



AVERE WEBINAR

World Electric Vehicle Association Journal



Innovation, 3 Revolutions, 4 Integration

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INNOVATION DRIVEN

Freedom of Enquiry



The spirit of Raphael's School of Athens and the principle “I love my teacher, but trust the truth more”.

Multi Dimensions Thinking

- ***Holistic Thinking***
- ***Mathematic Model & Big Data***
- ***Causal & Related Relationships***
- ***Closed Loop Thinking***
- ***Cycle Thinking***





Engineering Philosophy

System Integration

- 1) Objectives
- 2) Holistic Thinking
- 3) Creative Thinking
- 4) Divide and Conquer, Combine and Rule
- 5) Human Factors
- 6) Team Work

Objectives, Thought, Methodology, Implementation

Engineering = Science + Technology + Management

Experience & Practice

AUTOMOBILE REVOLUTION

- **Electrification**
- **Intelligent**
- **Connected and Sharing**

Mobility is Freedom.

*Mobility is the most apt expression for
our quest for happiness.*

Historical Document Signed at EVS.9

Committing Support to Formation of World Electric Vehicle Association

16th November 1988

Memorandum of Understanding

1 The undersigned, representing throughout the world a large majority of the organisations and people who in their respective countries, undertake the development of electric road vehicles or, more generally, electric propulsion, induced by the memorandum then drawn up on this subject and share their experiences.

They have then decided to convene within the framework of a worldwide organisation, the aims and structure of which are described hereunder:

2 The aims of the worldwide organisation are:

- to facilitate the exchange of information, which encourages the development of electric vehicles;
- to coordinate the activities of "EVS" committees to be held once every two years and, by region, in the three geographical zones: American continent, Asia and Pacific, Europe and Africa.


Along this principle, EVS 10 will be held in the Asia Pacific zone and EVS 11 in the Europe-Africa zone, following EVS 9 in Canada.

The world organisation has already set underway over national or regional meetings two parallel committees to address future "EVS" worldwide symposia, according to appropriate concerns, duplication and feasible cooperation.

3 To establish this world organisation and achieve the above aims, according to the above-mentioned, Canada has been asked to help for an initial period and has graciously agreed to provide a certified Memorandum under the direction of a Steering Committee composed of a limited number of representatives of the three geographical zones nominated by the organisation acts in electric vehicle development in other three zones.

The Steering Committee is constituted to prepare as soon as possible general working rules for the world organisation, in the success of which the undersigned are committed and for which they pledge to devote themselves their utmost efforts.

Toronto, Canada
November 15, 1988.



DÉCLARATION

1 Les personnalités ci-dessous, représentées par le présent mémorandum une large majorité des organismes et personnes participants dans leur pays respectif au titre d'affiliés au développement de véhicules électriques routiers ou de façon plus générale des engins de propulsion électrique, motivés par le présent mémorandum ont décidé de réunir leurs efforts et de partager leur expériences.

C'est pourquoi ils conviennent de se rencontrer au sein d'un organisme à l'échelle mondiale dont les buts et la structure sont définies ci-après:

2 Les buts de ce organisme sont:

- de faciliter l'échange de toutes informations susceptibles de favoriser le développement de véhicules électriques;
- de coordonner l'organisation des symposiums "E.V.S." ce rythme d'un fois les deux ans, par rotation entre les trois zones géographiques: continent américain, Asie-Pacifique, Europe-Afrique. Ce principe de rotation entrainera l'organisation d'E.V.S. 10 dans la zone Asie Pacifique et d'E.V.S. 11 dans la zone Europe-Afrique, après EVS 9 tenu au Canada.

MEMORANDUM SIGNED FOR WORLD ELECTRIC VEHICLE ASSOCIATION



Participants from Top left: B. Fijalkowski (Poland), R. Atanassov (Bulgaria), H. Payot (France), C. Hayden (U.S.), Z. Feng (China), W.A. Adams (Canada), Bottom left: M. Chiogioji (US), R. Leembruggen (Australia), J. Lea (Korea), L. Secord (Canada), C.C. Chan (Hong Kong), F. Dierkens (A.V.E.R.E.), A. Ananthkrishna (India), T. Matsuo (Japan). The above gentlemen signed the memorandum of agreement for the formation of a World Electric Vehicle Association during EVS.9 last November. Cliff Hayden (US), Ferdinand Dierkens (Europe) and Dr. C. Chan (Asia) have been appointed a steering committee.

Automobile Revolution

- Video Clip on Automobile Revolution

Engineering, U
c Vehicles A ation

家工程院



KEY TECHNOLOGIES

- **Light Weight Body**
- **Integrated Power Train**
- **High Performance Safety Battery Pack**
- **Intelligent Charging**

Core Proprietary Technologies - Light Weight



High Strength Steel Upbody

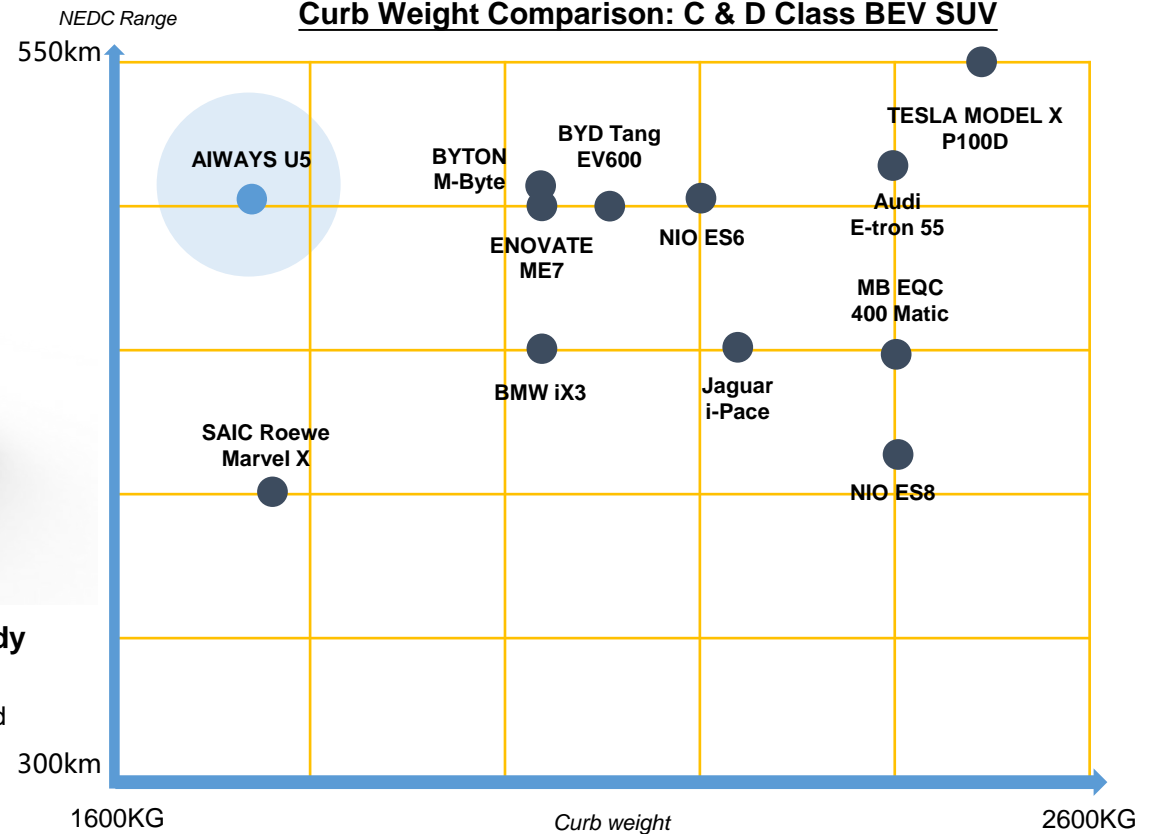
- Body strength is **60% higher** than industry average
- Side impact door beams made of **2,000 mPa** hot-formed steel with vanadium
- **Lower costs** of manufacturing and after-sales maintenance



Full Aluminum Underbody

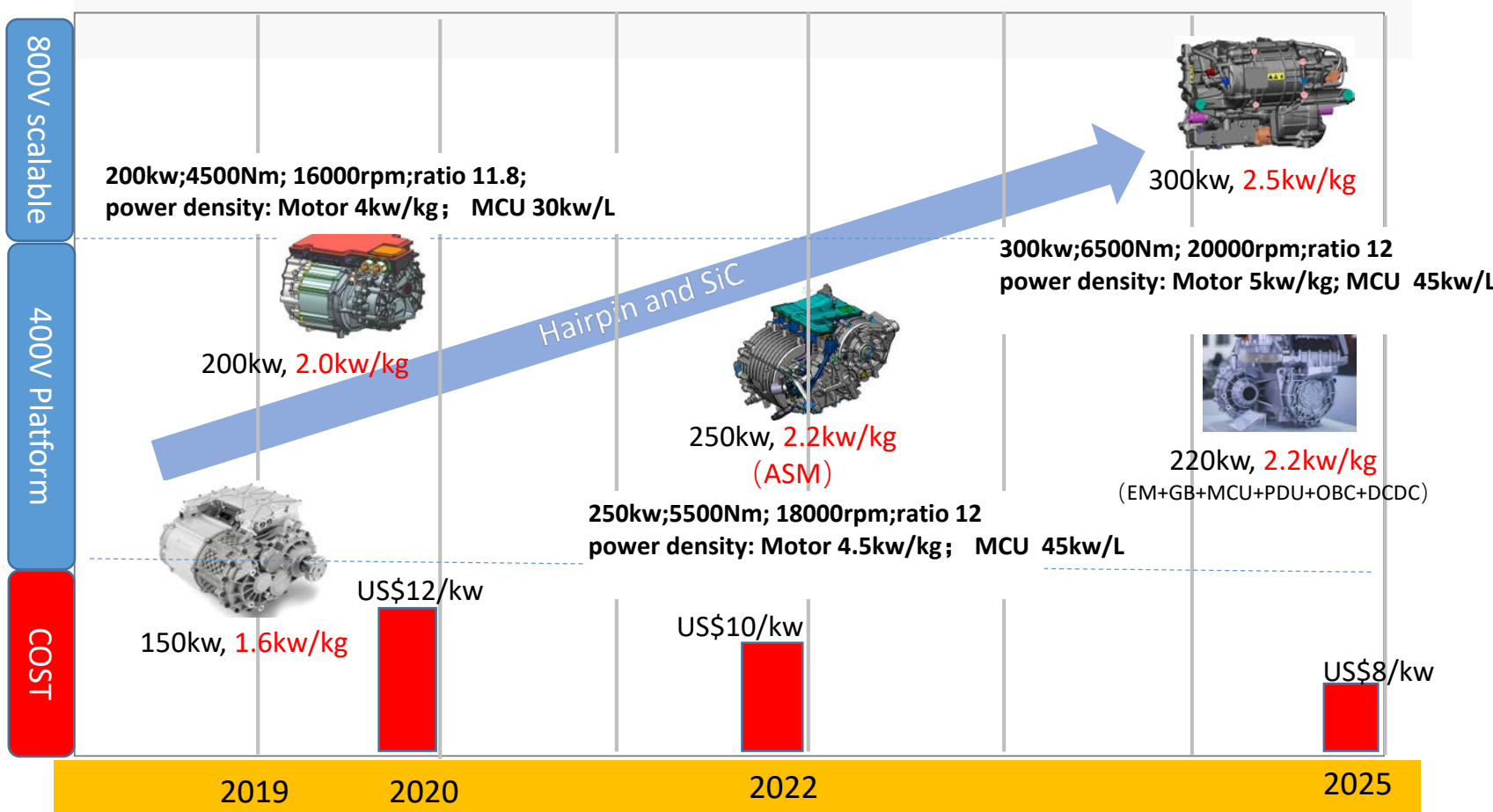
- Full aluminum underbody with SPR and FDS joining technologies
- Curb weight reduced by **50kg**

Curb Weight Comparison: C & D Class BEV SUV



Note: curb weight is for long range version

Confidential



- Higher System voltage
- Larger Power
- Higher power density
- Lower cost

Proprietary Technologies - Powertrain System



High Performance

Peak power of **170kW**, torque up to **315Nm**, max. speed of **16,000rpm**



Smaller & Lighter

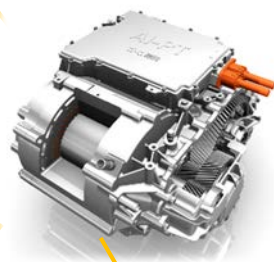
Integrated design and structure optimization allow **weight reduction of 10%**



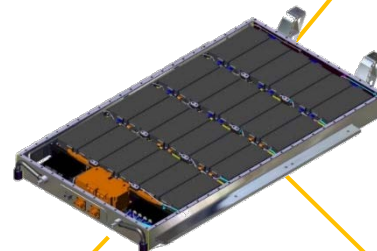
Better NVH Performance

Better noise, vibration and harshness (NVH) performance with **noise reduction up to 10%** compared to similar products

Highly integrated Powertrain System AIPT (from 2020)



Proprietary Battery Pack AIBP (installed)



High Energy Density

Leading energy density up to **181wh/kg**



Sandwich Structure

Sandwich structure design and high energy density for **better performance and safety**



Smart BMS

Battery monitor & analysis, Battery safety management, energy control management, battery information management


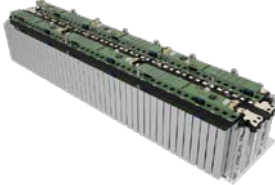
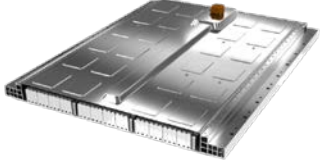


Confidential

Each vehicle with an electrified powertrain has different requirements that determine the development of the battery



KEY REQUIREMENTS PER BATTERY TYPE

	48 V	(P)HEV	BEV
			
High power density (pack level)	Up to 30 kW (30 C)	Up to 200 kW (10C for PHEV 100 C for HEV)	Up to 600 kW (6 C)
High energy density (pack level)	-	-	> 200 Wh / kg
Fast charging	-	80% in 20 min (<50 kW sufficient)	80% in <20 min (up to 350 kW)
Minimum cost	< 300 €/ kWh	< 160 €/ kWh	< 100 €/ kWh
Modularity & scalability	Tier-1 part Standard housing	Tailored design	Standard Modules & Customized housing

Source: FEV

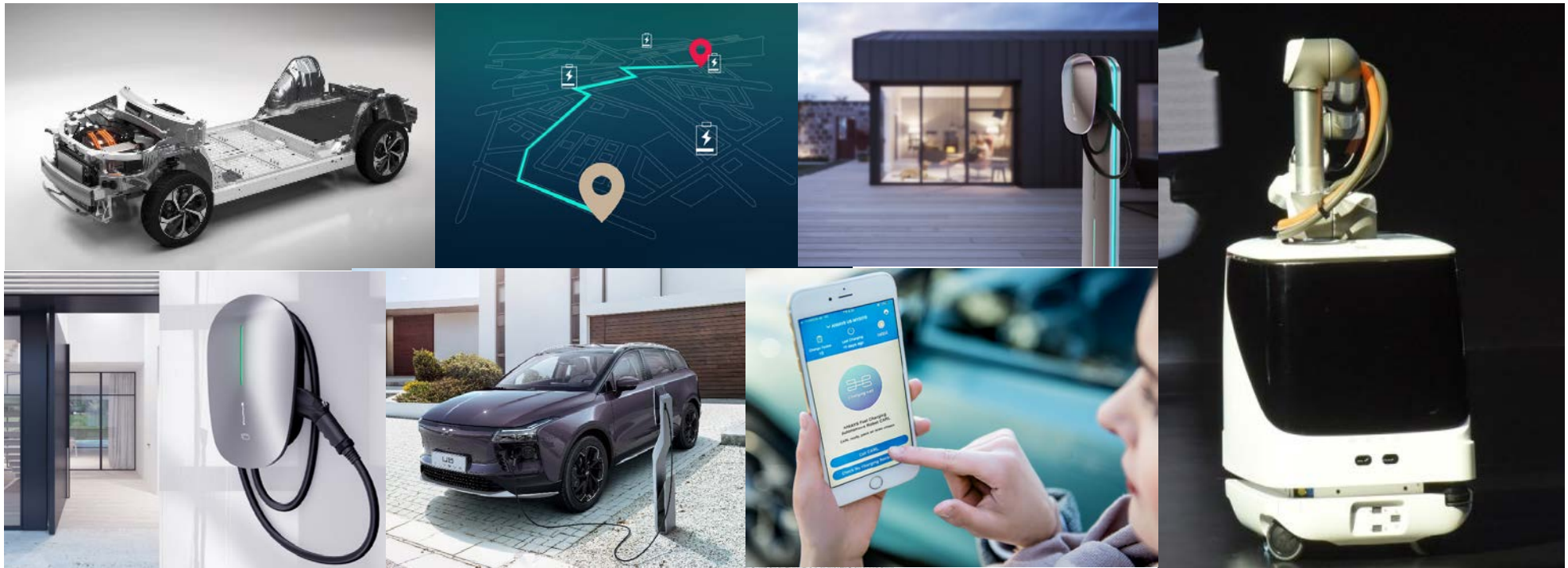
Worry-free Charging Solution – use the car like the phone



More than 503km(NEDC) mileage provide the worry-free driving

For charging, provide wall box for home charging, which support remote charging reservation on APP;

In some parking cluster area such as airport, hard to find enough charge station, charging robots will fill that gap.



Three Revolutions: 3R

- Energy Revolution
- Information Revolution
- Mobility Revolution

Four Networks: 4N

- Energy Network
- Information Network
- Transportation Network
- Humanity Network

Four Flows: 4F

- Energy Flow
- Information Flow
- Material Flow
- Value Flow

Three Revolutions and Four Integrations

❖ Through the integration of the **four networks**



Energy Network



Information Network



Transportation Network



Humanities Network

❖ And the integration **four flows**

- Energy Flow
- Information Flow
- Material Flow
- Value Flow

To link Energy Revolution, Information Revolution, and Mobility Revolution to gain the largest effect.

Integrating Philosophy, Science and Engineering.



- ❑ Philosophy and **patterns of energy integration**
- ❑ **What are 4 networks with 4 flows**
- ❑ **Features and benefits of 4N4F**
- ❑ **Vision of integration with 4N4F**

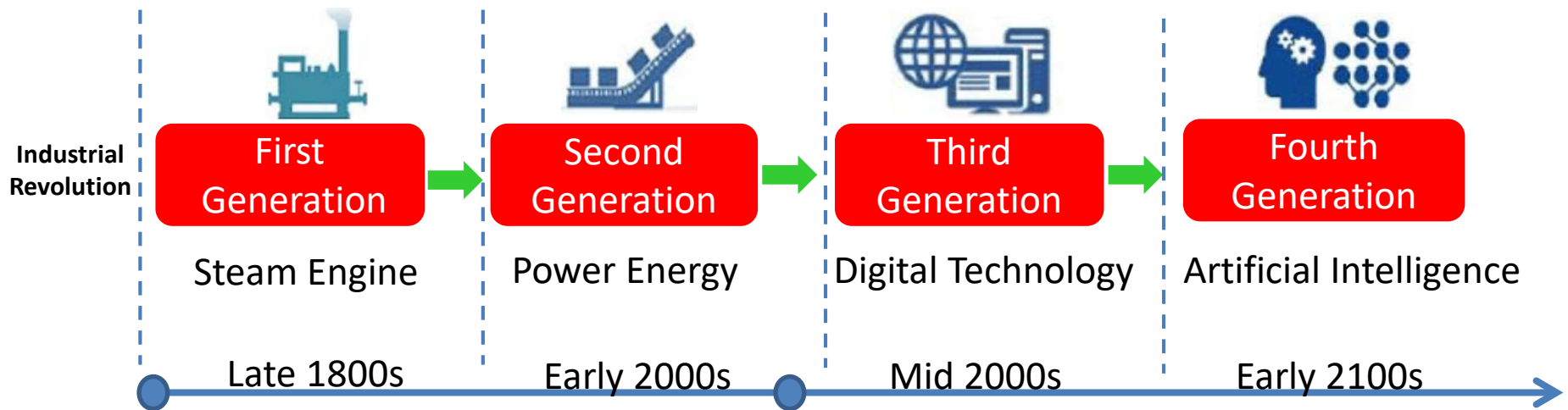
The Philosophy, Science and Engineering of

the integrations of 4 Nets and 4 Flows

- ❖ **To philosophy** of a holistic thinking - Whole is greater than the sum of each individual; Economic foundation interacts with superstructure.
- ❖ **To science theory** - It explored the fundamental relationship among energy, information and human behavior.
- ❖ **To engineering** - It combined the energy tech and information tech through a smart energy operating system already developed, with energy tech combined with cloud tech, edge computation, artificial intelligence, big data tech, to achieve value-added results.



AI's role as Human in 4th revolution



Energy & Information in the Nature

<p>Energy/Materials</p> <p><u>Einstein's Equation</u></p> <p>$E = MC^2$</p> <p>Energy E: mass M multiplied by square of the light velocity C²</p>	<p>Entropy/Information</p> <p><u>Shannon's Equation</u></p> <p>$I = - \sum P \log P$</p> <p>Information I: phenomenon occurring with the probability 1/2^N</p>
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Order $\xrightarrow{\text{time flow}}$ Disorder

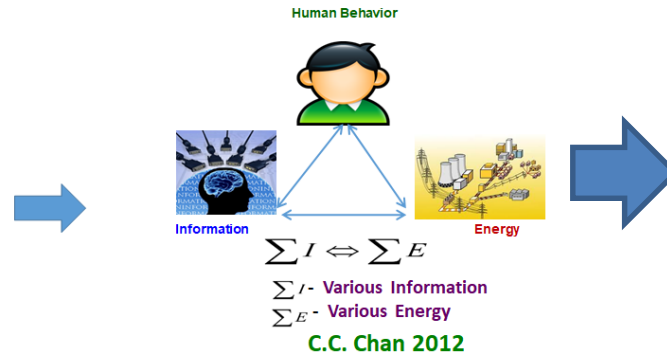
Systems Retention Time (t)

$t = \tau \exp(E/kT)$

$\tau = 10^{13} \sim 10^{14}$ by Schrödinger

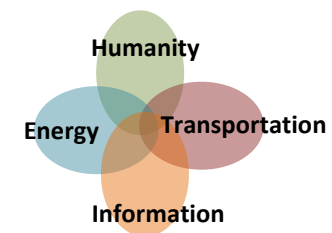
Boltzmann Constant: k, Abs. Temperature: T

Kozumi H., "Introduction to New Science of Humanity: Bridging & Fusion between the Theories on Materials & Information", J. Seizon & Life Sci. (2008)

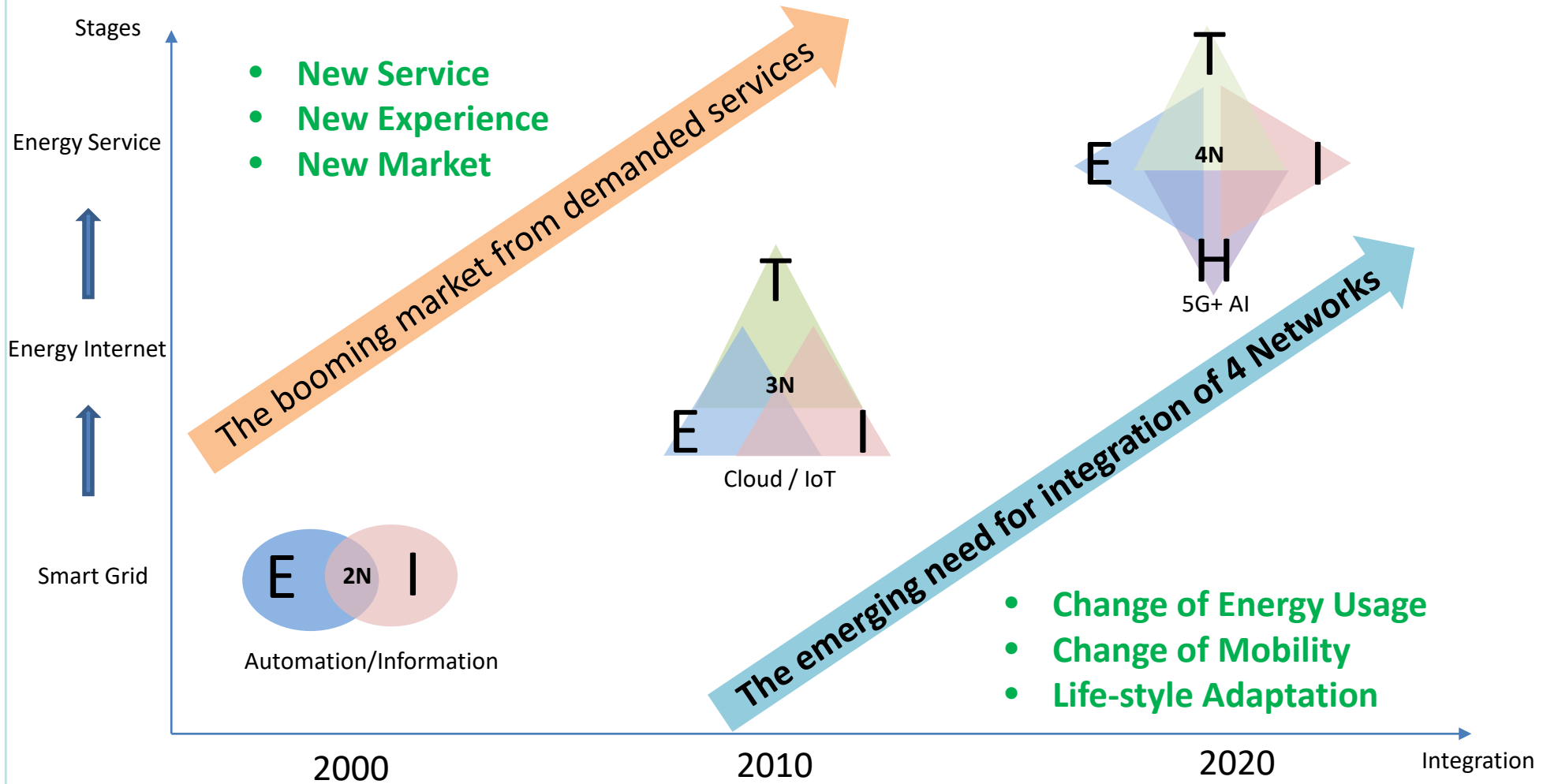


- 5G + AI has changed the interaction between **Technology & Human**
- Integration of key technologies with **humanity** is future trend
- **4 Network** will merge into one

- What is the correlation nature between **energy & information**
- How do **human behaviors** drive the correlation into intelligence



4N Trend of Energy Integration



E- Energy I- Information T- Transportation H- Humanity (behavior driven social network)

Patterns of Integration of 4N

Web Internet E-Commerce

- 1) Necessities
- 2) Individualized
- 3) High volume
- 4) Better deal



Food
Clothing

Human Behavior is the fundamental data source for E-commerce

Mobile Internet Sharing Economy

- 1) Sharing Concept
- 2) Platform enabled
- 3) Mobile trading
- 4) C2C ready

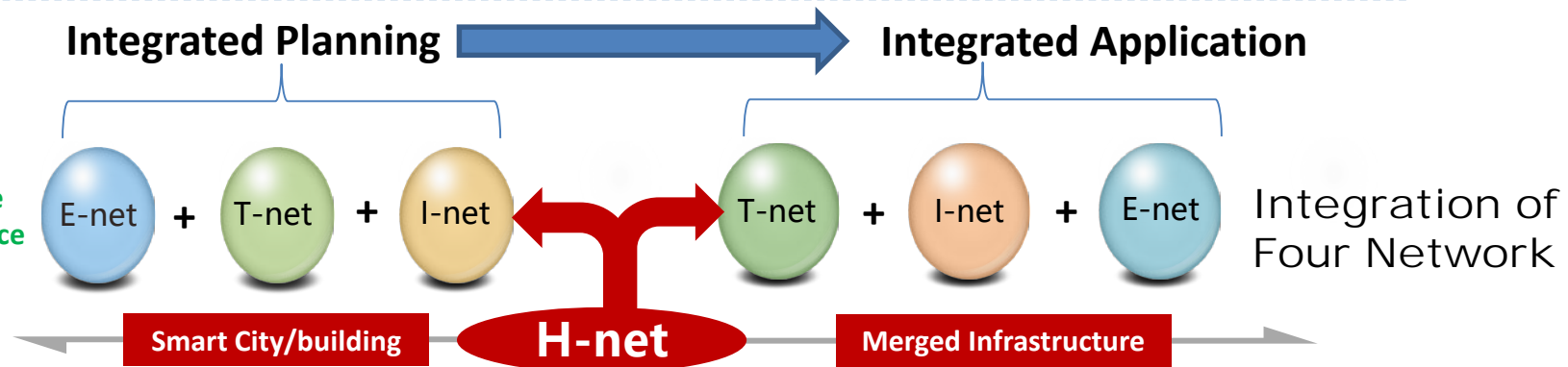


Housing
Transportation

Fragmented idle resources (**entropy**) is reorganized with added values (**exergy**)

5G+ IoT+AI X as a Service (XaaS)

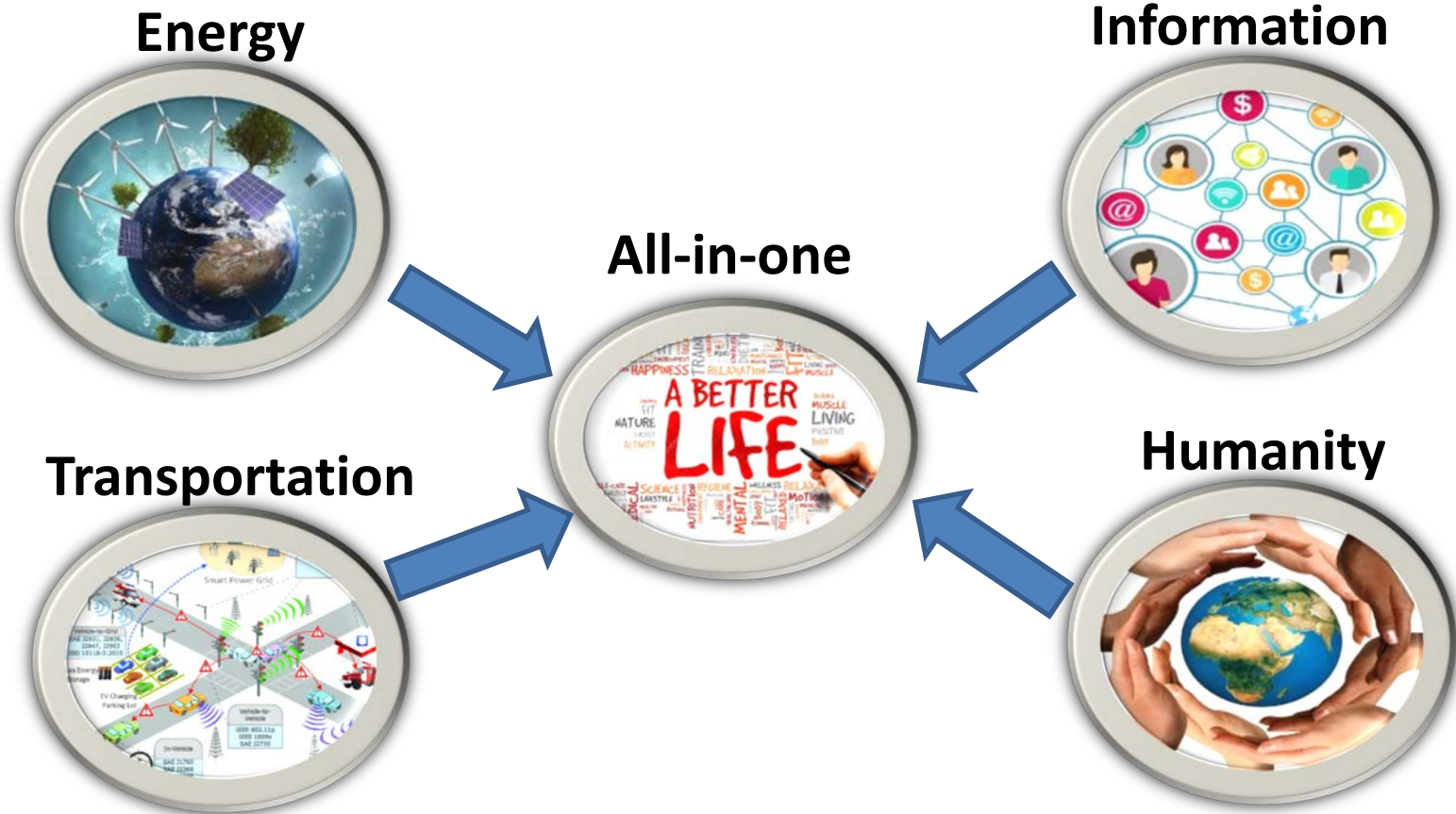
- 1) Energy as a Service
- 2) Mobility as a Service
- 2) Block-Chain Ready
- 3) Universal for all



Integration of Four Network is the key for XaaS

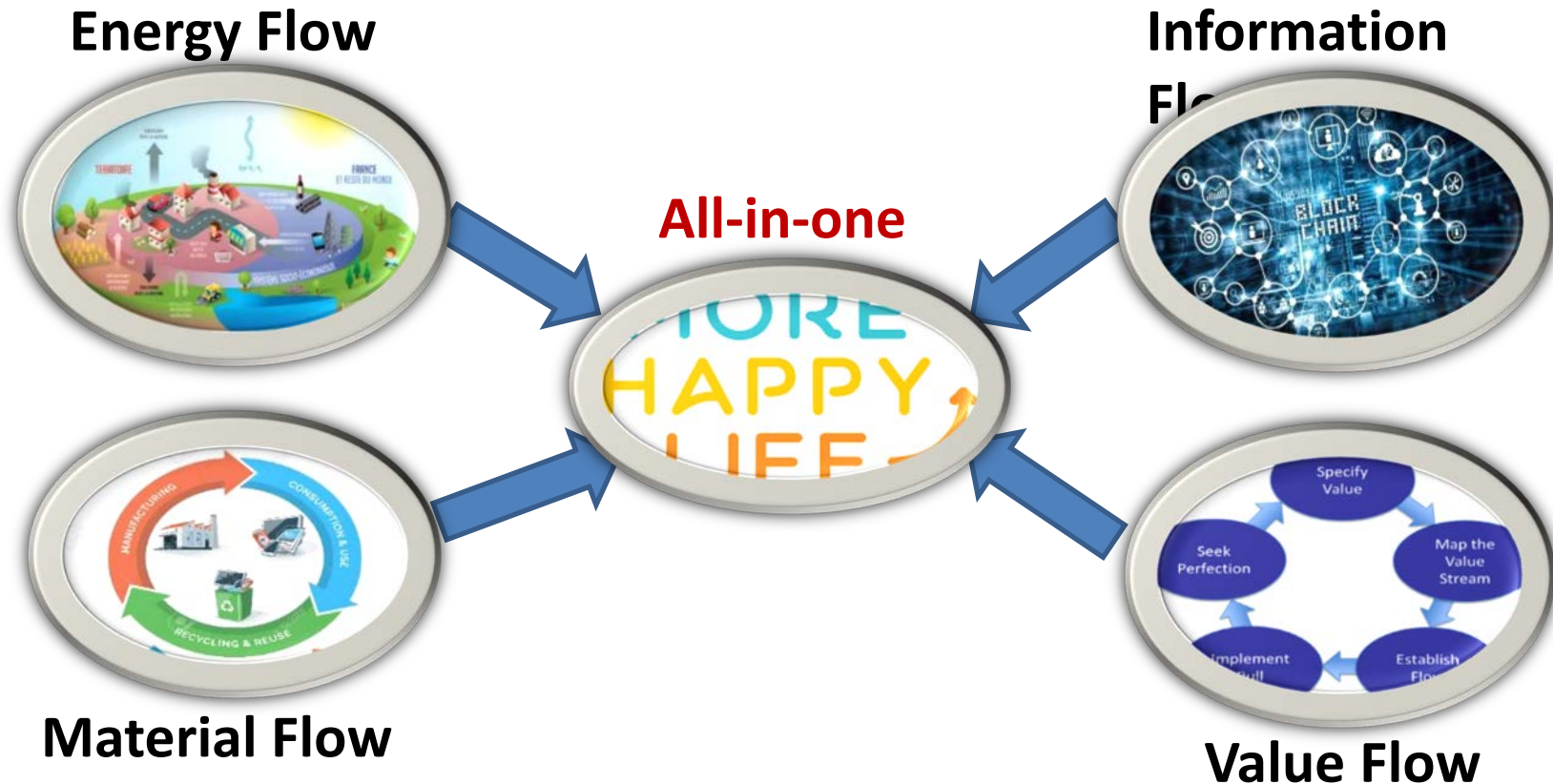
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Integration of Four Networks



**Life, Work, Travel, Low Carbon, Environment Friendly,
Comfortable, Convenient, Healthy, Intelligent, Happy.**

Integration of Four Flows



Solve four contradictions: contradiction of new energy and fossil energy, contradiction of primary energy and secondary energy, contradiction of centralized energy and distributed energy, contradiction of electrical energy and chemical energy. **Coupling optimization for different energy sources will make the waste energy become useful, meanwhile achieve the carbon balance.**

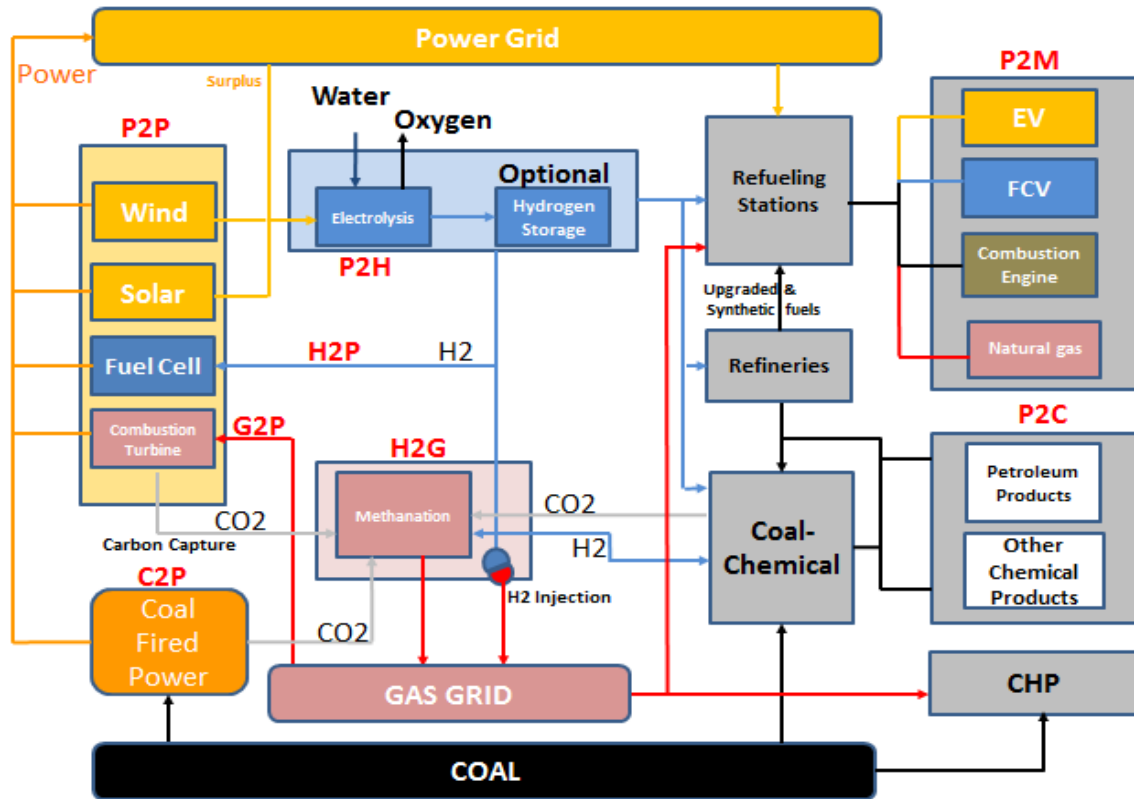
Intelligent energy driven by 4N4F

4F Principle:
 Energy Flow
 Information Flow
 Material Flow
 Value Flow

- Use 4-Flow principle
- Overcome 4 key conflicts

Fossil / Renewable
 Centralized / Distributed
 Primary / Second
 Power / Chemical

Carbon Neutral
 Eco-system

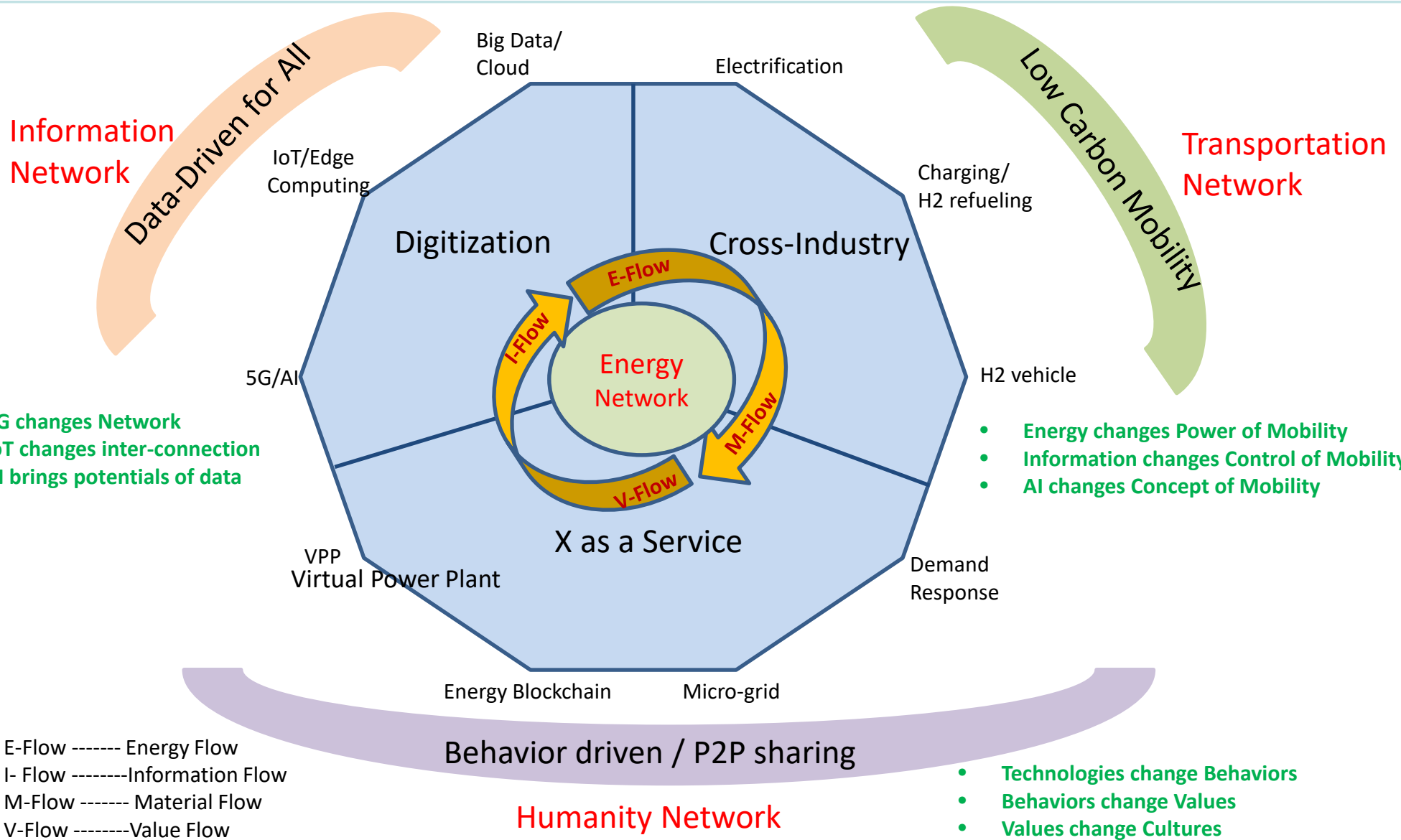


Energy Internet

Coupling of E-flow & M-flow

Carbon Neutral **Smart Energy** Eco-system

Interaction features between 4N & 4F



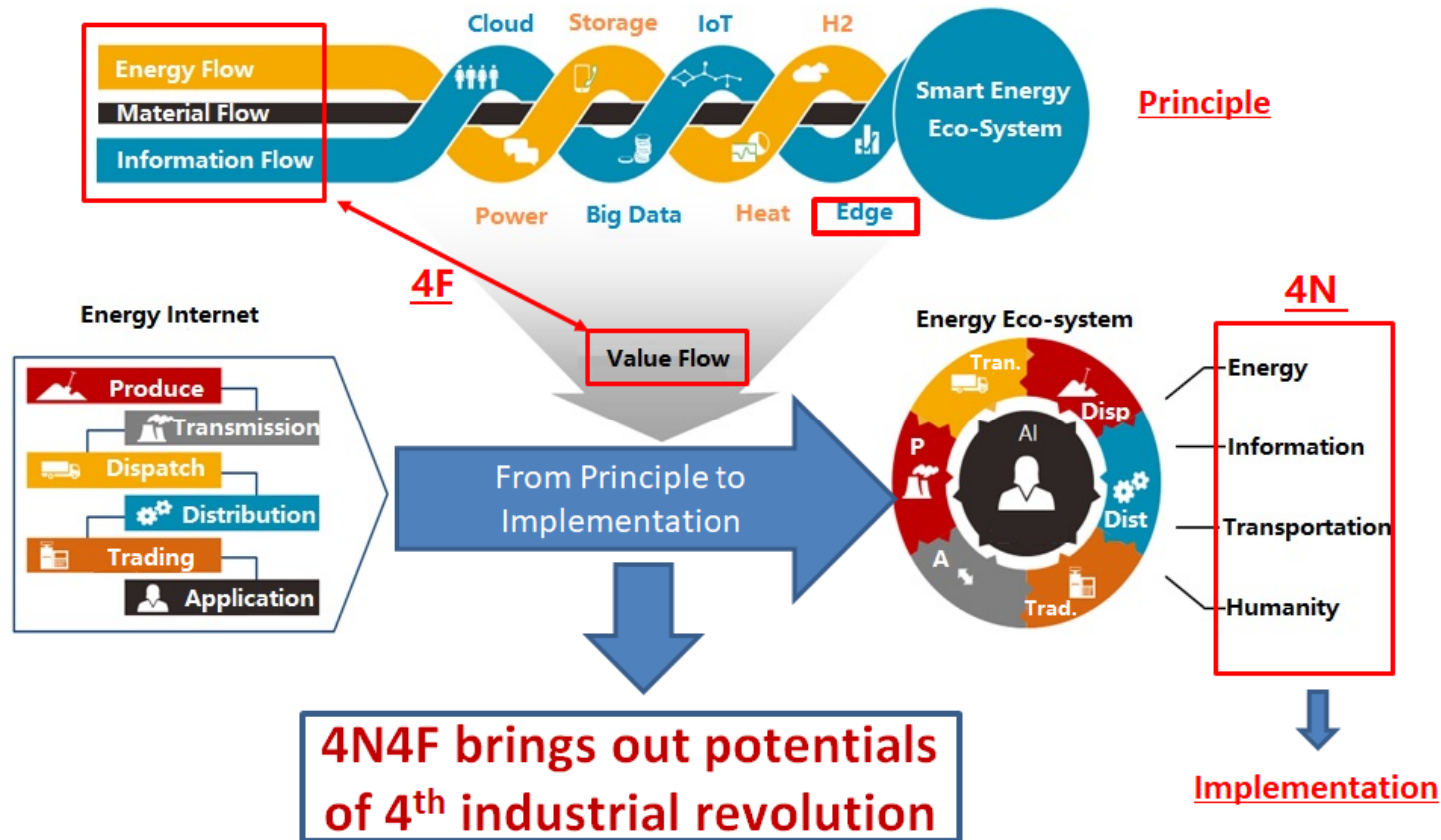
Five key elements among 4N4F



- **Data** ----- Un-structured(Internet) & structured (IoT)
- **Algorithm** ----- Physical Model & Data Model
- **Computing Power** ---- Cloud & Edge
- **Platform** ----- Operating System & App market
- **Openness** ----- Open Eco-system & Sharing under Block-chain

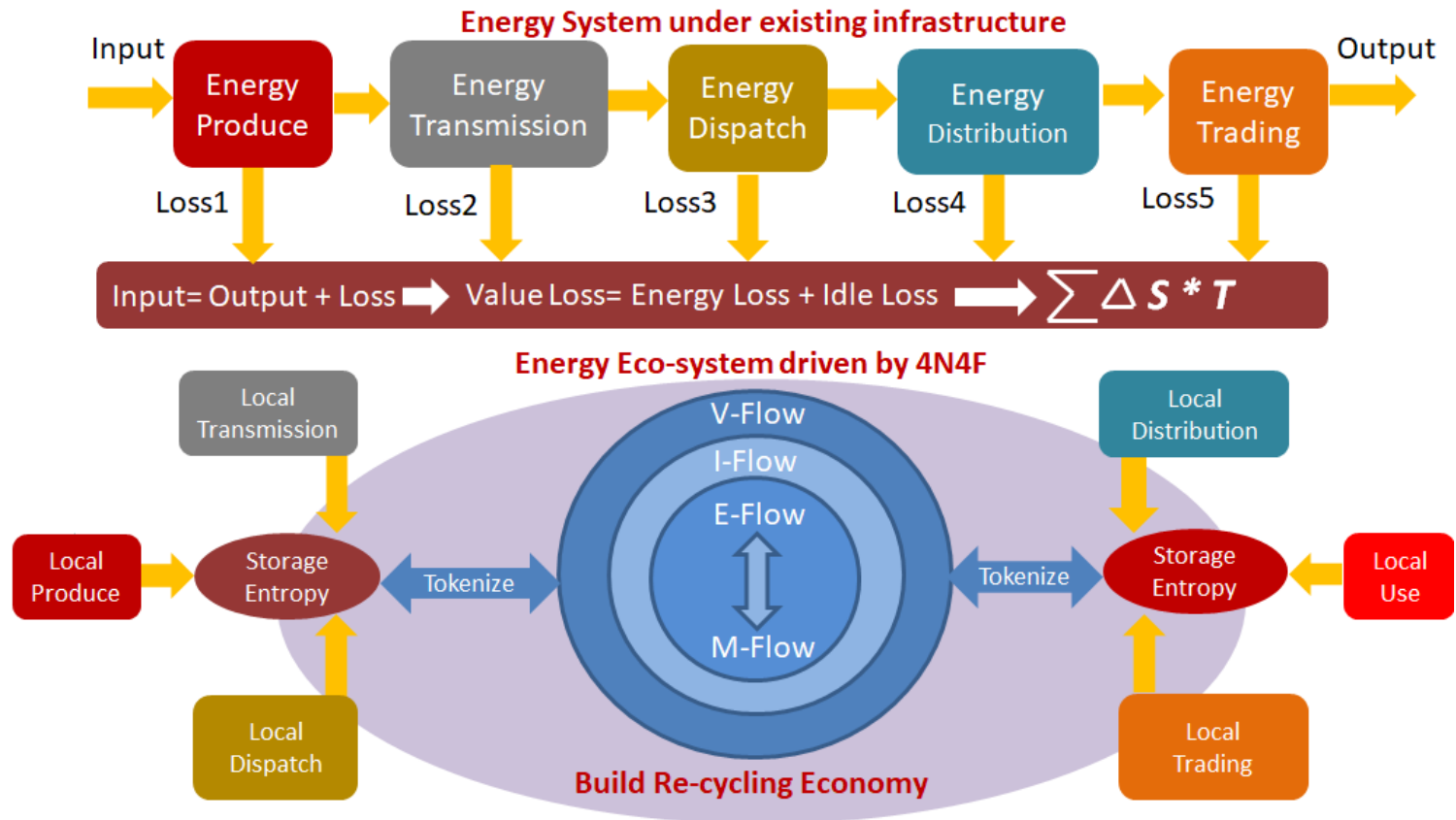
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4N4F for energy transition



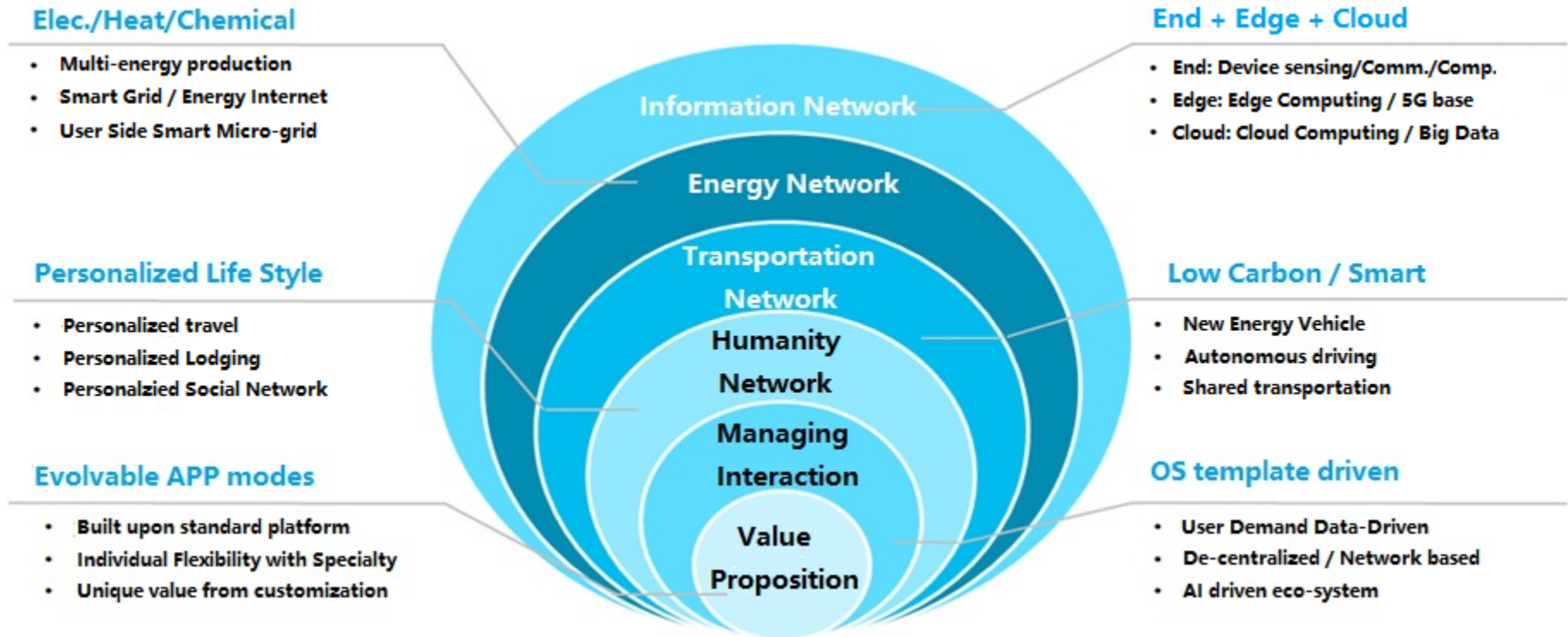
- 4-Flow integration is the principle of 4N4F across technology & economy
- 4-Network integration is the engineering implementation of 4N4F
- 4F4N is with global thinking so that it is better than added functions

Benefits of 4N4F



- Entropy Increase from Energy Loss can be stored for later use
- Entropy Increase from Values Loss can be re-directed for added value
- Both scenarios can be tokenized for trading under P2P mechanism

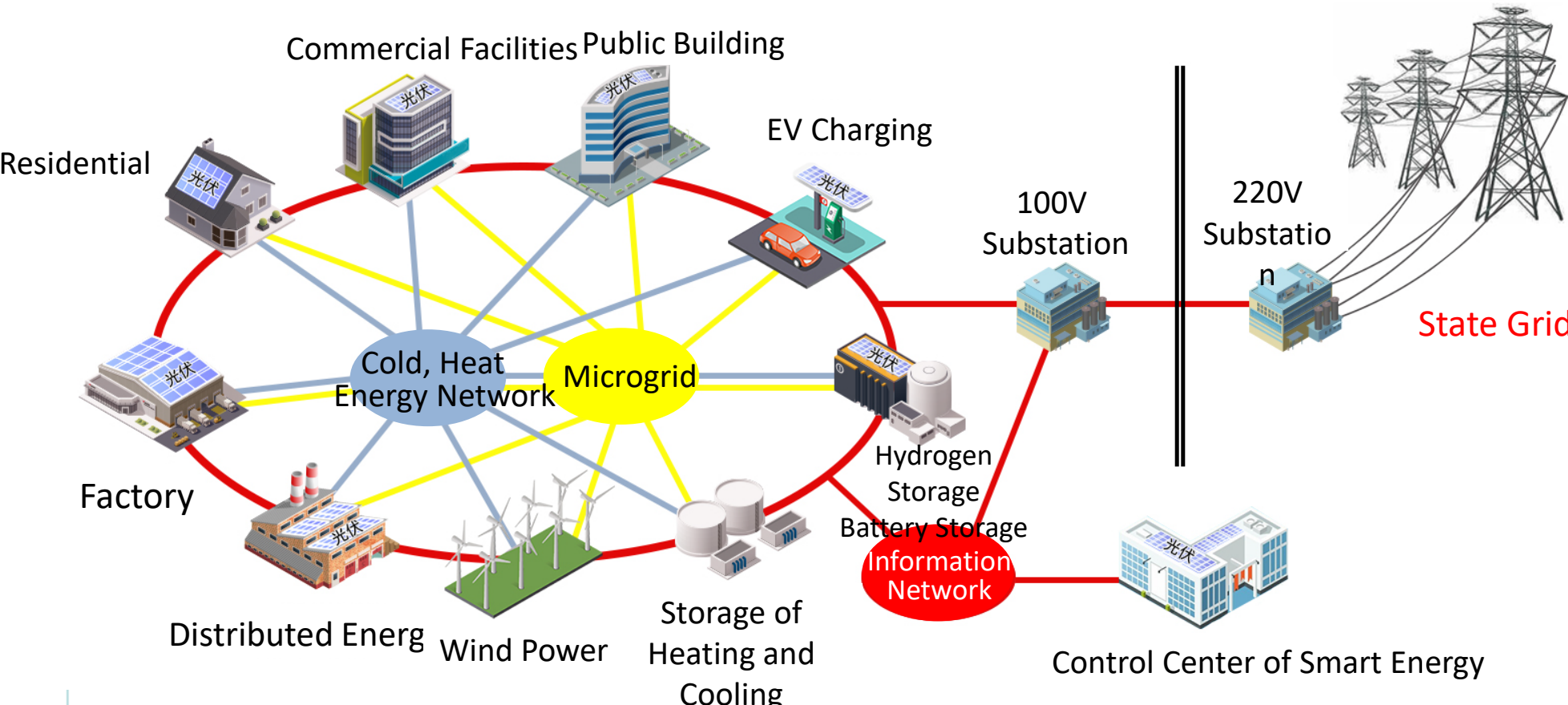
Evolution Layer of 4N4F



- Meet Personalized need with service accuracy
- Build data analytics from user's own experience
- Promote culture of shared economy for customers
- Study humanity pattern for better energy service

Key Driver: Big Data Profile of participants created from **personalized footprint**

Carrier and Network of 4N4F

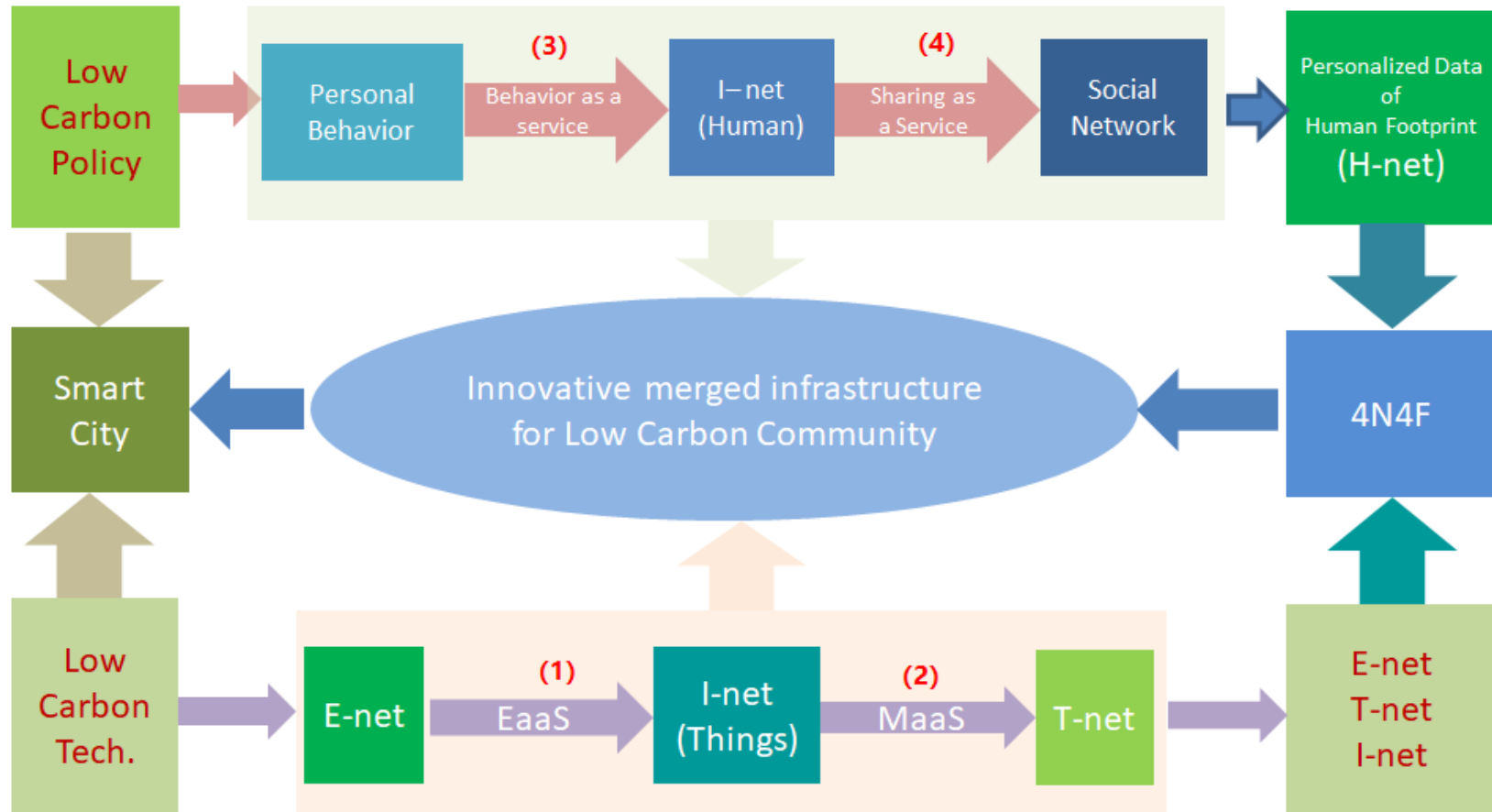


Control method: $ds \leq 0$ Strategy: Entropy minimization



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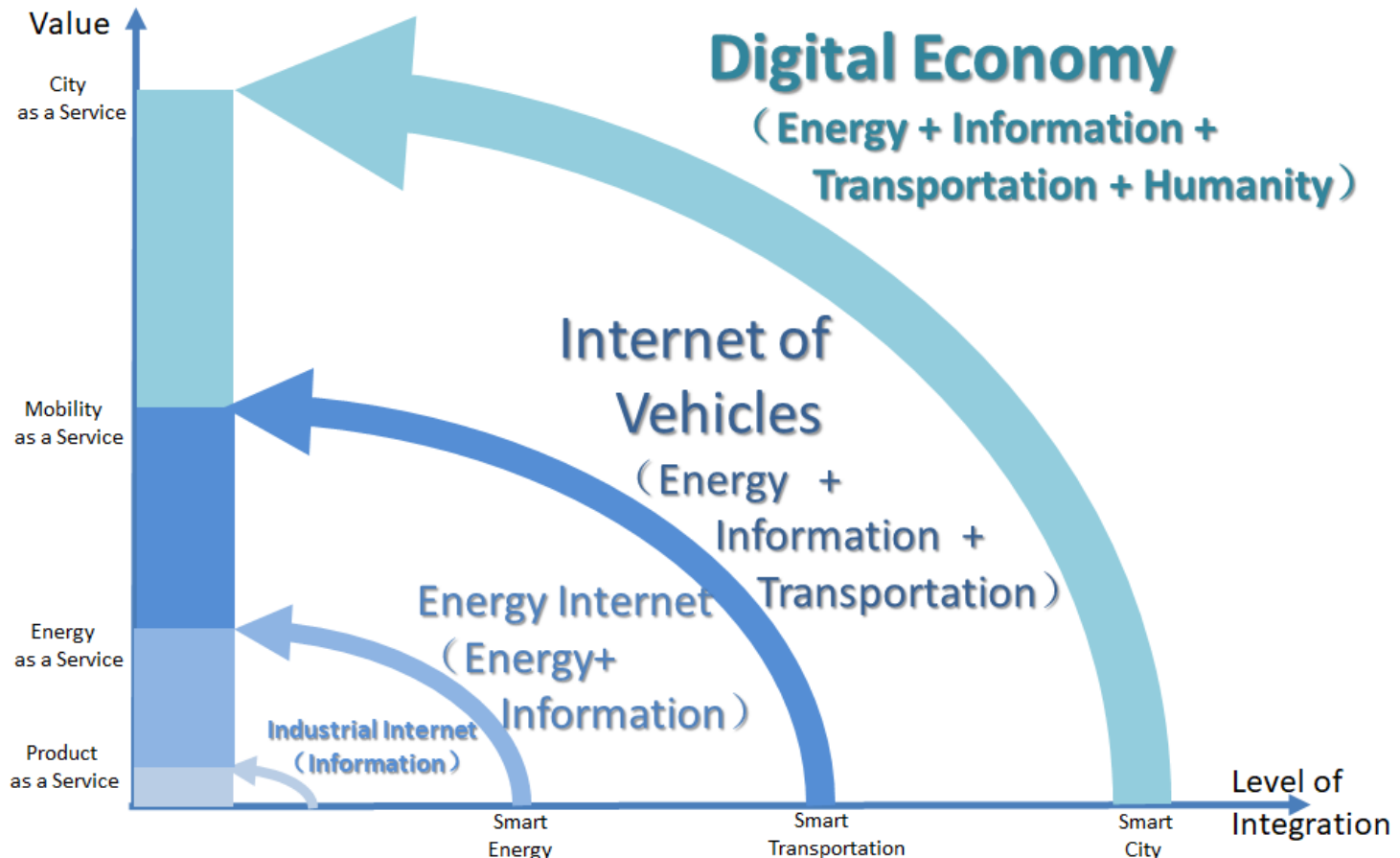
Vision of Smart City



4N4F brings out potentials for X as a Service for Smart City

- **Technology ---- Energy as a Service & Mobility as a Service**
- **Culture ----- Behavior as a Service & Sharing as a Service**

Vision of Digital Economy



- 4N4F is driving interaction between AI enabled technology with Human**
- 4N4F integrate Energy & Transportation with AI into human life
 - 4N4F enable culturization of AI-ready society towards digital economy



陈清泉院士科创中心

C.C.Chan Academician Science
& Technology Innovation Center

Inspiration

Imagination

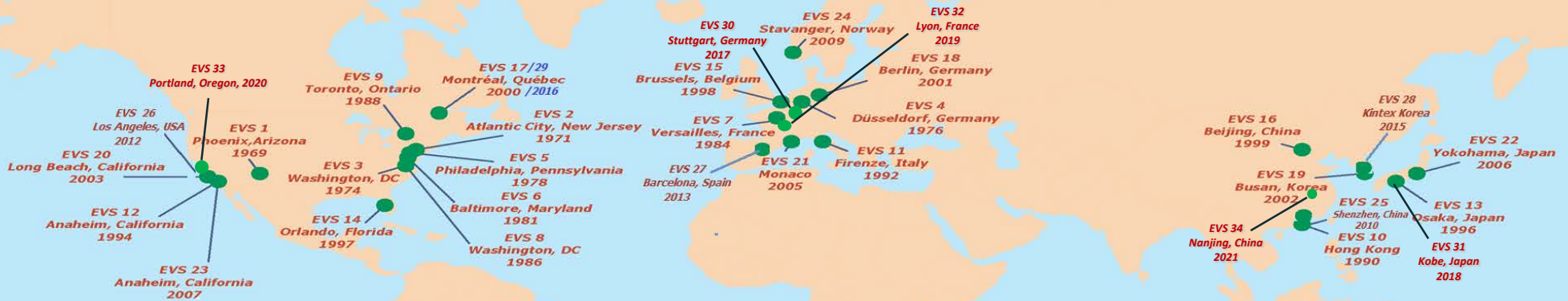
Innovation

Integration

Implementation

Investment

EVS 34 JUNE 2021, NANJING, CHINA



15 EVS



10 EVS



9 EVS

The World of
EVS

EVS Series – The World Longest & Largest Gathering of Electric Vehicles Community



Electric Vehicle Association of Asia Pacific



Towards Intelligent E-Mobility
NANJING, CHINA
June 25th-28th, 2021

The 34th World Electric Vehicle Symposium & Exhibition

Theme: Towards Intelligent E-Mobility

Venue: Air-hub Exhibition & Event Town, Nanjing, China

Date: 25 -28, June 2021



经济总量全国第六
6th largest economy, Approaching China
六朝古都
Ancient capital of six dynasties
中国历史文化名城
Chinese historical and cultural city
年旅游入境1.34亿人次
134 million tourists per year served
全国重要教育基地
Important educational base in China



会展酒店
Exhibition Hotel

会议中心
Convention Center

博览中心
Expo Center

会议室
Conference Room



1760m²
总面积
Total Area

宴会厅
The Banquet Area of
Conference Room



餐饮配套
Catering



1500m²
总餐厅面积
Total Area

楼层	1F	2F	3F	4F
面积	200	700	100	5



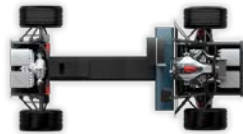
咖啡厅
Coffee Shop



the Topics:

A Electric vehicle and transportation system

Passenger cars, including pure electric, hybrid, plug-in hybrid and fuel cells;
 Commercial vehicles, including pure electric, hybrid, plug-in hybrid and fuel cells;
 Small cars, including electric two- and three-wheeled cars;
 Public transportation, including buses and railways;
 Shared and autonomous transportation applications;
 Other vehicle technologies and applications, such as flying cars.



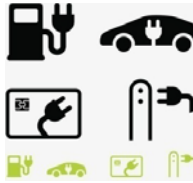
B Power battery and fuel cell

High-performance batteries, capacitors and other energy storage components and energy management systems;
 Fuel cell and its system.



C Electric drive technology

Motor design for EV application, multi-physics simulation and digital twin technology;
 Novel EV motors topology for EV application;
 Power electronic device packaging and drive technology, including Si-based IGBTs and SiC MOSFETs;
 High temperature passive devices and their packaging;
 Power electronics topology and control for EV application;
 Intelligent motor control and health status management;
 Electromagnetic compatibility technology;
 Test methods and test techniques;
 Powertrain Integration.



D Charging/fueling infrastructure

Smart charging and V2G;
 Hydrogen fueling infrastructure;
 Standardization and interoperability of charging/fueling;
 Wireless charging infrastructure (static and dynamic);
 Case study on infrastructure deployment;
 Fees, standardization and services;
 Smart grid, micro-grid, charging network and smart home.



E Connection of power grid, power supply and vehicle

Demand management;
 Automotive batteries in energy storage;
 Grid implications of DC fast charging and ultra-high speed charging;
 Advancements in V2G, V2X and connectivity;
 Utilities project deployment case study;
 Public policies and strategies for electric vehicle charging.



F Market

Domestic and global market development strategy;
 Consumer needs, education, training, demonstration and motivation analysis;
 City market case and demonstration.



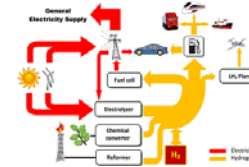
G Policy

National and international electric vehicle development policies;
 National initiatives;
 Local and regional partnerships;
 Case study of government project deployment;
 Standards and regulations.



H Environmental, Energy and Social Assessment

Environmental benefits of electric vehicles;
 Supply chain analysis: materials, manufacturing, recycling and reuse;
 Energy security;
 Analysis of the social impact of electric vehicles;
 Hydrogen and sustainable energy;
 Safety.



I Emerging Technologies

Smart Connected EV Outlook ;
 Integration of Transportation Network, Energy Network, Information Network and Humanities Network.





Electric Vehicle Association of Asia Pacific



Towards Intelligent E-Mobility

NANJING, CHINA

June 25th-28th, 2021

the Important Dates:

Call for Abstract Opens: 27 Aug 2020

Deadline for Abstract Submission: 9 Nov 2020

Abstract Acceptance and attendance Notification: 15 Dec 2020

Abstract Acceptance Registration and Payment Close: 15 Mar 2021

Deadline for Full Paper Submission: 10 Apr 2021

Website: www.evs34.org.cn



Nanjing brocade



Creating enriched and comfortable car utilization experiences for customers by providing a range of services that address various driving situations

Optimizing energy use for the entire society and realizing stress-free and environmentally considerate living with a high quality of life

HZVeneli
Support of energy-efficient lifestyle



SAFETY

Toward the realization of Toyota's ultimate goal: zero casualties from traffic accidents

CONVENIENCE

Building a stress-free traffic environment where everyone can move around smoothly, exactly as they wish