



Fostering public-private R&D  
cooperation in HTS development

ASG Superconductors

April 18th, 2023

[www.asgsuperconductors.com](http://www.asgsuperconductors.com)



## QUICK INTRODUCTION ABOUT OUR ORGANIZATION

Headquarters in Italy with subsidiaries also in France, USA and UK, ASG is a worldwide leader in the production of superconducting magnets & systems for the industrial sector and scientific research, while the other two business units focus on magnesium diboride (MgB<sub>2</sub>) wire and healthcare systems.

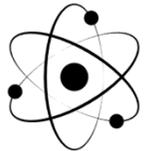
The ability to work with cutting-edge superconducting technologies and hi-tech materials are at the core of our organization and allowed us to contribute to important goals in scientific research.

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# MAIN APPLICATION FIELDS AND CUSTOMERS



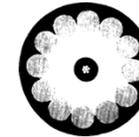
## HEP AND NUCLEAR FUSION

ASG is currently the largest European producer, and among the market leaders worldwide, of superconducting magnets for applications in high-energy physics and in nuclear fusion magnetic confinement.



## DIAGNOSTICS AND THERAPY

ASG is among the market leaders in manufacturing of bespoke magnets for MRI imaging and oncologic therapy applications. Furthermore ASG has developed a full value chain for manufacturing and integrating cryogen free MRI systems, based on a proprietary technology of MgB2 superconductors.



## MGB2 CABLES FOR ENERGY

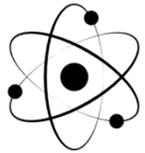
ASG is at the forefront of the technology for the development of magnetic energy confinement systems (SMES), superconducting power cables and Superconducting fault current limiters (SFCL).





# A TECH PARTNER AND SYNERGISTIC INVESTOR\* TO EMERGING TALENTS IN ENERGY AND HEALTHCARE

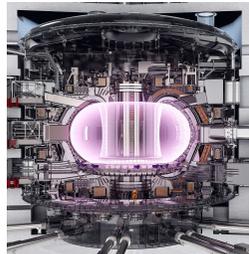
\* with ASG Shareholding Company



## NEW-GEN NUCLEAR AND FUSION START UP SCENARIO

ASG eclectic experience has brought the company to master high energy cyclotron technology – enabling Accelerator Driven Systems or ADS fission power plants – and magnetic confinement for thermonuclear fusion reactors.

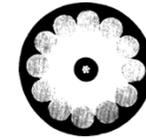
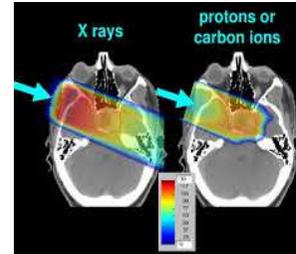
Both sectors are seeing enormous interest by scientists and investors alike.



## MED-TECH: DIAGNOSTICS AND THERAPY

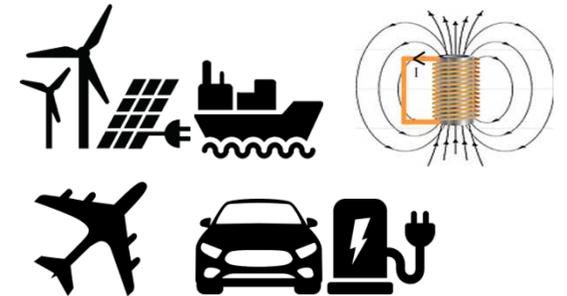
ASG is siding with MRI imaging companies to bring innovative more economic, more compact, cryogen free products to the market. Image driven radiation and hadron therapies are among these.

Healthcare start ups are blossoming around IGRT/IGPT technologies.



## GRID TECHNOLOGIES AND ENERGY STORAGE

ASG is developing superconducting technologies to support the electrification demand, connection of RES to the grid, improve connectivity with SFCLs, enhancing energy storage efficiency with SMES and supporting the abatement of carbon footprint of transport by synergizing electrification with Hydrogen.



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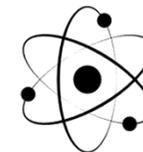


# D2 HIGH FIELD DIPOLE MAGNETS – HI LUMINOSITY LHC PROJECT CERN

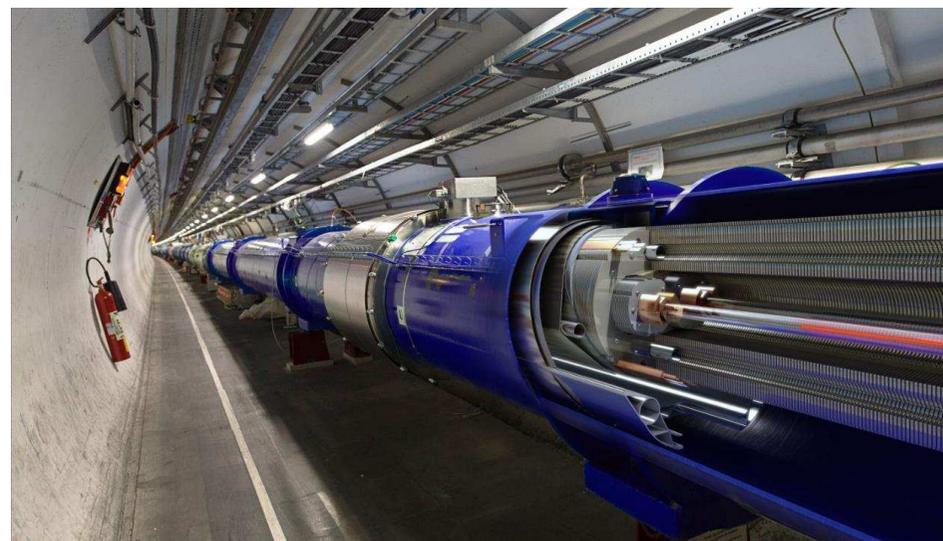
INFN

January 31, 2023

HIGH ENERGY PHYSICS



ASG is currently collaborating with INFN and CERN in design and construction of high field magnets for LHC High Luminosity Upgrade , with Superconducting Dipoles "D2" and to the Future Circular Collider with the "Falcon D" Nb3Sn program



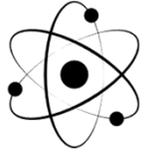
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# TRANSPORT SOLENOID- M2E PROJECT FERMI NATIONAL LABS FERMILAB

April 18th, 2023

**HIGH ENERGY PHYSICS**



ASG has supplied 56 superconducting modules for Fermi National Labs TS detector magnet for the Mu2e experiment.



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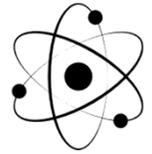


# ARC DIPOLES OF THE LARGE HADRON COLLIDER AND RELEVANT POWERING

CERN

April 18th, 2023

HIGH ENERGY PHYSICS



ASG collaborated with CERN for the development and deployment of a 100kA power cable in MgB<sub>2</sub> aimed at powering the LHC collider ring remotely as the bremsstrahlung would otherwise damage the power supplies. ASG supplied in excess of 1000km of MgB<sub>2</sub> wires. The system has been successfully commissioned in 2020.



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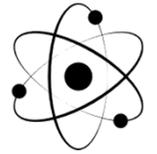


# ATLAS , CMS DETECTOR

CERN

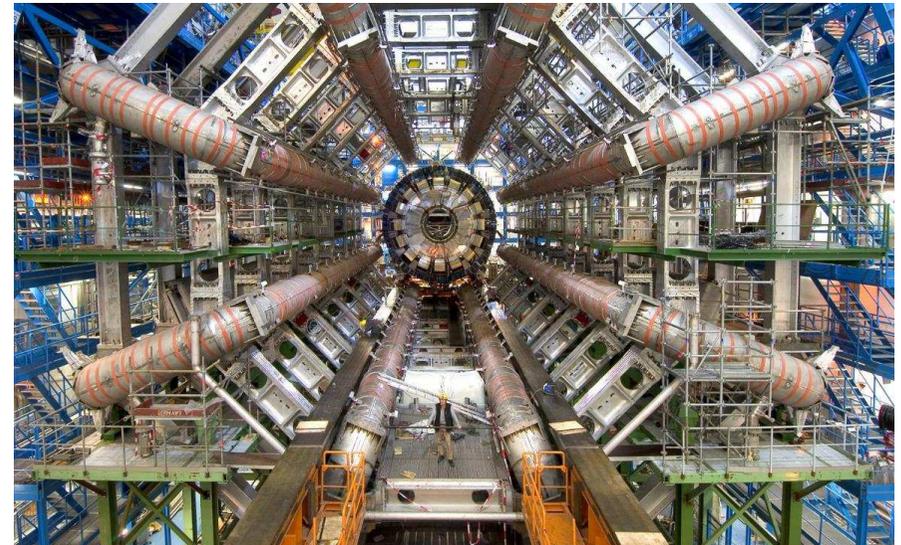
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HIGH ENERGY PHYSICS



CERN choose ASG as its Partner for the development of High performance, special, Superconducting Magnets. A legacy continuing for 40 years.

The ATLAS and CMS detectors are still today in operation as well as the 446, 7T - arc dipoles deployed in the LHC



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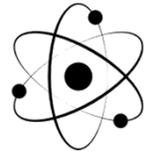


# MULTI PURPOSE DETECTOR

JINR

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**HIGH ENERGY PHYSICS**



ASG successfully delivered the magnet for the Multi Purpose Detector Magnet (MPD) for the NICA heavy-ion accelerator of the Joint Institute for Nuclear Research.



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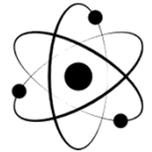


# GSI'S FAIR PROJECT SUPER FRS – MULTIPLETS

Gesellschaft fuer Schwerlonenforhung

April 18th, 2023

HIGH ENERGY PHYSICS



This project consists of 31 NbTi Multipolar magnets to constitute a beamline feeding the SIS 100 and R3B Glad experiments in the FAIR Super FRS Facility of the GSI. Each multiplet is made of up to 9 different coils with different polarities, often nested. The individual multiplet is a 70t assembly.

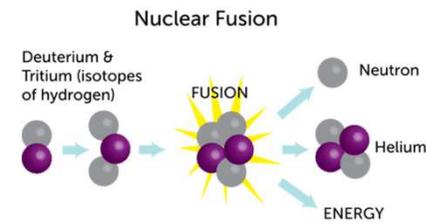
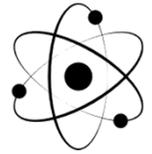


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# THERMONUCLEAR FUSION: MAGNETIC CONFINEMENT

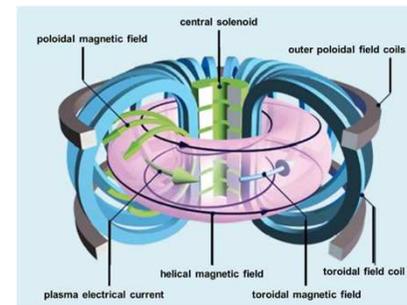
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## NUCLEAR FUSION

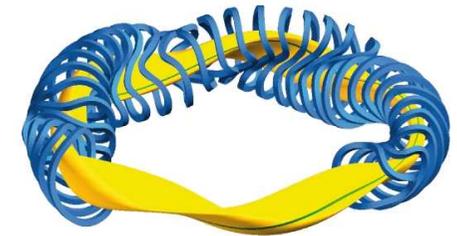


Light Water Reactor fuel element (fission)	~5 GW/m <sup>3</sup>
Burning coal	~5 MW/m <sup>3</sup>
<b>DT fusion reaction in ITER</b>	<b>~1 MW/m<sup>3</sup></b>
Humming bird body	~50 kW/m <sup>3</sup>
Human body	~1 kW/m <sup>3</sup>
<b>Sun's core (fusion)</b>	<b>~250 W/m<sup>3</sup></b>

### TOKAMAK



### STELLARATOR



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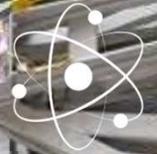


# HOW DOES A TOKAMAK LOOK IN REALITY

Toroidal coil on the assembly rig  
at ITER site in Cadarache.

April 18th, 2023

NUCLEAR FUSION



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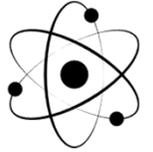


# WELDENSTEIN 7-X

IPP

April 18th, 2023

**NUCLEAR FUSION**



W7-X is the only stellarator in operation in EU. It is constituted by 60 superconducting NON-planar coils, 36 of which have been manufactured by ASG.



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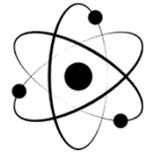


# ITER: ASG MOST RELEVANT FUSION PROJECT

ITER

April 18th, 2023

**NUCLEAR FUSION**



ASG has recently completed the manufacturing of 10 Toroidal Field Coils generating each an 11T field intensity, with a current of 68kA. All the TFCs have been positively tested and are currently being installed at ITER site.



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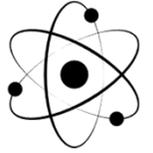


# ITER: ASG MOST RELEVANT FUSION PROJECT

ITER

April 18th, 2023

NUCLEAR FUSION



ASG is currently manufacturing 4 of the 6 Poloidal Field Coils in Cadarache, as their diameter exceeds 24m. Currently the last PF coil is being completed.



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# IBA PROTEUS ONE RECURRENT PRODUCTION

IBA

January 31, 2023

**THERAPY**



ASG has entered a framework contract for the recurrent supply of compact superconducting-cryogen free magnets for IBA's synchro-cyclotron for hadrontherapy. Such systems are now operating since more than a decade with guaranteed uptime.



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# CRYOGEN FREE MRI SYSTEM RECURRENT PRODUCTION

evo MROpen

April 18th, 2023

DIAGNOSTICS



ASG has developed and is commercializing an open-sky, cryogen free MRI system based on proprietary superconducting wire and magnet technologies. The system has now an installed base of more than 30 units worldwide mostly in UK and USA.



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# EVOLUTION OF MROPEN SYSTEM TO IMRT AND IGPT

HZDR  
MAGNET TX

April 18th, 2023

**THERAPY**



MR Open Evo unique characteristics allow for operation while rotating around the patient isocentre in order to deliver image guided radio and particle therapy. Research institutions in Canada and Germany are currently validating treatment protocols for this machine



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# UHF MRI MAGNETS AND SYSTEMS

SIEMENS HEALTHINEERS  
GACHON GILL MEDICAL CENTRE  
National Institute of Health

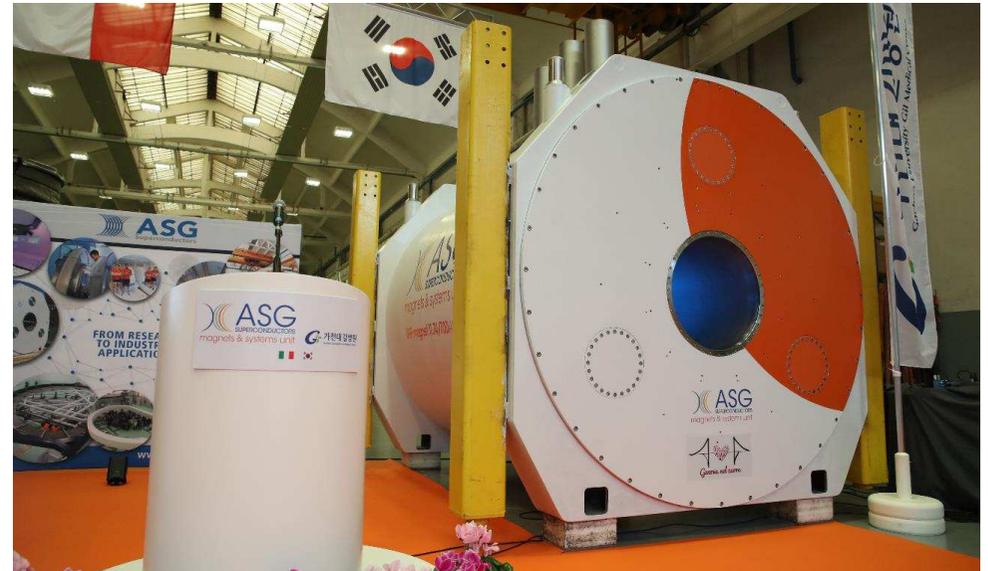
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DIAGNOSTICS



ASG delivered two 11.74T MRI magnets to GUGMC, in Korea, and to NIH in the USA. Furthermore ASG delivered a 17.6T MRI magnet to NIH.

Today ASG is an exclusive partner of Siemens Healthineers for the supply of UHF MRI systems and is currently working on a 10.6T MRI system for the Chinese Academy of Sciences.

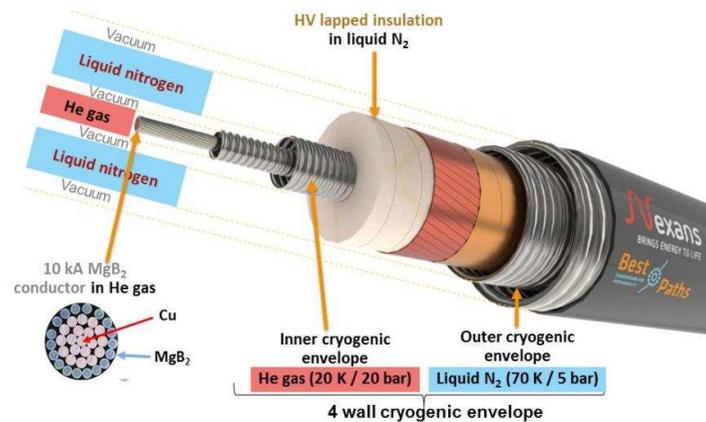
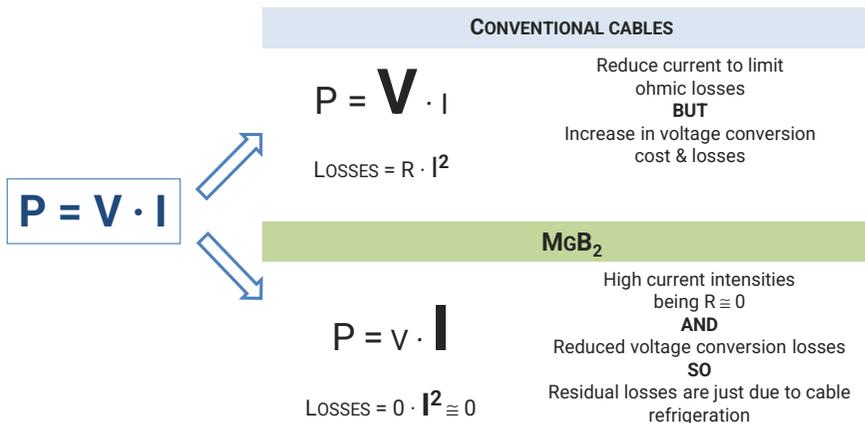
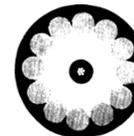


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# POWER TRANSMISSION WITH SUPERCONDUCTING CABLES

January 31, 2023

## MGB<sub>2</sub> CABLES FOR ENERGY



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# POWER TRANSMISSION WITH SUPERCONDUCTING CABLES

RENEWABLE ENRGY SOURCES

April 18th, 2023

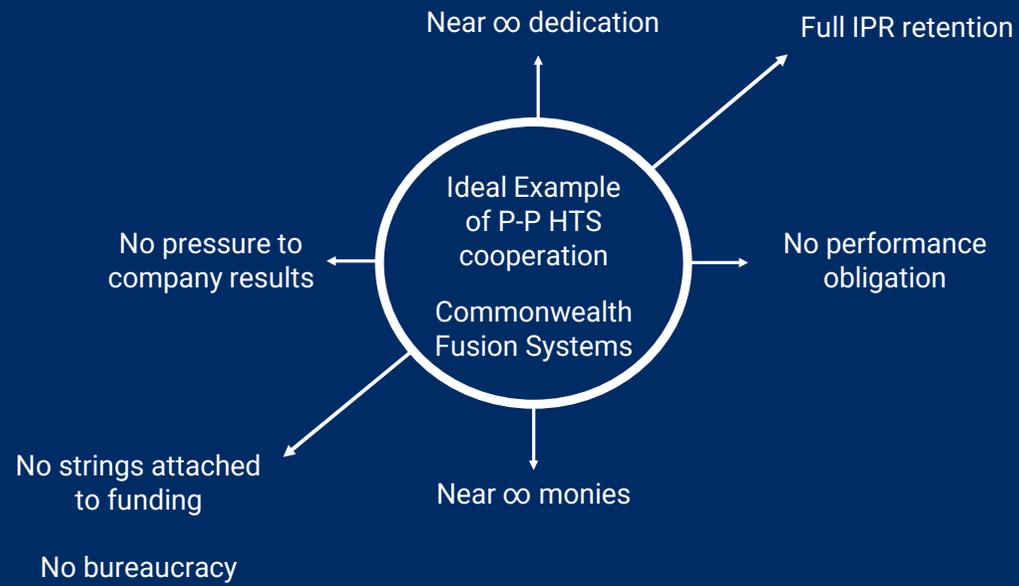
MGB2 CABLES FOR ENERGY

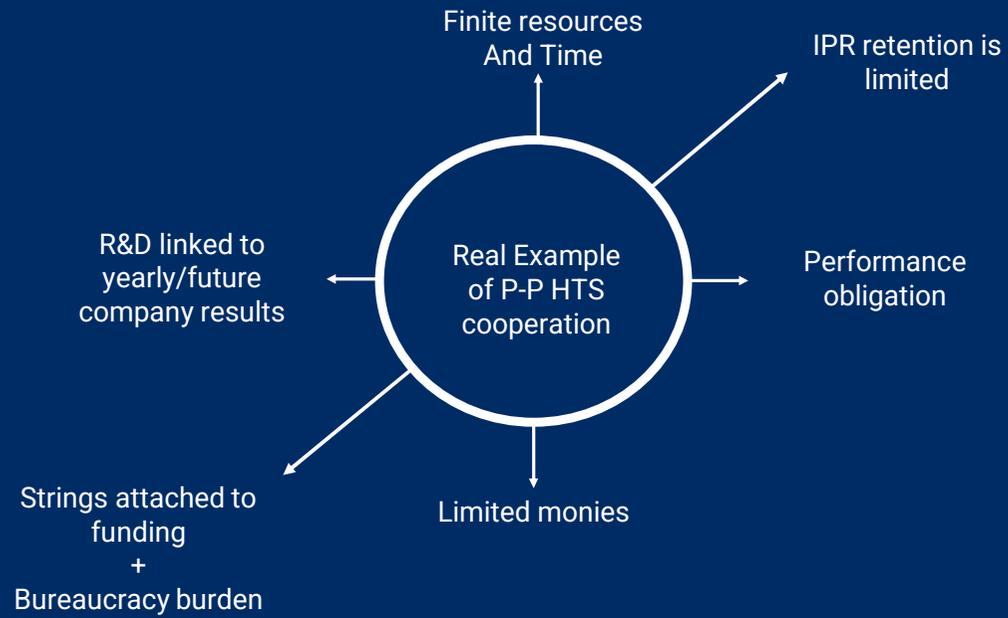
DATA CENTRES

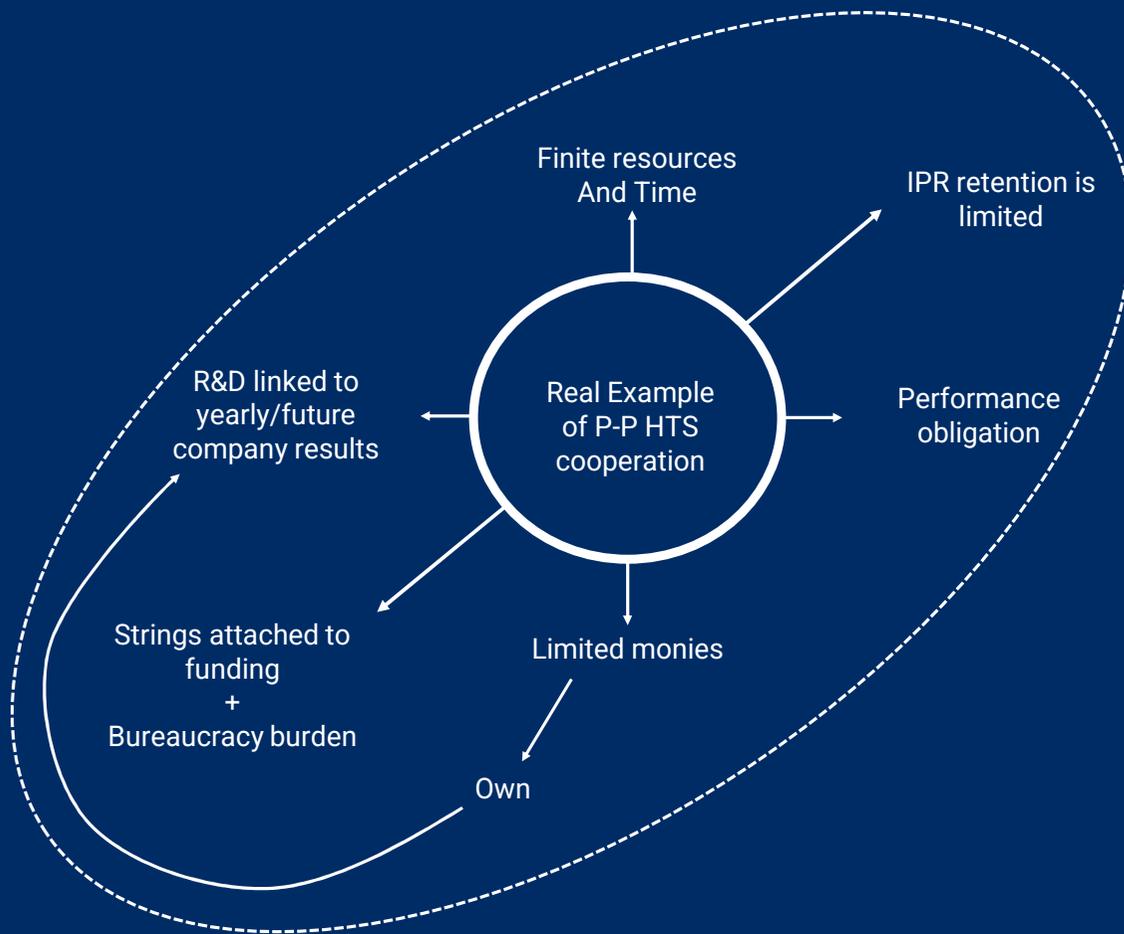
ZERO EMISSION LOGISTICS

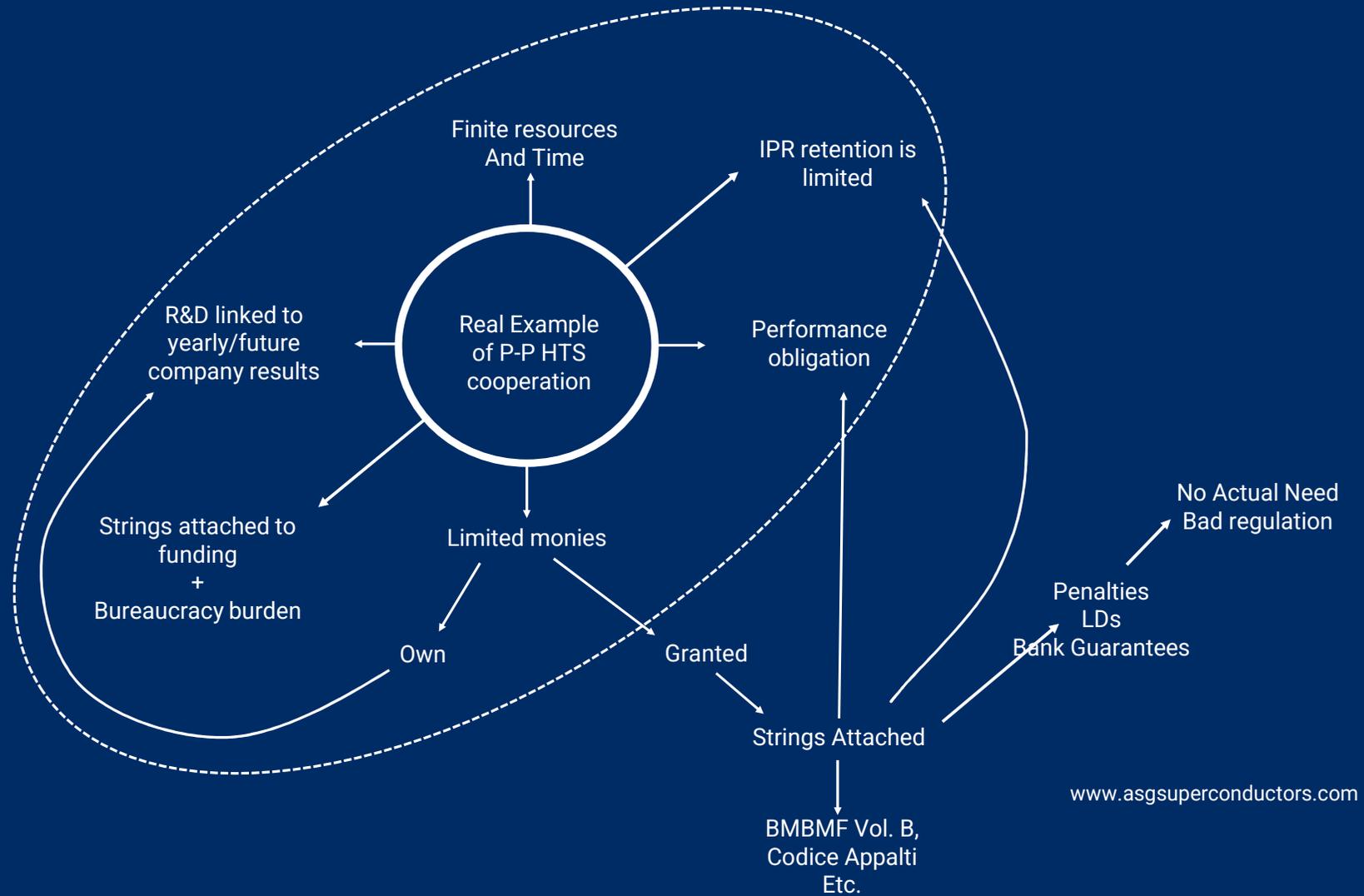
INDUSTRY DECARBONIZATION

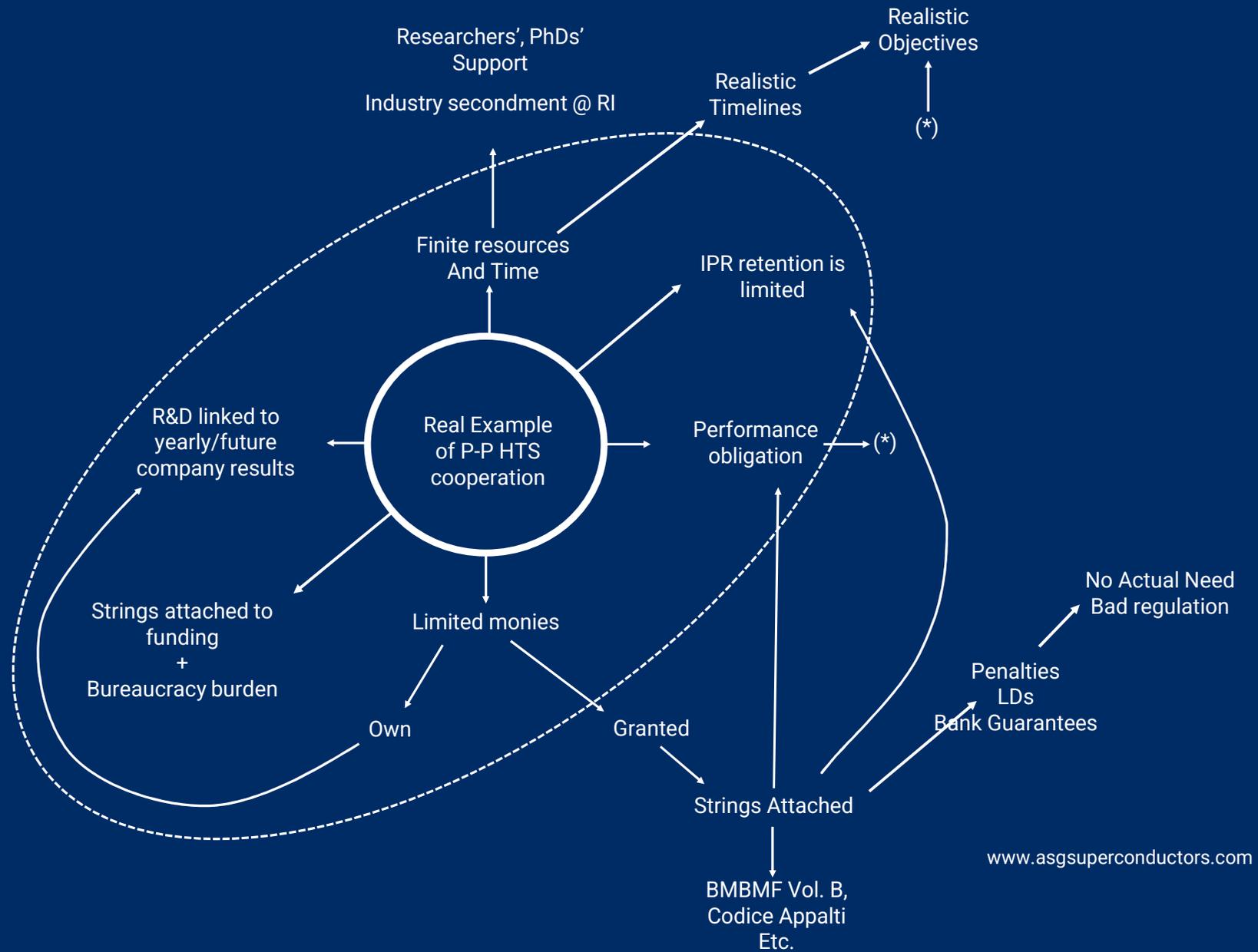


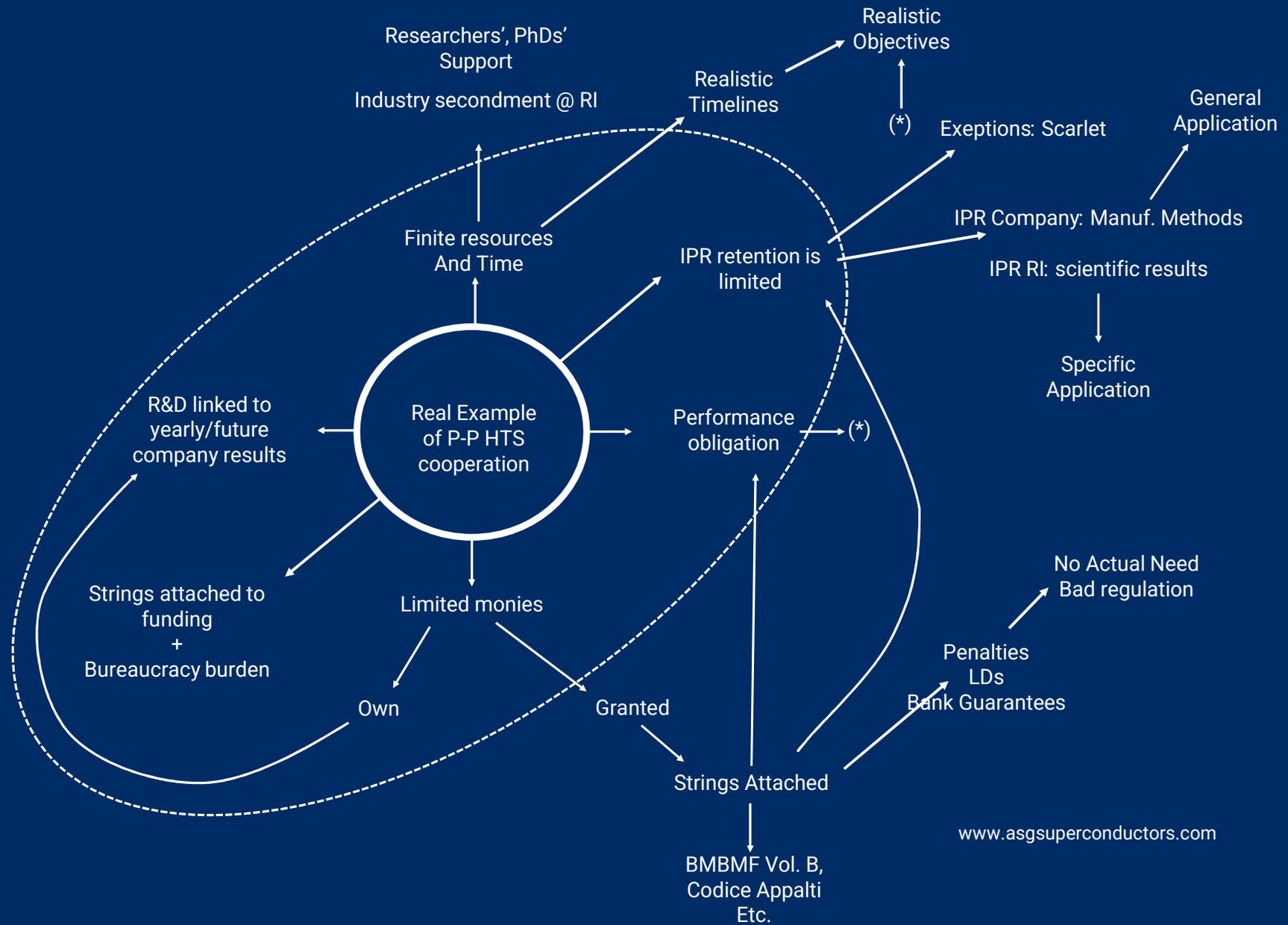














RI: to fund R&D activities as if they were supply contracts.

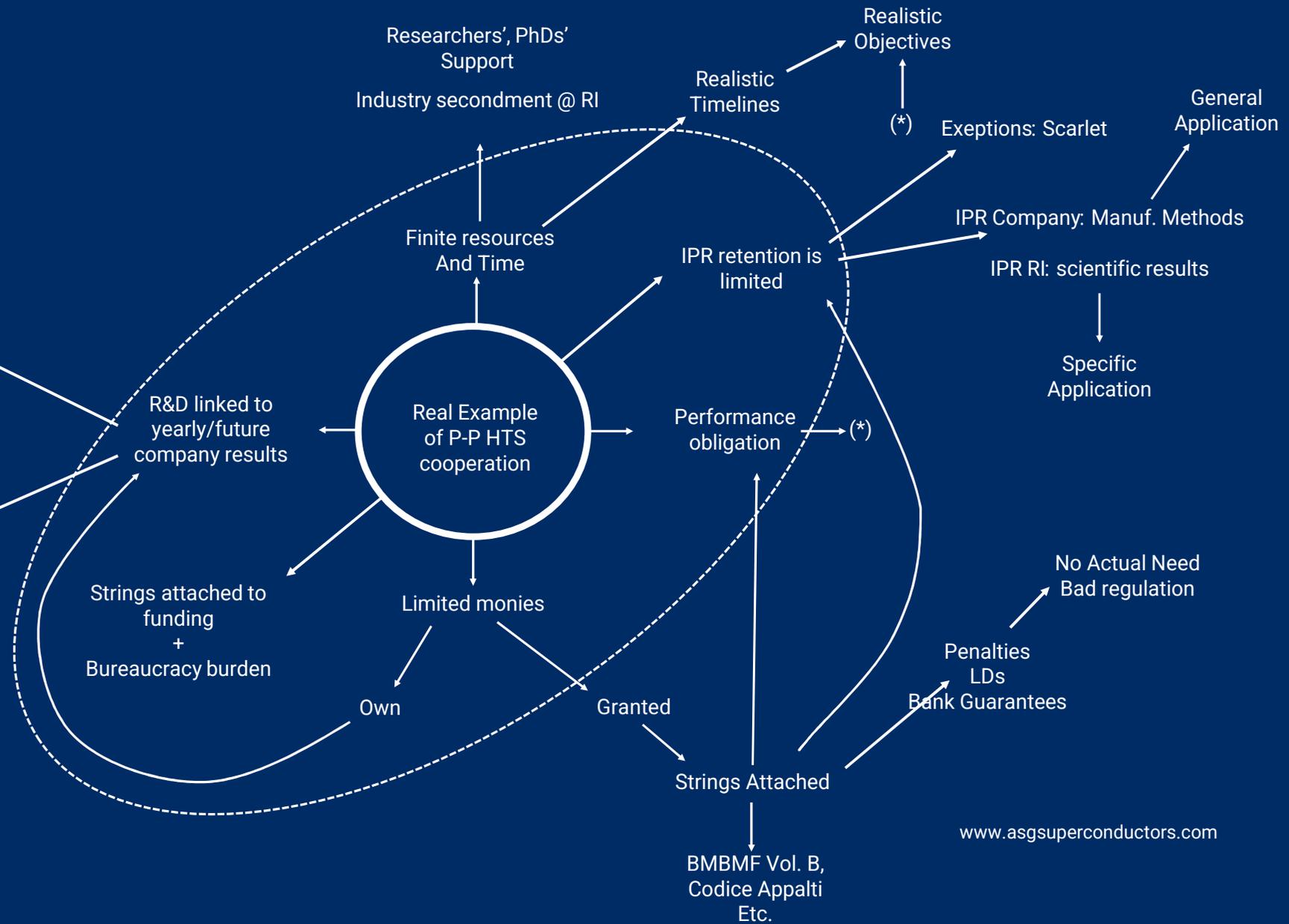
Lower margins for companies

Companies to act as enablers to make R&D meaningful

Future RoI could be also royalty based

Example: XFEL

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