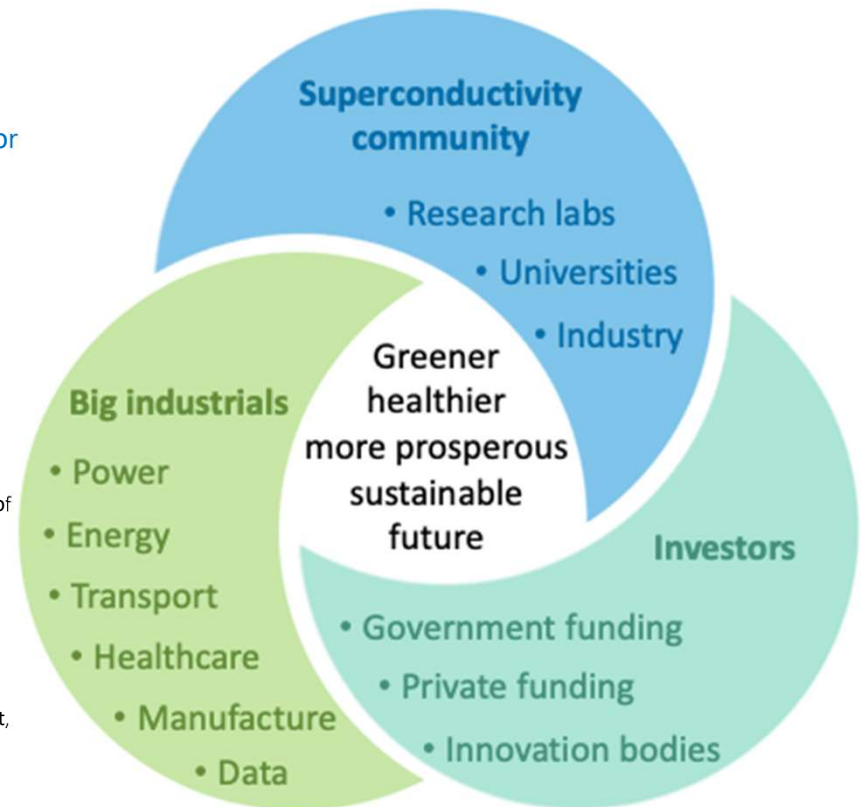


Global Superconductivity Alliance for the Future Initiative

Need new thinking on the role of Superconductivity in our future

Superconductivity Global Alliance (ScGA) initiative

- Need new thinking on the role of Superconductivity in our future through a public-private partnership between :
 - A. The Superconducting Science community (Research Labs, Universities, and Industry).
 - B. Government Funding, private funding and Innovation bodies and National Laboratories bodies.
 - C. Big industrials (Power, Energy, Transport, Manufacturing, Health care, Life, and Physical Sciences
- We wish to catalyse this process and fast-track development through an “Initiative for Superconductivity for the Future” towards a greener, healthier, prosperous, and sustainable future.
- This ambitious initiative will require setting up formally a “Superconductivity Global Alliance (ScGA) for the Future” to facilitate
 - Delivery on the promise from superconductivity
 - Guide the development of strategic roadmaps and white paper
 - Identify grand challenges where SC can make an impact
 - Develop national initiative at grand scale and establish funds from public and private bodies to support the delivery on grand challenges
 - Development of consortia on agreed grand challenges.
 - Facilitate summit meeting to adopt options for public and private partnerships on funding and delivery of future commercial products
- Hold a **Superconductivity Summit** at senior executive and decision-making level with the following objectives:
 - Develop and agree on a **strategic roadmap** for superconducting solutions and commercial products, including a concise list of **grand challenges** where SC can make a step change and significant impact on commercial products . This will include:
 1. Define and establish partnerships between the SC Science and industrial community, Government, Private Funding, and Big Industries.
 2. Establish a mechanism for sustaining the development of commercial SC solutions and products linked to the 17 SDGs.
 3. Adopt options for public and private partnerships on funding and delivery of future SC solutions.



The Vision -Superconducting Global Alliance (ScGA)

Superconductivity has already enabled major advances and capabilities such as MRI, NMR, high magnetic field research and high energy physics accelerators which otherwise would not be possible. In the future, superconductivity will provide a means towards zero emission targets, for example by enabling fusion power, expanding usage of wind power, and facilitating zero-emission transportation, as well as enabling new technologies such as superconducting classical and quantum computing, water purification, new medical diagnosis and therapy tools, and new scientific breakthrough



**Superconductivity from the Frontiers end to
Mainstream technologies**



SUSTAINABLE DEVELOPMENT GOALS

Superconductivity
Global Alliance
ScGA

1 NO POVERTY

2 ZERO HUNGER

3 GOOD HEALTH AND WELL-BEING

4 QUALITY EDUCATION

5 GENDER EQUALITY

6 CLEAN WATER AND SANITATION

7 AFFORDABLE AND CLEAN ENERGY

8 DECENT WORK AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

10 REDUCED INEQUALITIES

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

15 LIFE ON LAND




















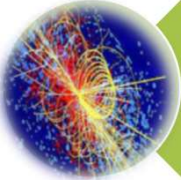




16 PEACE, JUSTICE AND STRONG INSTITUTIONS

17 PARTNERSHIPS FOR THE GOALS



Superconducting Technologies and the UN's Sustainable Development Goals (SDG)

Superconductivity
Global Alliance
ScGA

ScGA Outcome	Core SDG	Additional SDG			
Net Zero emission, climate ready economy and community					 SMART Electronics & Computing Markets
Healthy, resilient and biodiverse environment					 SMART Industry, Energy Power, & Transport Markets
Safe, sustainable and productive water resources					 SMART Healthcare Markets
Reliable, sustainable and affordable energy services					 SMART Science Markets
Reduced impact of major bushfires, flooding, emergencies on the environment					

Innovation in Superconducting applications

Superconductivity
Global Alliance
ScGA

Research & Medical Magnets

- Medical- MRI, NMR , Proton Beam Therapy
- Basic Research- Physical sciences RM
- HEP- Beamlines/Accelerates/ Detectors
- Fusion – LTS & HTS
 - UHF >25T (LTS+HTS)
 - 5T-20T >20K (HTS)
 - Bench Top Applications (LTS+HTS)
 - 0.5-5T >20K-77K

Industrial applications

- Non-destructive Testing
- Inductive Heaters
- Magnetic separation
- Crystal Growth

Microelectronics

- Quantum Computing
- Faster Computers
- Power Electronics

Superconducting (SC) Applications

Power & Energy Applications

- Fault Current Limiters (FCL)
- Transmission Cables
- SC Magnet Energy Storage
- Generators (Wind/Utility)
- Transformers
- Motors
- Synchronous Condensers

Communications

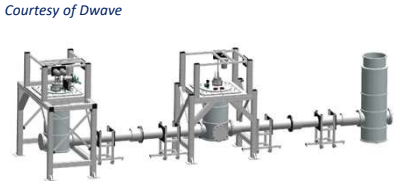
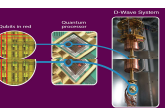
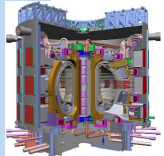
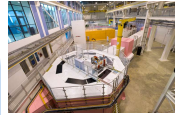
- Satellite channels
- Wireless devices
- Antennae

Defence & Security

- Detectors/Sensors
- Rail gun
- Degaussing cables

Transportation

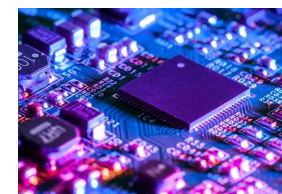
- Electric planes
- Maglev
- Ships
- Rocket propulsion



QMICS Cryolink @ 35 mK for SC cable
Courtesy of Oxford Instruments and WMI

Expected Emerging SC markets by 2035

- Fusion
- Electric planes
- SC magnetic storage
- Renewables
- Compact and portable HF magnet systems for Physical and Life Sciences
- SC quantum computing
- Superconducting Electronics
- Medical diagnostics and therapy
- Industrial
- Transport

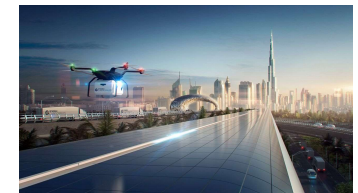
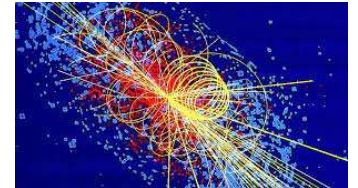


Why ScGA initiative for the Future

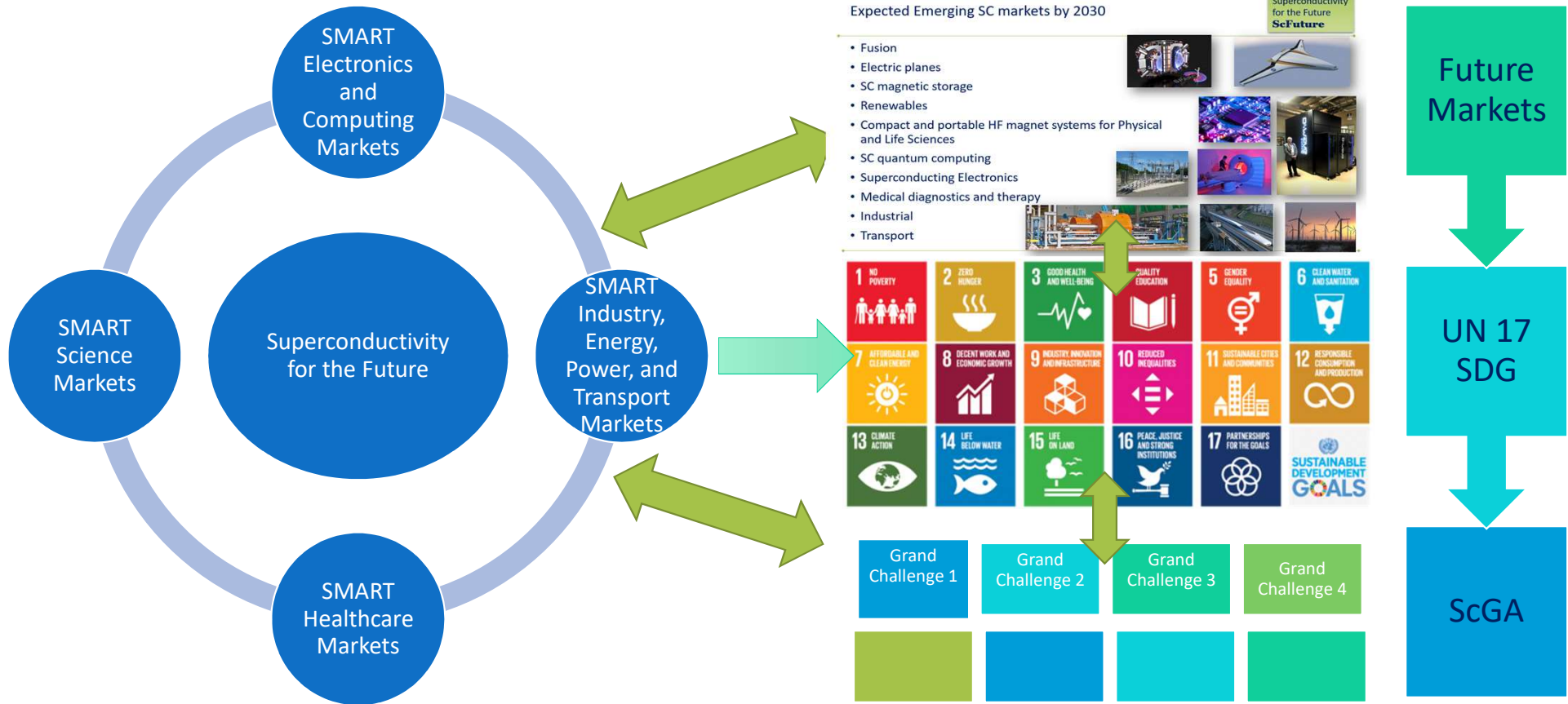
- Superconductivity enable smart materials leading to diverse and transformative economic impact:
 - Energy, Medical, Transportation, Industry, High Energy Physics, Security
- Superconductivity will be one of the critical solutions to tackle environmental challenges :
 - 18 million tons reduction in CO2 emissions/yr.
- Superconductivity Growth Drivers:
 - Growth in Energy industry - Renewables
 - Growth in Energy industry - Fusion
 - Robust growth in medical industry
 - Robust product demand in electronic and Computing industry
 - Strong superconducting materials demand from R&D industry (HEP, Physical Sciences & materials discovery)
- Large market potential:
 - ~ \$10 B industry now (dominated by LTS);
 - Forecast to ~ \$20 B by 2035 – without ScGA
 - Adoption of the ScGA Roadmap will lead to an estimated growth in 2035 > 2-3 times of estimated 2035 market

Why now

- Superconductivity already demonstrated enabling state of the art solutions otherwise not possible
 - **SMART Life Science** (MRI, NMR) and **SMART Physical Science** (Physical Sciences, HEP)
- Environmental challenge and the Zero Carbon targets require new thinking and innovations to provide sustainable environmental solutions
 - Superconductivity directly impact power generation and management and provide efficient solution towards zero carbon emissions leading and enabling **SMART Industrial, Power and Transport solutions**
- Demand for Energy will continue increasing
 - Superconductivity will be instrumental in enabling **SMART and secure sources of energy**
- Healthcare and quality of life for ALL will facilitate new diagnostics and treatments for variety of health conditions including Cancer, Parkinson disease, Covid-Pandemics, etc.
 - **SMART Healthcare**
- Big demand for powerful data management and computation
 - Superconductivity will facilitate new superconducting electronics and Quantum Computing - **SMART Electronics and Computing**














4 SMART Markets for the Future linked to Grand challenges























ScGA International Organising Committee (IOC)

Superconductivity
Global Alliance
ScGA



Member	Affiliation	Logo
Dr. Ziad Melhem	Oxford Quantum Solutions Ltd/UK	
Dr. Joe Minervini	Novum-Industria, MIT, IEEE-CSC/USA	 
Dr. Luca Bottura	CERN, ESAS/France/Switzerland	
Prof. Susannah Speller	University of Oxford/UK	
Prof. Lance Cooley	Florida State University, IEEE-CSC/USA	
Prof. Venkat Selvamanickam	University of Houston/USA	
Prof. Stephen Gourlay	Fermi National Accelerator Laboratory, USA	
Dr. Anna Herr	Interuniversity Microelectronics Centre (IMEC)	
Dr. Kathleen Amm	Brookhaven National laboratory, IEEE-CSC	
Dr Kazuhiko Hayashi	ISIS Chairman and CSSJ Executive Director	ISIS, 

ScGA Working Groups (WG) Convenors

Superconductivity
Global Alliance
ScGA

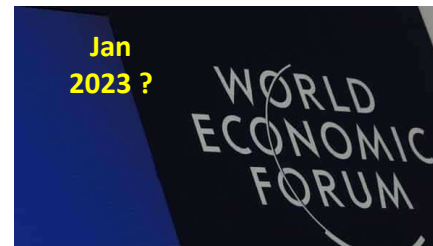
I. Applications				
1. SMART & Sustainable Industry, Energy, Power, and Transport				
1a. Fusion (WG1)	Prof. Chris Grovenor University of Oxford/UK 	Dr. Mitchell Neil ITER/EU 		
1b. Industry, Energy, Power (WG2)	Dr. Parizh, Michael GE Research/ US 	Prof. Sastry Pamidi Florida State Univ./US 	Dr. Mohammad Yazdani University of Glasgow/UK 	
1c. Transport (WG3)	Prof. Marco Breschi University of Bologna/Eu 	Dr. Loïc Quéval University of Paris/Eu 	Dr. Arno Godeke Independent Consultant	
2. SMART Healthcare (WG4)				
	Dr. Amm, Kathleen Brookhaven National Lab/US 	Dr. Joe Minervini Novum/MIT/US  		
3. SMART Electronics and quantum information processing (WG5)				
	Dr. D. Scott Holmes IEEE/US 	Prof. Giampiero Pepe ESAS/Eu 	Dr Anna Lees de Escobar Founder/CEO of Technology Vector Inc	
4. SMART Science discovery (WG6)				
a. HEP/Nuclear science	Dr. Luca Bottura CERN/Eu 	Dr Pierre Vedrine CEA/Eu  	Prof. Amalia Coldea University of Oxford/UK 	Dr. Mark Bird NHMFL/US 
b. HF research & Astrophysics (Dark Matter)				
II. Materials for the identified applications (WG7)				
	Prof. Susannah Speller University of Oxford/UK 	Prof. Selvamanickam, Venkat University of Houston/US 		
III. Communications & Funding (WG8)				
	Prof. Ziad Melhem Oxford Quantum Solutions/UK 			

ScGA Editorial Board (EB) members

Member	Affiliation	Logo
Dr. Joe Minervini	Novum-Industria, MIT, IEEE-CSC/USA	 
Prof. Susannah Speller	University of Oxford/UK	
Prof. Lance Cooley	University of Florida, IEEE-CSC/USA	
Prof. Stephen Gourlay	Fermi National Accelerator Laboratory, USA	
Dr. Cathy Foley	Australia's Chief Scientist, Australia	
Prof. Ziad Melhem	Oxford Quantum Solutions Ltd/UK	

- **Develop partnerships and alliances with Decision Makers/Funders and Big Industrials**

1. **White paper on grand challenges – Under review before launching in Sep**
2. **Strategic roadmap for 10 years directly linked with the SDGs including potential funding required Under review before launching in Sep**
3. **SCGA targets:**
 1. **Target 1-** Superconducting summit at senior level to facilitate the proposed partnership (2023)
 2. **Target 2-** Options for national and private funding of the proposed grand challenges (2024)
 3. **Target 3-** Develop consortia/partnerships between the SC Community, National and Private funding and Big industrials to address grand challenges (2024)
4. **Mechanisms for raising awareness of the Potential from Superconductivity**
 1. Aim to present the SC initiative at selected International forums, e.g.
 1. World economic forum – Davos (Jan 2024?)
 2. 2023 UN Climate Change Conference (UNFCCC COP 28) 30 November to 12 December 2023 – UAE
 3. COP29 (Nov 2024) ?
 4. Doha Forum (Mar 2024 ?)
 2. Establish regular communications channels
 3. Focused market research on grand challenges
5. **Establish a mechanism for sustaining the initiative**
 - Register the Superconductivity Global Alliance as a Non-profit organisation



ScGA Whitepapers (WPs)

- 7 White papers
 - WP1,2,3: SMART & Sustainable Industry, Energy, Power, and Transport
 - WP1:Fusion (WG1) (Prof. Chris Grovenor, Dr Neil Mitchell)
 - WP2: Industry, Energy, Power (WG2) (Dr. Parizh, Michael, Prof. Sastry Pamidi, Dr. Mohammad Yazdani Asrami)
 - WP3: Transport (WG3) (Prof. Marco Breschi, Dr. Loïc Quéval, Dr. Arno Godeke)
 - WP4: SMART Healthcare (WG4) (Dr. Amm, Kathleen, Dr. Joe Minervini)
 - WP5: SMART Electronics and quantum information processing (WG5) (Dr. D. Scott Holmes, Prof. Giampiero Pepe, Dr Anna Lees de Escobar)
 - WP6: SMART Science discovery (WG6) (Dr. Luca Bottura, Dr Pierre Vedrine, Prof. Amalia Coldea, Dr Mark Bird)
 - HEP/Nuclear science
 - HF research & Astrophysics (Dark Matter)
 - WP7: Materials for the identified applications (WG7) (Prof. Susannah Speller, Prof. Selvamanickam, Venkat)

ScGA focus meetings

- **ScGA special session at MT28 - France**
 - Keynote ScGA overview
 - Update on Healthcare, Fusion, Big Science, and Industry – Magnet Focus
 - Panel
 - IOC+Conveners to nominate representation for the updates and the panel attending the MT28 conf.
- **ScGA Plenary event EUCAS 2023 - Italy**
 - Keynote ScGA overview
 - Update on 4 SMART markets strategic roadmap and Shortlist ambitions/partnerships -
 - Panel
 - IOC+Conveners to nominate representation for the updates and the panel attending the MT28 conf.
- **Invited Plenary at ICSM 2023 – Turkey**
- **Update at LTSW by Joe Minervini – Florida, USA**
- **IOP+InnovateUK One day event (SC Community+Funders+Industrials) – London UK (Oct 2023 TBC)**
 - 1st Meeting is on ScGA for Net Zero Emission Targets by 2050 (Oct 2023 TBC at IOP with sponsorship from IOP and UKRI(UKInnovate))
- **One-day event in EU in (SC Community+Funders+Industrials) –Brussels or Geneva TBC**
 - Dates and Locations in the EU for the 1-day meetings TBC (Anna, Luca, and Pierre to lead on this with support from Eu Based IOC and Conveners)
- **One-day event in US in (SC Community+Funders+Industrials) –**
 - Dates and Locations in the US for the 1-day meetings TBC (Joe and Steve are leading on this with support from US-based IOC and Conveners)
- **One-day event in Japan/South Korea (Two events) (Confirmed and Coordinated by Kazuhiko Hayashi)**
 - 1) ISIS meeting in **South Korea** (Nov.7 - 9)
Japan, Korea, China, Europe (CONNECTUS), US (Prof. Sastry Pamidi) will join.
 - 2) Special symposium at CSSJ domestic meeting (Dec.4 - 6, Shimonoseki near Fukuoka, **Japan**)

Acknowledgments

- Thanks to ScGA IOC, WG Conveners, EB, and Members > 100
- Thanks to Sponsors of the Oxford Workshop and for the follow up
 - IOP Superconductivity Group members
 - CfAS at Oxford University
 - IEEE-CSC
 - ESAS
 - British Cryogenic Council (BCC)
- Thanks to IEEE-CSC for sponsoring ASC 2022 Mtg and Lunch
 - Thanks to Bruce Strauss and Kathleen Amm for securing the sponsorship and to Paula for the setup
- Thanks to Prof Susannah Speller (University of Oxford) ScGA activities

Sponsors of Workshop held at Oxford University 11-12th Jul 2022

