

Making the most of **UK/China** research and innovation partnership The Arup Perspective

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11 June 2014

ARUP

More than **11,000** staff based in over **90** offices across
more than **35** countries





Sydney Opera House, Australia

ARUP



National Stadium and National Swimming Centre, China

ARUP



The Helix, Singapore



New Songdo City, South Korea



Why

- Innovation supported by research is a vital factor in business success
- Research at Arup is a tool for creating financial and knowledge value by building capability and evidence; these enhance business advantage
- Value from research comes in a variety of forms as well as revenue growth, and often over an extended period

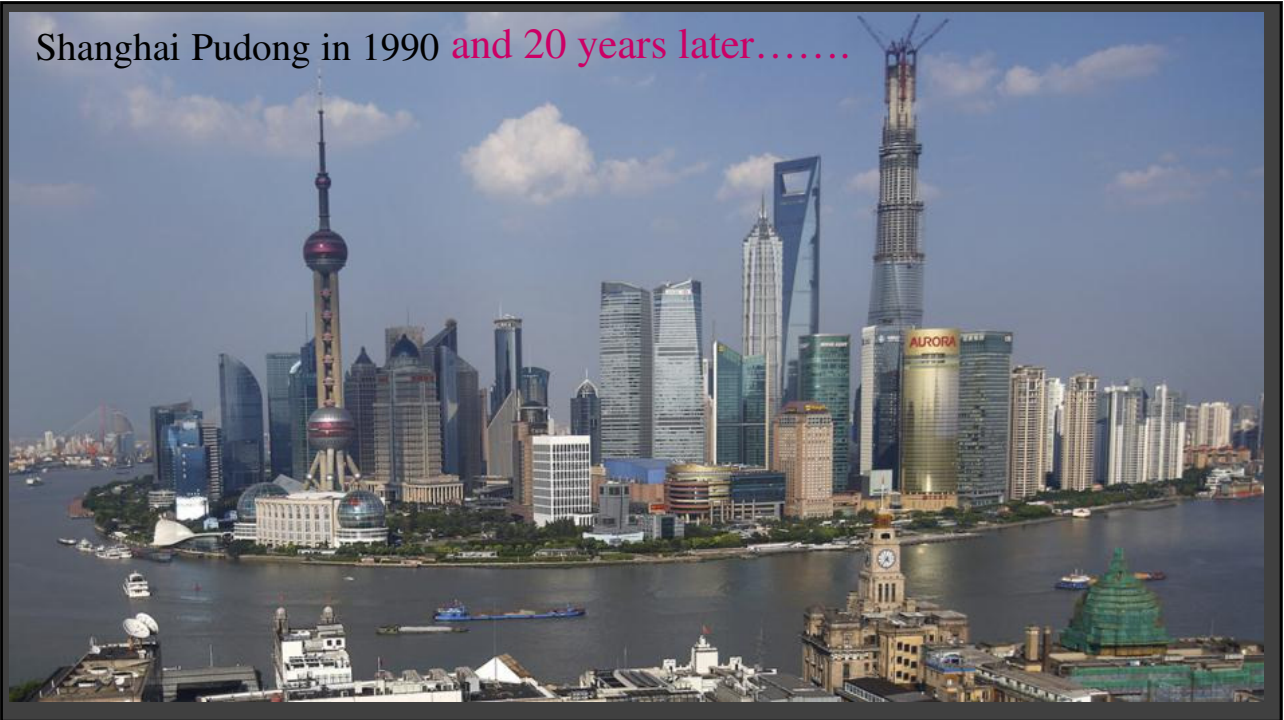
- Arup as a **knowledge enterprise**, globally
- Arup as a **knowledge enterprise, in China**

- The **scale** of innovation
- A **hunger** for innovation
- The **demand** for innovation
- The **speed** of innovation
- The **drive** for innovation
- The **people** for innovation

Shanghai Pudong in 1990



Shanghai Pudong in 1990 and 20 years later.....



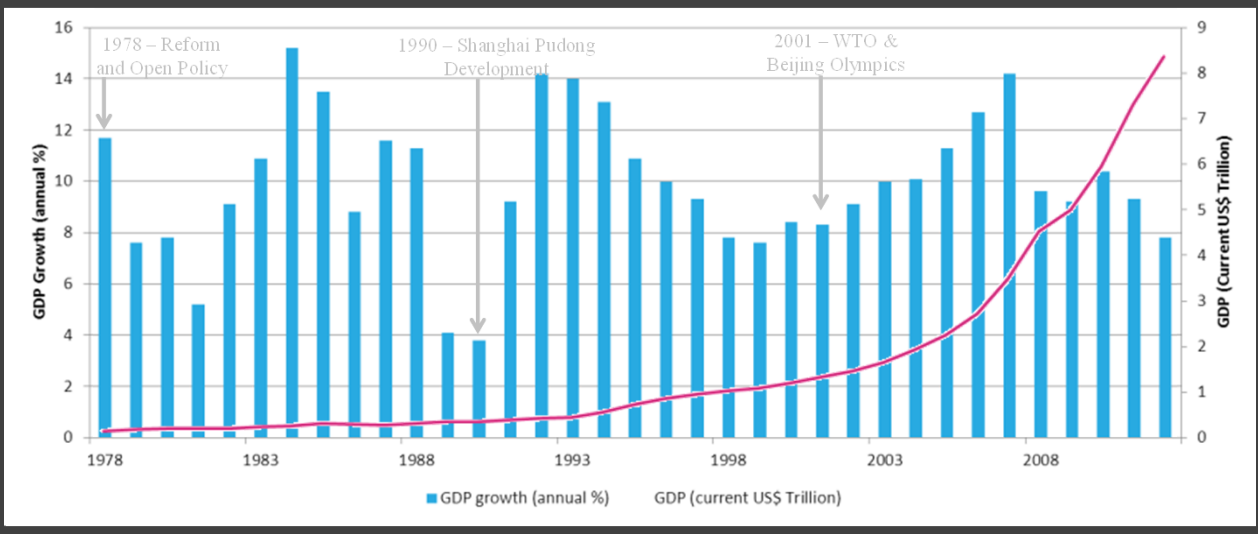
First in China



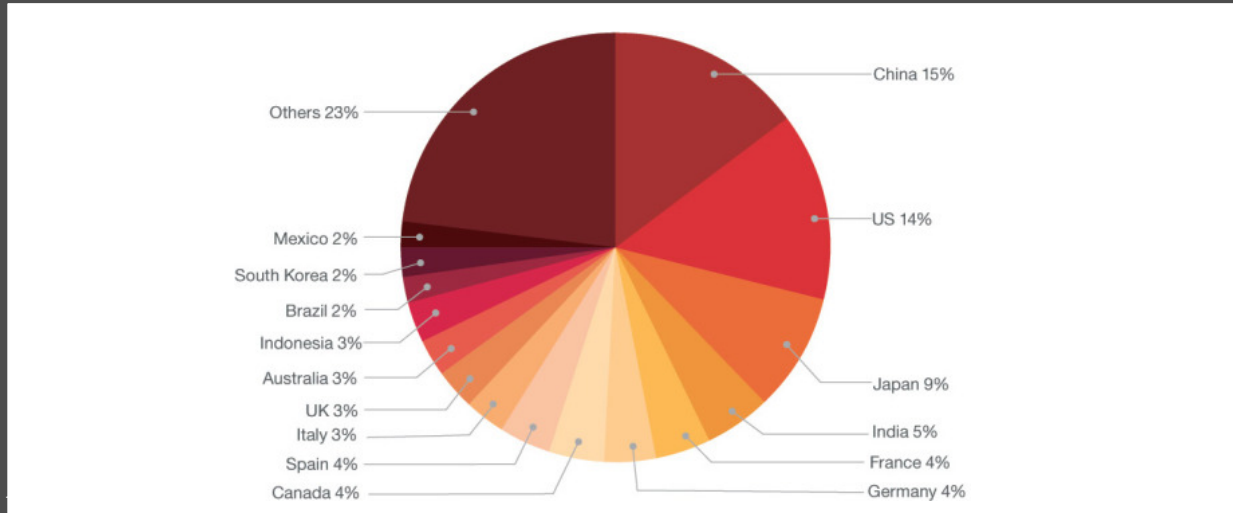
Reaching new height



Economic miracle



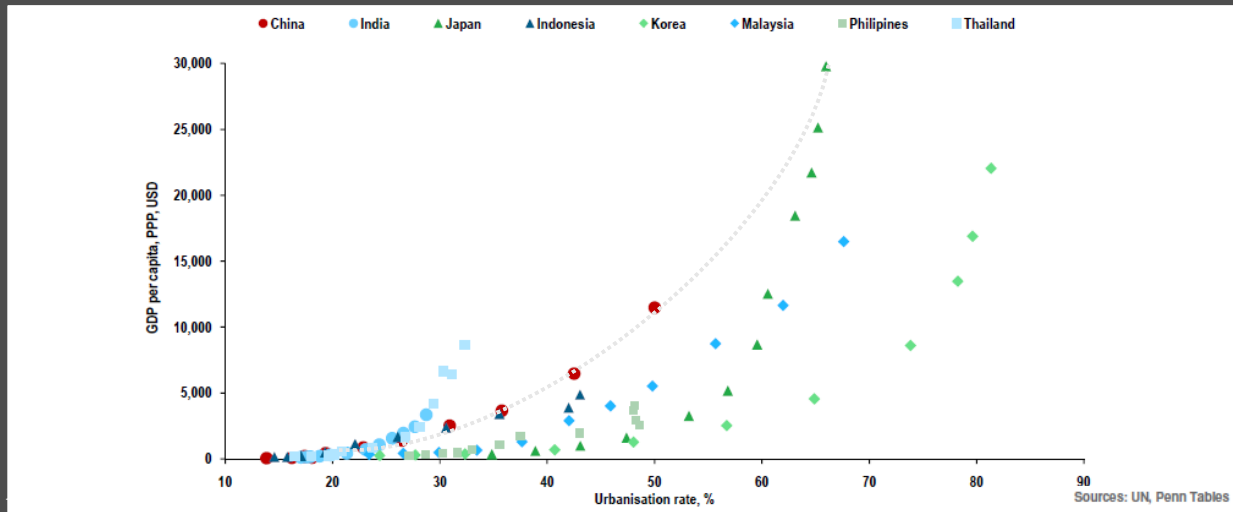
China has overtaken US as largest construction market



Chinese Cities: Scale and Speed of Urbanization



Urbanization and per capita income growth go hand in hand



The demand for innovation



China's Carbon Targets

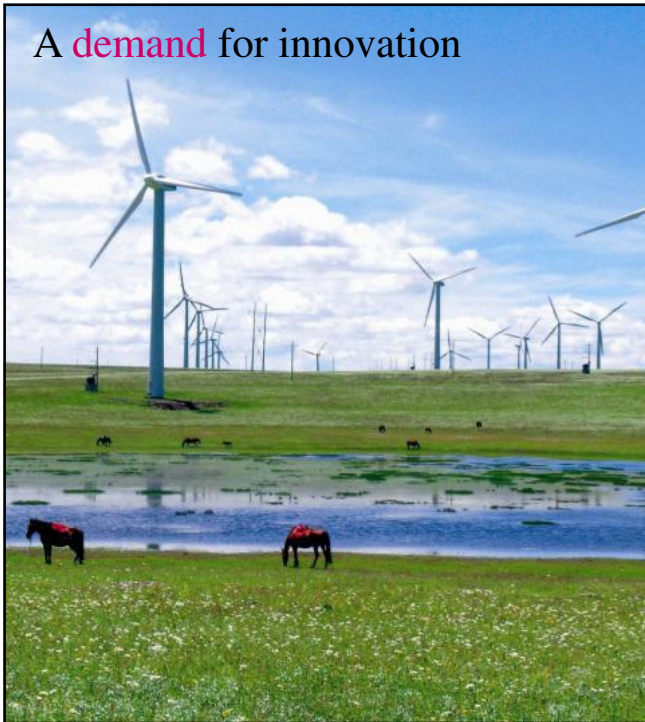
Reduce Carbon Intensity by **40-45% by 2020** - compared to 2005 levels (State Council, 2009 – First time having specific carbon emissions target).

12th 5 Year Plan - **Reduce Carbon Intensity by 17%** by end 2015

Carbon/ energy saving measures & targets for **10,000 businesses** in energy intensive industries.

Forest Coverage target of **> 21.66%**

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A demand for innovation

Other Clean Tech Initiatives

Renewable Energy

Wind Power – 200GW by 2020

Solar – 50 GW by 2020

Biomass – 15 GW by 2015

Automotive

Fuel Efficiency – China V by 2016

Electric Vehicles – Target 5m by 2020

Subsidies for smaller engines, fuel efficiency and hybrid/ EV

Green Building Movement Plan

Developers Incentives – 1% GFA increase for each star in the 3-star green building rating system.

Subsidies for communities with at least 30% green buildings.

Construction of Smart Grid

UHV lines & networks, remote monitoring and EV charging

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The speed of innovation

Urban Metro

1995

4 lines

in 3 cities

2013

55 lines

in 17 cities

2015

87 lines

in 25 cities



The speed of innovation



Location: Fengtai District, Beijing City
Area: 5km²
Client: Beijing Institute of Urban Planning and Design/Wannian Group

Beijing Changxindian Eco-City
 Conceptual and detailed regulatory planning

The first approved detailed regulatory plan in China, which was integrated with ecological indicator.

The comprehensive resource Management Method provided the Energy Consumption, Hydrologic Cycle and waste with integrated solutions.

Integrate the breeze corridor into the urban design layout to ameliorate the micro-climate environment.

The speed of innovation

Setting targets

50% reduction in CO₂ emission compared to BAU

Domestic **water** use to be less than **110 litres** p/d

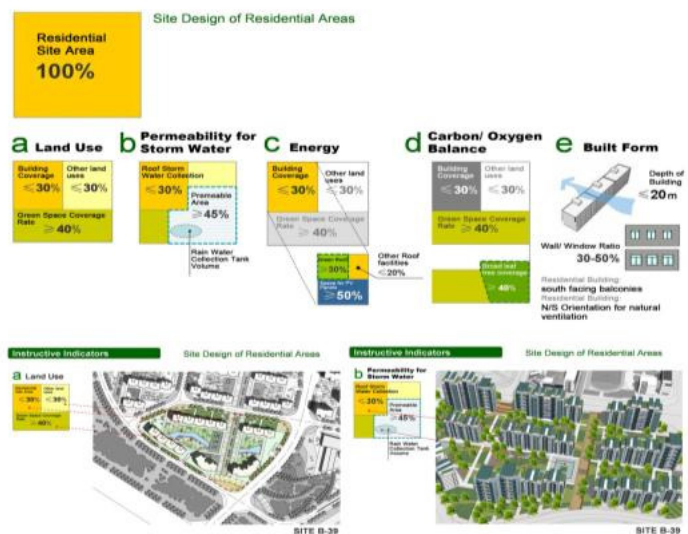
Reduce domestic **waste** generation to **0.8kg** /p/day

100% of residents within **400m** of public transport stops

At least **15%** of energy supply from **renewable energy**

At least **15%** of residential development for social housing

2010




5.2.1 Sustainable Urban Design Guidelines

Instructive Indicators **2 Site Design of Residential Areas**


C Energy

Building Coverage < 30%
Other land uses < 30%
Green Roof Coverage > 40%
Other Roof features > 30%
Green Roof Coverage > 50%



VANION Changxing Urban Design Control Guideline - One
(Regulatory Indicators)

Location



Development Parameters

Site No.	0-03
Land Use	R0
Site Area	3.88
Plot Ratio	2.38
Building Height (m)	88
Building Density (%)	35
Green Space (%)	40
Car Parking (m ²)	100
Remarks	—

Legend

- site no.
- land use
- boundary
- building setback
- land use buffer line
- green line
- blue line
- vehicle entrance exit
- entrance
- entrance/parking

The speed of innovation

2010

Innovative Zoning Plan

500 hectares site south-west of Beijing city
Innovative approach to incorporate low carbon & sustainable planning conditions into statutory zoning plans.

First of its kind in the China urban planning system.

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The speed of innovation

Beijing Changxindian Eco-City Implementation



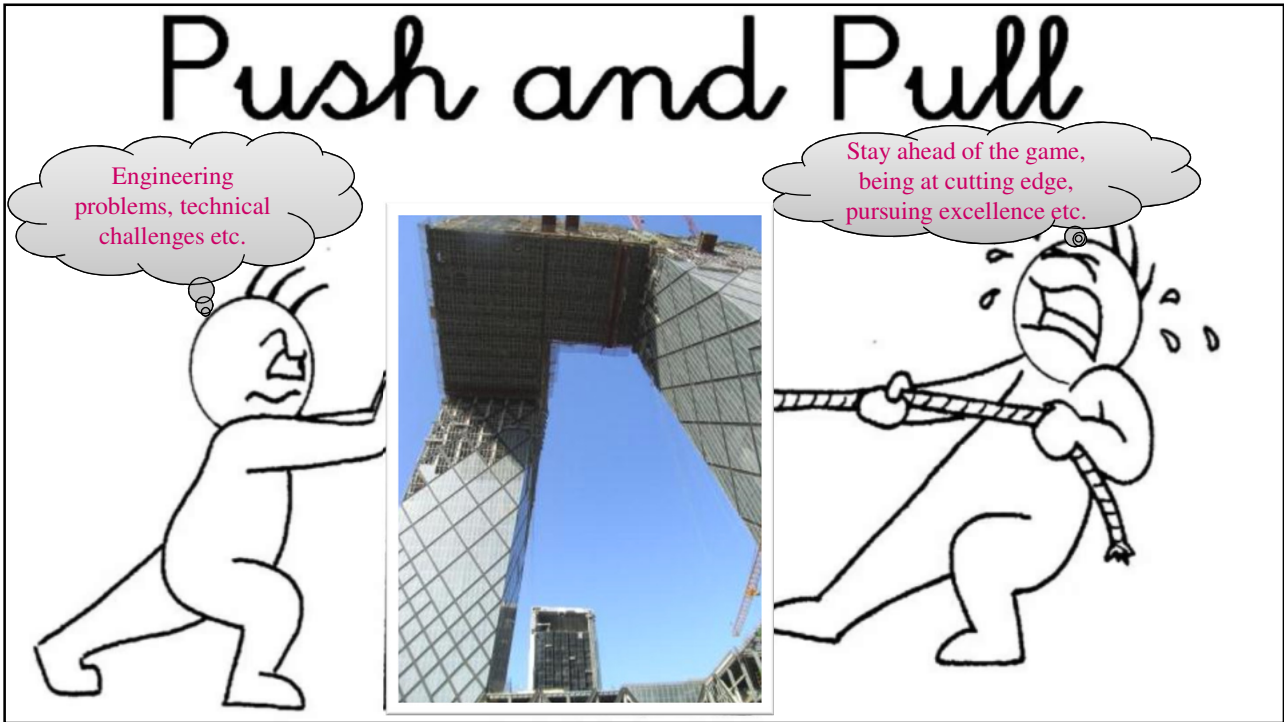
The speed of innovation Beijing Changxindian Eco-City Implementation

2013



How

- Research Roadmap
- Joint research
- Project collaborations
- Knowledge sharing



Developing 2009 Roadmap to 2013 Roadmap

Research elements are classified into six new categories in this 2013 Roadmap. Previous 2009 Roadmap categories are represented by following icons and are shown for each research element in this booklet

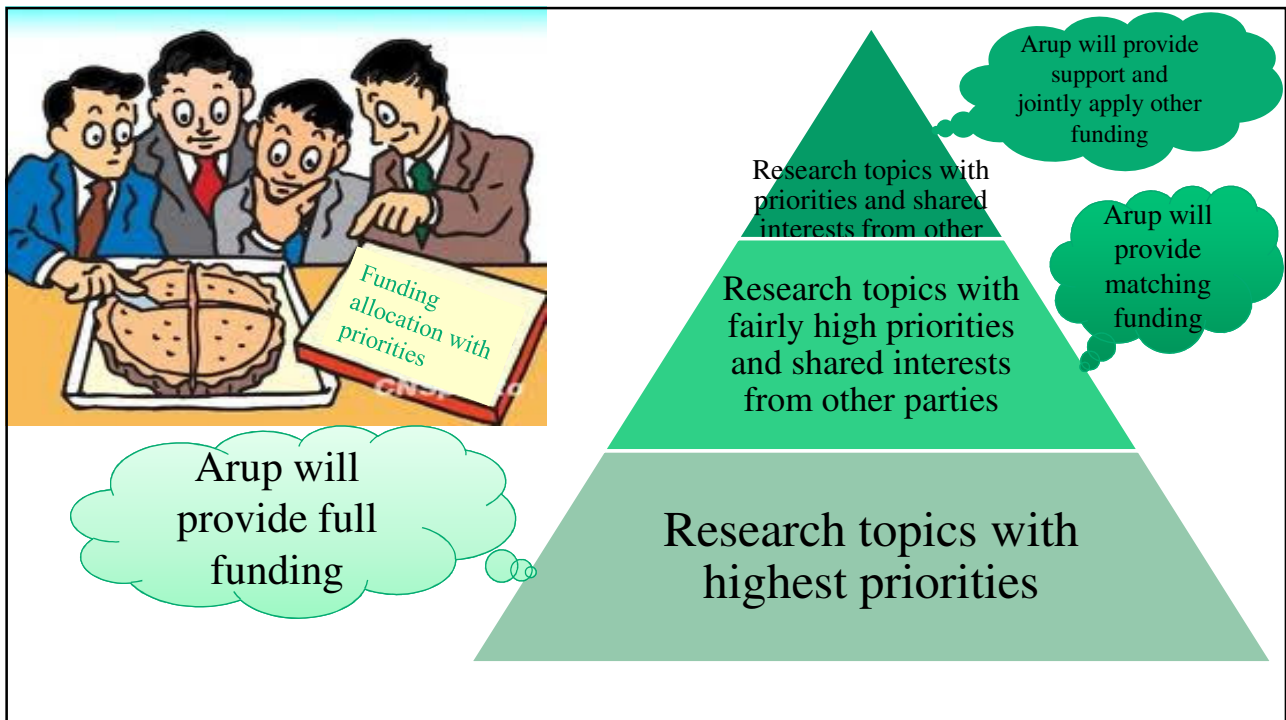
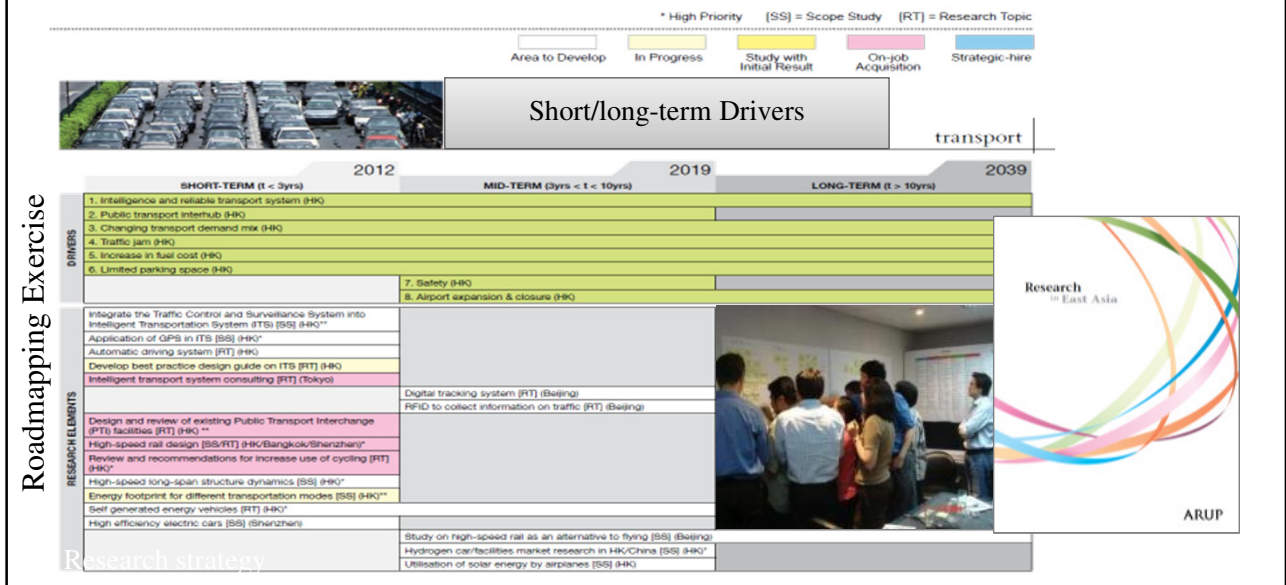
Energy	Urbanisation	Water	Waste	Humanities
Climate Change	Design tools	Risk & Disaster	Transport	Resources

East Asia Research Roadmap: 2013

City Infrastructure	Urban Resilience	Energy & Resources	Evolving Technologies	Intelligent & Efficient Systems	Social & Economic Impacts

Research roadmapping

Drivers, Business Opportunities, and Research Elements



Research partners: maximizing co-benefits



A successful example

- Research title: Damped outrigger concept for tall buildings
- Research aim: verify the compliance of Arup damped outrigger concept to the Chinese standards through laboratory test
- Research partner: Guangzhou University, China

Why succeeded?

- Approaching the right partner and solving challenges well;
- Very well applications of research results (e.g. direct application in Arup projects), and helping Arup keep leading position in this field;



Project Collaborations

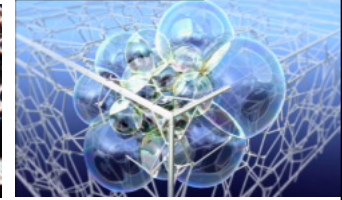
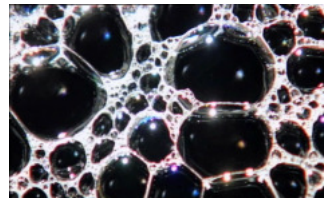
- Collaboration with external partners
- Multi-disciplinary skills



Collaboration Parties

- Arup
- PTW Architects
- China State Construction Engineering Corporation (CSCEC)
- China State Construction International Shenzhen Design Consulting Co

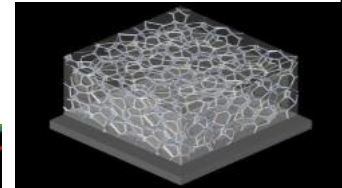
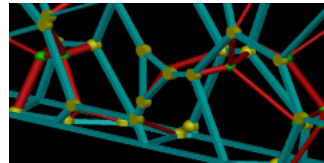
Case Example – Water Cube



Concept & Design

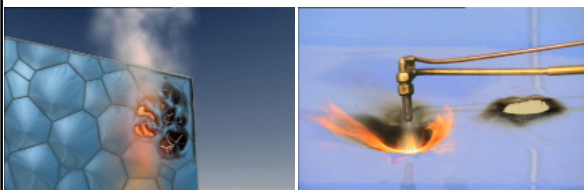
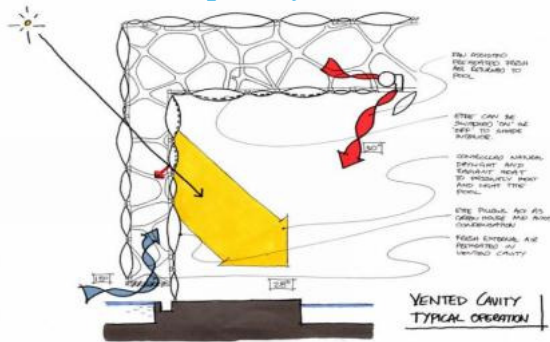
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Structure



Project Collaborations

- Collaboration with external partners
- Multi-disciplinary skills



Case Example – Water Cube

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Sustainability

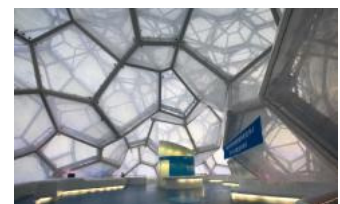
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Fire Engineering



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Construction Management



Technical forums: knowledge sharing



Tongji U- Nov. 2011

HKUST- March 2012

South China University of Technology - Sept. 2012

Shenzhen U - Dec. 2013

Student visit (South China University of Technology) : knowledge dissemination



In Arup HK

Tolo Highway

HK-Macao-Zhuhai Bridge

HATs-2a

What

- MoU
- Strategic Partners
- Joint research
- Challenges

Strategic partners: exploring broadly

Memorandum of Understanding concerning International Collaboration on Sustainability Research, including Institutes for Sustainability in London and Shanghai

2009

Signatories: Thames Gateway Institute for Sustainability, Tongji University and Arup

Memorandum of Understanding between Arup and University of Nottingham at Ningbo, China concerning Collaboration on Engineering Research and Professional Development

Signatories: University of Nottingham at Ningbo and Arup

2011



华南理工大学
South China University of Technology

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关于共同申请国际和国家基金开展能源和环境领域科技创新活动的合作备忘录

April 2013

March 2013

签署方:

河南省科技厅对外科技交流中心, 郑州市花园路 27 号

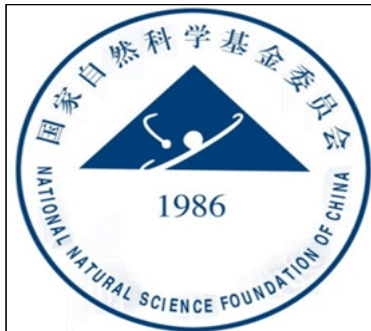
英国奥雅纳(香港)公司, 中国香港, 九龙塘, 达之路 80 号,

又一城 5 楼

MEMORANDUM OF UNDERSTANDING

Strategic partners: exploring broadly

Joint research applications towards external funding: keep mind open under funding bodies in China and International Collaboration Programmes



中华人民共和国科学技术部

Ministry of Science and Technology of the People's Republic of China



中华人民共和国国家发展和改革委员会

National Development and Reform Commission



中华人民共和国住房和城乡建设部

Ministry of Housing and Urban-Rural Development of the People's Republic of China (MOHURD)



上海科技

上海市科学技术委员会主办
www.stcsm.gov.cn



国家能源局

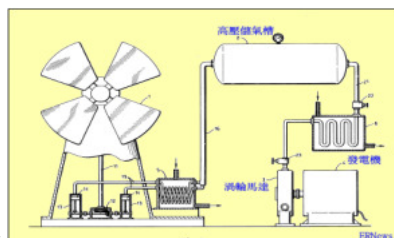
National Energy Administration

Other National and International Funding Bodies and various Foundations

Strategic partners: examples of exploring broadly

Joint research applications towards external funding under MoU

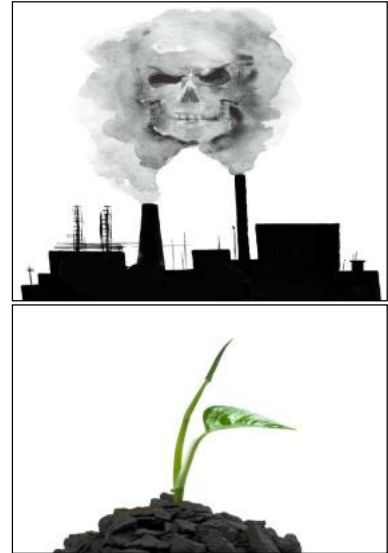
- **Research partner:** Dr Xin Yuan and Prof. Xuefei Shi, Tongji U
- **Research title:** designing bridge energy self-sufficiency system
- **Funding budget:** 200,000 RMB
- **Funding body:** Guang Hua Foundation, Tongji U, Shanghai
- **Brief:** considering various energy demands during bridge operation and different types of renewable energy, developing bridge energy self-sufficiency system and making life cycle analysis



Strategic partners: examples of exploring broadly

Joint research applications towards external funding under MoU

- **Research partner:** Prof Ruiqin Zhang, University of Zhengzhou, Henan
- **Research title:** High tech Henan - Winning carbon savings and air pollution from upgraded industrial policy and practice in the 13th Five Year Plan
- **Funding budget:** 1,200,000 RMB in total
- **Funding body:** half provided by UK's Strategic Programme Fund (SPF) Programme for China Prosperity; another half by Henan Development and Reform Commission (DRC);
- **Brief:** Clearly identify the goal of Henan Province's industrial restructuring for the year 2020, with a comprehensive and effective proposal for the de-carbonisation, clean air and industrial restructuring strategy for the province



Strategic partners: examples of exploring broadly

Joint research applications towards external funding under MoU

- **Research partner:** Prof Shifu Wang, South China University of Technology, Guang Dong
- **Research title:** exploring business framework for smart city in future
- **Funding budget:** 80,000 RMB (to be confirmed)
- **Funding body:** Open call – National Building Key Lab 2015;
- **Brief:** reviewing current business framework of smart city, discuss different industries matching with different types of framework, connecting the practices of Smart Guangzhou and proposing future business framework with challenges and timeline.



Strategic partners: examples of exploring broadly

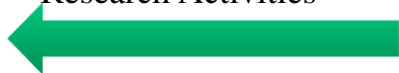
Joint research applications towards external funding: global collaboration

- **Research partner:** London School of Hygiene & Tropical Medicine, UCL, Peking University etc.
- **Research title:** PURGE ----->
- **Funding budget:** around 35 million RMB
- **Funding body:** Seventh Framework Programme (FP7), EU
- **Brief:** the PURGE project aims to add further evidence in this area by developing methods to quantify the positive and negative impacts on health and wellbeing of GHG reduction strategies in urban areas of Europe, China and India, so as to inform policy decisions in such areas as energy, housing/built environment, transport, and food.



China's R&D Funding Structure

Government-led Research Activities



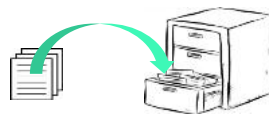
Sponsors:

↳ **Government**
Professional associations
Research Institutes

↳ **Inefficient** productivity transformation from research outcomes

↳ **Strong** influence on policy and industry development

↳ International cooperation through **intergovernmental** agreement



Non-Government-led Research Activities



Sponsors:

↳ **Non-government foundations**
Non-profit organizations
Corporations

↳ **Efficient** productivity transformation from research outcomes

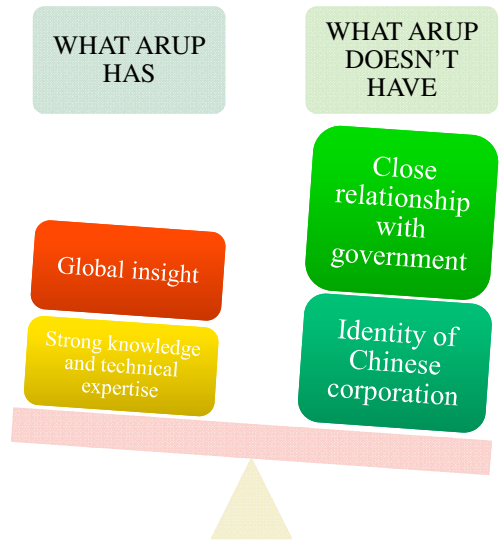
↳ **Weak** influence on policy and industry development

↳ International cooperation through **private** activities



Not Always Successful

An invisible barrier to enter Chinese government-led research activity



Best-case Scenario

