



Board of Funders

Brussels, 22nd November 2019

Graphene Flagship

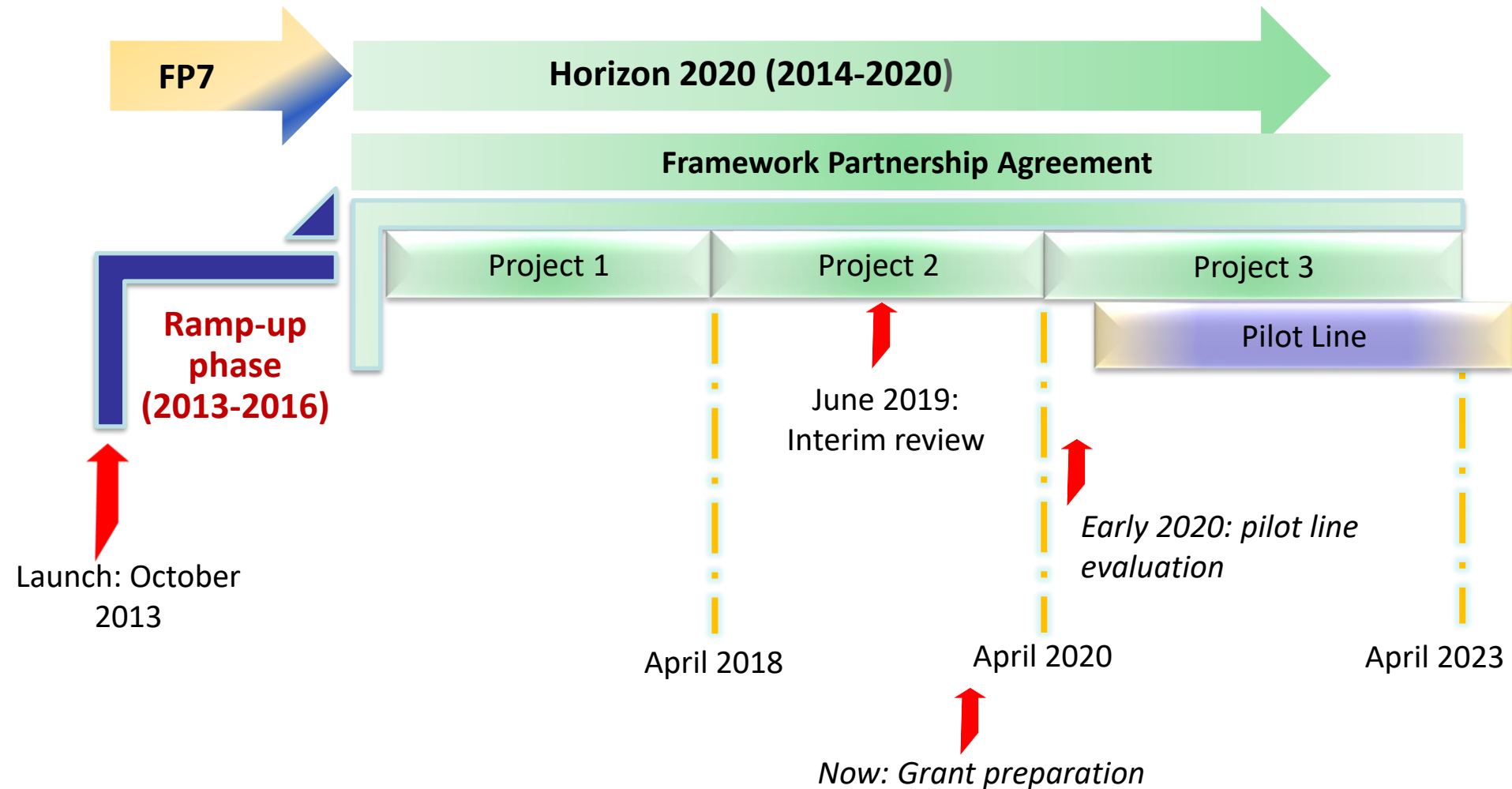
State of play

Wide Hogenhout

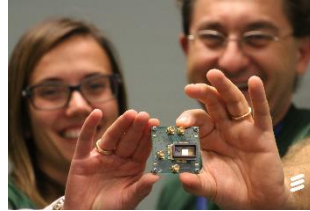
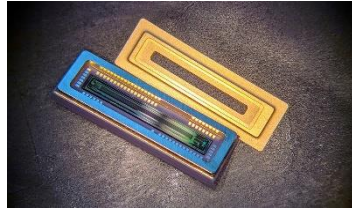
Flagship Unit

DG Connect, European Commission

Timeline



Recent Results



A few highlights:

- The demonstration of Silicon-graphene coin cell batteries with high recyclability
- Perovskite solar cells with graphene have been measured to have a power conversion efficiency of over 20%
- An ultrafast photonic switch with a switching speed of one hundred picoseconds
- Fundamental science: growing Graphene using chemical vapour deposition with high mobility at room temperature.
- Environment / product end of life: discovery that white rot fungi are able to degrade few-layer graphene and graphene oxide

>3000
publica-
tions

>160
Proto-
types

180
Research
agreements

68
products

12 spin-off
companies

25 November 2019



Progress in Core2

Water filtration;
supercapacitors; anti-
corrosion

Photonic switch
10.000 times faster

Pressure sensors at
5-200 times better
SNR than SotA

Medical
technologies

Silicon-graphene coin
cell batteries with
high recyclability

Moving from devices
to circuits

Clinical advisory
board for passive
electrode

Strong progress with
wearables

>20% power
conversion efficiency

Demonstrators (UV,
THz, ...) giving rise to
business opportunities

2022
AND
BEFORE



2023
—
2029



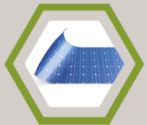
Functional
and surface



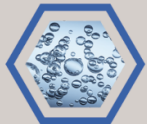
Structural
materials



Multifunctional
construction materials



Flexible perovskite
solar cells



Water treatment
and desalination



Supercapacitors for
warehouse logistics



Advanced network
infrastructures



High frequency
electronics



Flexible devices



Neural
interfaces



Perovskite
multijunction
photovoltaics

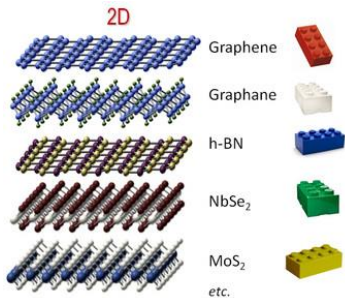
Advanced lo
com

ete
physical c
sensors

Biosensors

Validation service and standardisation

Samples & Materials database



The SMDB is a common, secure location for

- samples requests,
- test protocols/standards,
- test results

It allows **requesting (a) material/sample with a desired properties**

Validation service

The Graphene Flagship's Validation Service

- ❖ National Physical Laboratory (UK), Universidad de Zaragoza (Spain), and Laboratoire National de Métrologie et d'Essais (France)
- ❖ The aim of the service is to provide confidence in graphene and related materials to enable a quicker transition of graphene products to market.



Unique for a project to cover and set up the whole first steps of the value chain and is able to maintain and exploit its created knowledge.

Standardization



- ❖ Published so far
 - ISO/TS 80004-13:2017(en): *Nanotechnologies — Vocabulary — Part 13: Graphene and related two-dimensional (2D) materials*
 - ISO/TR 19733:2019(en) *Nanotechnologies — Matrix of properties and measurement techniques for graphene and related two-dimensional (2D) materials*
- ❖ IEC/TC 113 **9/35 ongoing projects lead by the GFSC**

Market places and trade fairs

*Marketplace
Tetrapack
Oct 2019
Modena, Italy*



Public lecture, San Carlo Church



Graphene Marketplace TetraPak



'Meeting graphene' for Business
Network CRIT

*Marketplace
2020:
Ericsson,
Stockholm,
Sweden*

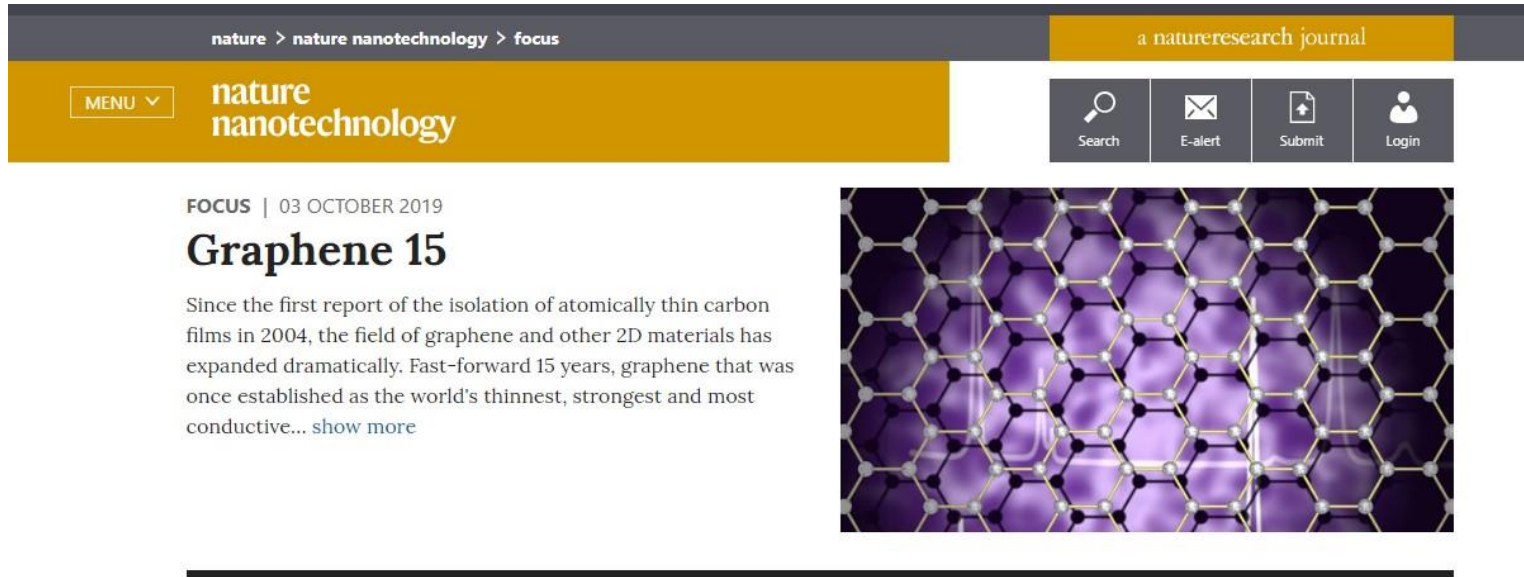


Mobile World Congress
24-27 February 2020
Barcelona



JEC World
3-5 March 2020
Paris

Recent and upcoming news



The screenshot shows the top navigation bar of the Nature Nanotechnology website. The breadcrumb trail reads "nature > nature nanotechnology > focus". The page title is "nature nanotechnology". On the right, it says "a natureresearch journal". Below the navigation bar, there is a "MENU" button and a "Search" icon. The main content area features a "FOCUS | 03 OCTOBER 2019" header and a large article titled "Graphene 15". The article text states: "Since the first report of the isolation of atomically thin carbon films in 2004, the field of graphene and other 2D materials has expanded dramatically. Fast-forward 15 years, graphene that was once established as the world's thinnest, strongest and most conductive... show more". To the right of the text is a large image of a graphene lattice structure.

The graphene times. *Nat. Nanotechnol.* **14**, 903 (2019) doi:10.1038/s41565-019-0561-4
Path towards graphene commercialization from lab to market. *Nat. Nanotechnol.* **14**, 927–938 (2019)
doi:10.1038/s41565-019-0555-2

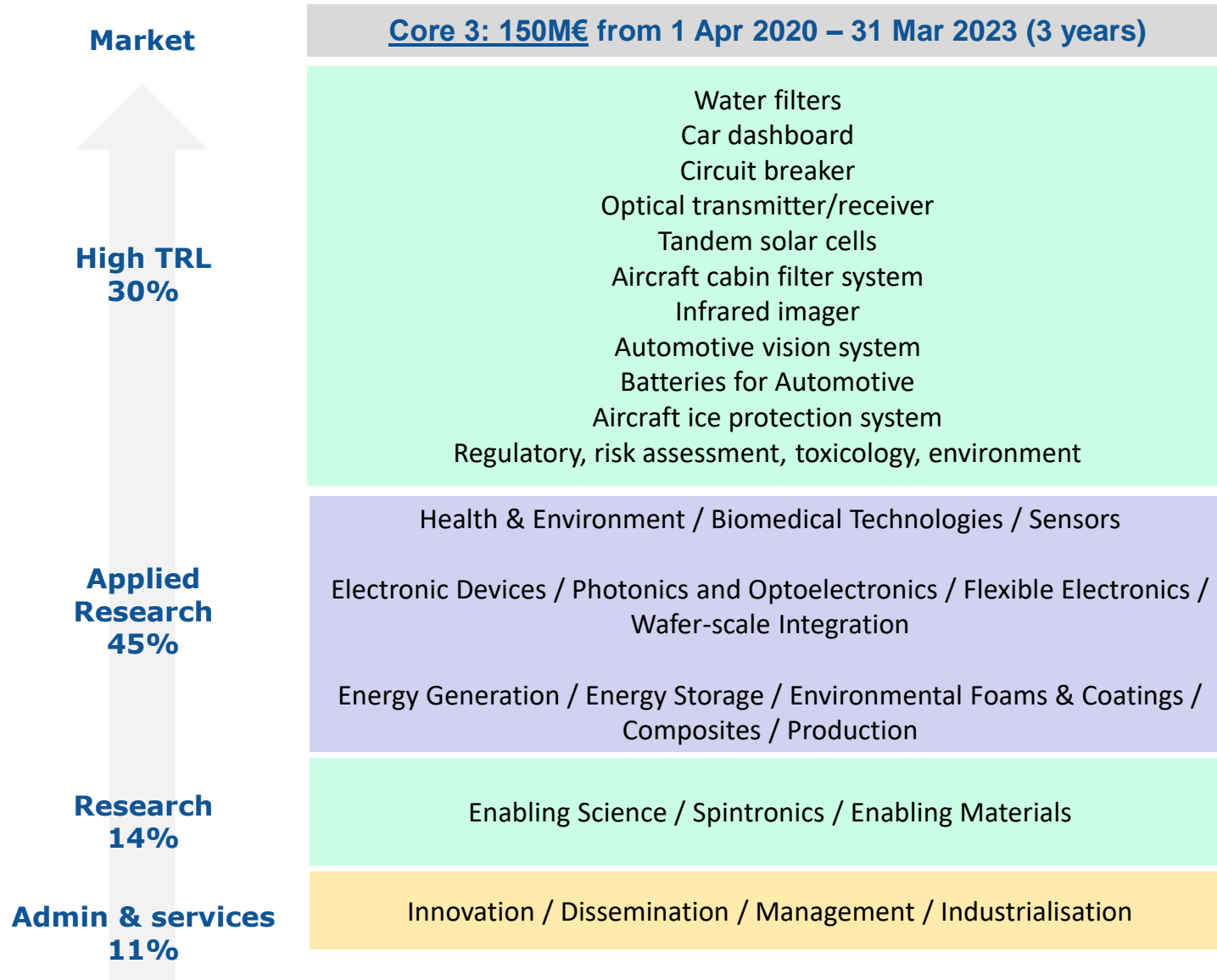


Coming soon: whitebook explaining how to synthesize/elaborate up to 5000 2D materials.

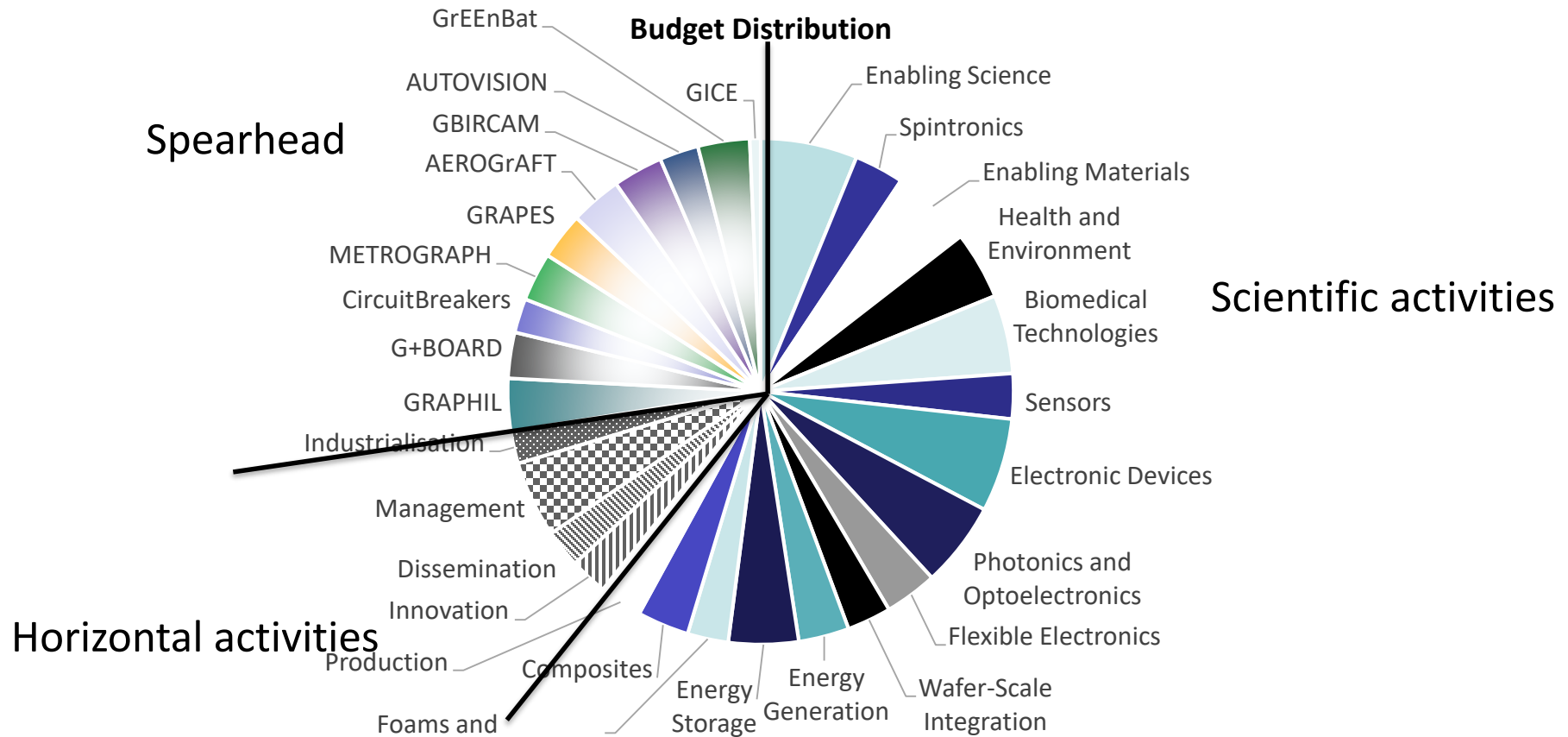
Encompassing more than 1,500 references and the knowledge of 70 co-authors from Graphene Flagship partners and associate members, the book aims to provide a single source of knowledge on graphene and other layered materials.

Core3

starting April 2020



Core3 budget



- 16 partners leaving after core2
- 17 new partners as a result for spearhead projects
- 14 new partners as a result of calls for expression of interest