>Buyer Tools &amp; Features (By RenewCRed)</b> |                                                                                                                                                               |                                  |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>Capability</b>                                | <b>Features</b>                                                                                                                                               | <b>ONCM Fit</b>                  |
| <b>High-Quality Credit Access</b>                | <ul style="list-style-type: none"> <li>- Live performance tracking</li> <li>- Transparent ownership</li> <li>- Global South focus (India projects)</li> </ul> | Green finance/ESG/net-zero ready |
| <b>Risk Mitigation</b>                           | <ul style="list-style-type: none"> <li>- No greenwashing (continuous data)</li> <li>- Buyer-ready metrics</li> <li>- Audit-ready evidence</li> </ul>          | Corporate buyer confidence       |
| <b>Onboarding</b>                                | <ul style="list-style-type: none"> <li>- Simple buyer form</li> <li>- Credit exploration dashboard</li> </ul>                                                 | Instant access to Bharat credits |

| <b>Supplier Tools &amp; Features (By RenewCRed)</b> |                                                                                                                                                                    |                           |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>Capability</b>                                   | <b>Features</b>                                                                                                                                                    | <b>Benefits</b>           |
| <b>Full Project Lifecycle</b>                       | <ul style="list-style-type: none"> <li>- Project registration</li> <li>- Methodology alignment</li> <li>- Digital issuance</li> <li>- Credit retirement</li> </ul> | End-to-end support        |
| <b>Real-Time Verification</b>                       | <ul style="list-style-type: none"> <li>- IoT integration</li> <li>- Continuous monitoring</li> <li>- Automated checks</li> </ul>                                   | No manual audits          |
| <b>Scalability</b>                                  | <ul style="list-style-type: none"> <li>- Project expansion</li> <li>- Site replication</li> <li>- Multi-project dashboard</li> </ul>                               | Low marginal costs        |
| <b>Market Access</b>                                | <ul style="list-style-type: none"> <li>- Buyer matching</li> <li>- Financier connections</li> <li>- Flat buyer-pays model</li> </ul>                               | Small developers included |

| Science & Standards Tools (By RenewCRed) |                                                                                                                                                                               |                                          |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| Tool/Community                           | Capabilities                                                                                                                                                                  | Methodologies                            |
| Science Community (93+ experts)          | <ul style="list-style-type: none"> <li>- Peer-reviewed standards</li> <li>- Live methodology development</li> <li>- Domain expertise (climate science/engineering)</li> </ul> | CCS, DAC, Biochar, EV Fleets, Solar, CBG |
| Rigorous Standards                       | <ul style="list-style-type: none"> <li>- Tech-first verification</li> <li>- Transparent processes</li> <li>- Financial ratings (project viability)</li> </ul>                 | India-first methodologies                |

## 6. Existing Building Blocks and Tech Capabilities with Intellecapt:

| dMRV Products & Pilots (By Intellecapt) |                                                                                                                                                                                                                                                                                              |                                    |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| Product/Pilot                           | Capabilities                                                                                                                                                                                                                                                                                 | ONCM Fit                           |
| <b>Cookstove Sensor Pilots</b>          | <ul style="list-style-type: none"> <li>- Real-time usage tracking</li> <li>- Emission reductions calculation</li> <li>- Hawthorne effect adjustments (KPT vs. sensor data)</li> <li>- Data-as-a-Service APIs for dashboards</li> </ul>                                                       | Clean cooking credits verification |
| <b>Agroforestry App/Portal</b>          | <ul style="list-style-type: none"> <li>- Land Use Land Cover –LULC, GPS-based carbon estimates (ML/AI simulations)</li> <li>- Centralized data repository (farmer profiles/baselines/land docs)</li> <li>- Validator access for VVB audits</li> <li>- Single project transparency</li> </ul> | Smallholder agroforestry dMRV      |
| <b>Biochar dMRV System</b>              | <ul style="list-style-type: none"> <li>- Feedstock-to-field tracking</li> <li>- Integrated data repository (weights/process data/application)</li> <li>- Registry/validator transparency</li> </ul>                                                                                          | Biochar removal credits            |
| <b>Data-as-a-Service Protocols</b>      | <ul style="list-style-type: none"> <li>- Sensor data APIs</li> <li>- Real-time visualization (Livable Planet Observatory)</li> <li>- Multi-sensor hosting (soil moisture/etc.)</li> </ul>                                                                                                    | Federated dMRV data layer          |

| <b>AI/Analytics Tools (By Intellectap)</b> |                                                                                                                                                                                                                                                                                  |                                                             |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| <b>Product/Tool</b>                        | <b>Capabilities</b>                                                                                                                                                                                                                                                              | <b>ONCM Fit</b>                                             |
| <b>AI Project Assessor</b>                 | <ul style="list-style-type: none"> <li>- Website-based assessor: Project stage/ registries/ methodologies/ financials</li> <li>- Gap identification/ remediation for biochar/agroforestry</li> <li>- Open-source questionnaire can generate answers in form of report</li> </ul> | Project developer and resource owner onboarding accelerator |
| <b>Local LLMs/SLM Tools</b>                | <ul style="list-style-type: none"> <li>- Article 6 policy frameworks</li> <li>- FPO creditworthiness ratings/underwriting</li> <li>- Gender-inclusivity tools for Financial Inclusion</li> <li>- Banking dashboards (NABARD)</li> </ul>                                          | FPO analytics for carbon participation                      |
| <b>MRV Analytics</b>                       | <ul style="list-style-type: none"> <li>- Stove usage adjustments</li> <li>- Emission modeling</li> <li>- Double-counting flags</li> </ul>                                                                                                                                        | Anomaly detection                                           |

| <b>Advisory &amp; Finance Platforms (By Intellectap)</b> |                                                                                                                                  |                                                        |
|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| <b>Platform</b>                                          | <b>Capabilities</b>                                                                                                              | <b>ONCM Fit</b>                                        |
| <b>Sankalp Forum</b>                                     | <ul style="list-style-type: none"> <li>- Investor matchmaking</li> <li>- SDG accelerators</li> <li>- ~3k+ enterprises</li> </ul> | Ecosystem building, climate finance investor discovery |
| <b>I3N (Impact Investment Network)</b>                   | <ul style="list-style-type: none"> <li>- Deal syndication</li> <li>- ~\$500M+ capital mobilized</li> </ul>                       | Carbon project funding                                 |
| <b>Carbon Finance (TRIF)</b>                             | <ul style="list-style-type: none"> <li>- Smallholder offsets</li> <li>- Climate-smart ag platforms</li> </ul>                    | Focused Scaling of smallholder offsets                 |

## 7. Identified Gaps to be Addressed by ONCM Network Orchestrator:

- **Capability Inventory & Alignment:** Map existing ONCM tech building blocks to NFH Fabric; repurpose/ build missing/ required building blocks via consortium volunteers.
- **Schema Definition:** Carbon sector schemas (essential for JSON attributes file); defining extensions (if necessary) for India/ cross-border without core protocol changes.
- **Ecosystem Actors Onboarding & Policies:** Network-level processes for participant KYC/evolution; programmable rules.
- **Network Governance Layer:** Define governance mechanisms for network operations, dispute resolution, standards evolution, and consortium coordination (Decision-making framework)
- **Dashboards & Observability:** Define dashboards and their purpose, scope of observability
- **ICM (CCM)-VCM Meshing:** Define interoperability layer between Indian Carbon Market (ICM) compliance requirements and Voluntary Carbon Market (VCM) standards enabling seamless meshing of both the markets' digital infrastructures
- **Data/AML Challenges:** Define node-level responsibility for using local data and storing data.
- **Pilot Scope:** Define value exchanges interactions among ONCM Nodes and their expected integration with carbon market registries, dashboards, exchange.

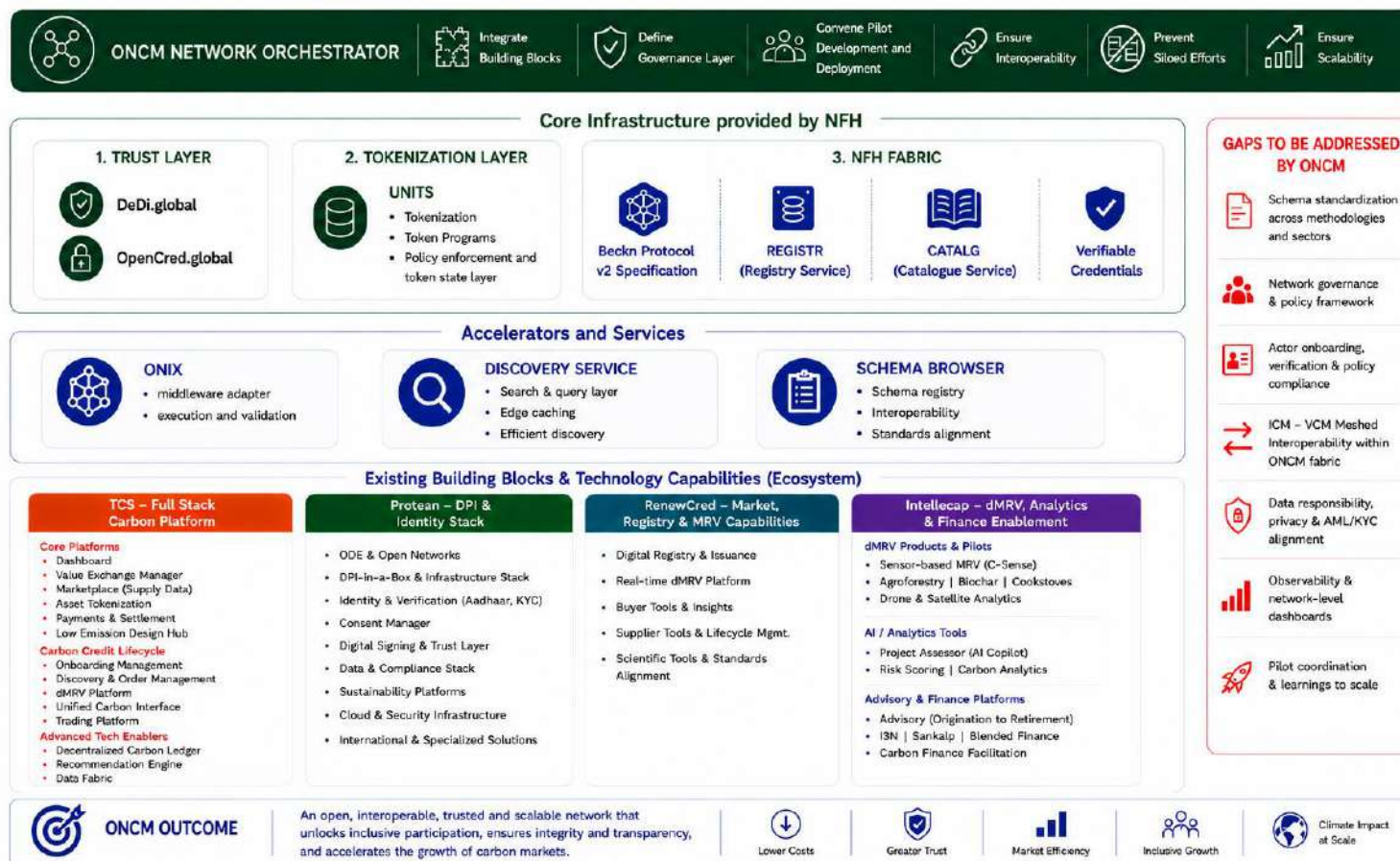
## 8. Technology Capabilities Mapping for ONCM Pilot Design and Development:

### ONCM POSITION PAPER MAP

Open, Interoperable, Inclusive Digital Infrastructure for Carbon Markets

### ONCM

Open Network for Carbon Markets



## 9. Way Forward:

This technology position paper brings together the ONCM capability inventory, the mapping of existing building blocks to NFH offerings, and the identification of gaps that still need to be addressed for pilot development. It helps create clarity on what already exists, what can be repurposed, what needs to be built, and where consortium partners need to take responsibility. This paper becomes a practical design reference for the ONCM pilot development by showing the visibility needed across core infrastructure, schemas, onboarding, governance, observability, and data/AML responsibilities. It also helps avoid duplication by making the building blocks explicit and by showing how each piece fits into the broader open network architecture.

This overview is essential because without understanding the state of every system layer, pilot design cannot begin effectively. As a result, the paper outlines the expected next steps, including defining carbon-sector schemas, coordinating cross-border and India-specific extensions, establishing network-level onboarding and policy procedures, outlining dashboard and observability requirements, and allocating node-level responsibilities for local data and risk management. By identifying these gaps early on, the paper provides the consortium with a shared development agenda and facilitates the process of prioritizing what must be done right. Additionally, it provides a common framework for the pilot team to decide what needs to be jointly produced and what is currently available in the ecosystem.

The strategy ahead is to consolidate the efforts of all consortium partners into a phased and synchronised pilot design and development plan. Aligning on the minimal viable building blocks needed for pilot development, defining explicit accountability, and reaching a consensus on the technical and governance design decisions that would facilitate ecosystem partner interoperability are the initial steps. ONCM intends to cover the entire market lifecycle interactions while designing use cases for multiple nodes (carbon market ecosystem actors) with focused pilots that test a real value exchange through the open network, for the compliance and voluntary carbon market foundations in place. This entails beginning with use-cases that are significant for proving interoperability and transparency by verifying the flow of interactions across nodes, registries, dashboards, and exchanges, and then progressively growing as the architecture and governance develop.

IIMB CDPG as a network orchestrator would work as a convener and integrator as the pilot develops; while ensuring consortium partners' efforts are cohesive and focused. IIMB CDPG would coordinate schema work, onboarding logic, policy enforcement, and observability throughout the ecosystem to prevent the pilot development efforts to get siloed. As ONCM's convener, IIMB CDPG's goal is to demonstrate a functional ONCM value-exchange layer that is extendable, interoperable, and prepared to expand into a larger market network.

## Appendix 1: Participants of ONCM Technology Position Paper Sprint on 27<sup>th</sup> April 2026 at IIMB Campus

| Sr. No. | Name                 | Affiliation                  |
|---------|----------------------|------------------------------|
| 1       | Chaitrali Bhoi       | IIMB CDPG                    |
| 2       | Srinivasan R         | IIMB CDPG                    |
| 3       | Bachi Allamsetty     | Networks for Humanity (NFH)  |
| 4       | Mythili Anish Kamath | Networks for Humanity (NFH)  |
| 5       | Rajesh Amirthlingam  | TCS Sustainability Practices |
| 6       | Syeda Nishath        | TCS Sustainability Practices |
| 7       | Naveen Kondamundi    | TCS Sustainability Practices |
| 8       | Praveen Pallikala    | TCS Sustainability Practices |
| 9       | Ameer Y Faisal       | TCS Sustainability Practices |
| 10      | Dinesh Ramakrishnan  | Protean eGov Technologies    |
| 11      | Abhimanyu Rathi      | RenewCred                    |
| 12      | Yogendra Pachal      | RenewCred                    |
| 13      | Kaushik Gupta        | RenewCred                    |
| 14      | Anurag Dhir          | Intellectap                  |
| 15      | Shreya Banerjee      | Intellectap                  |