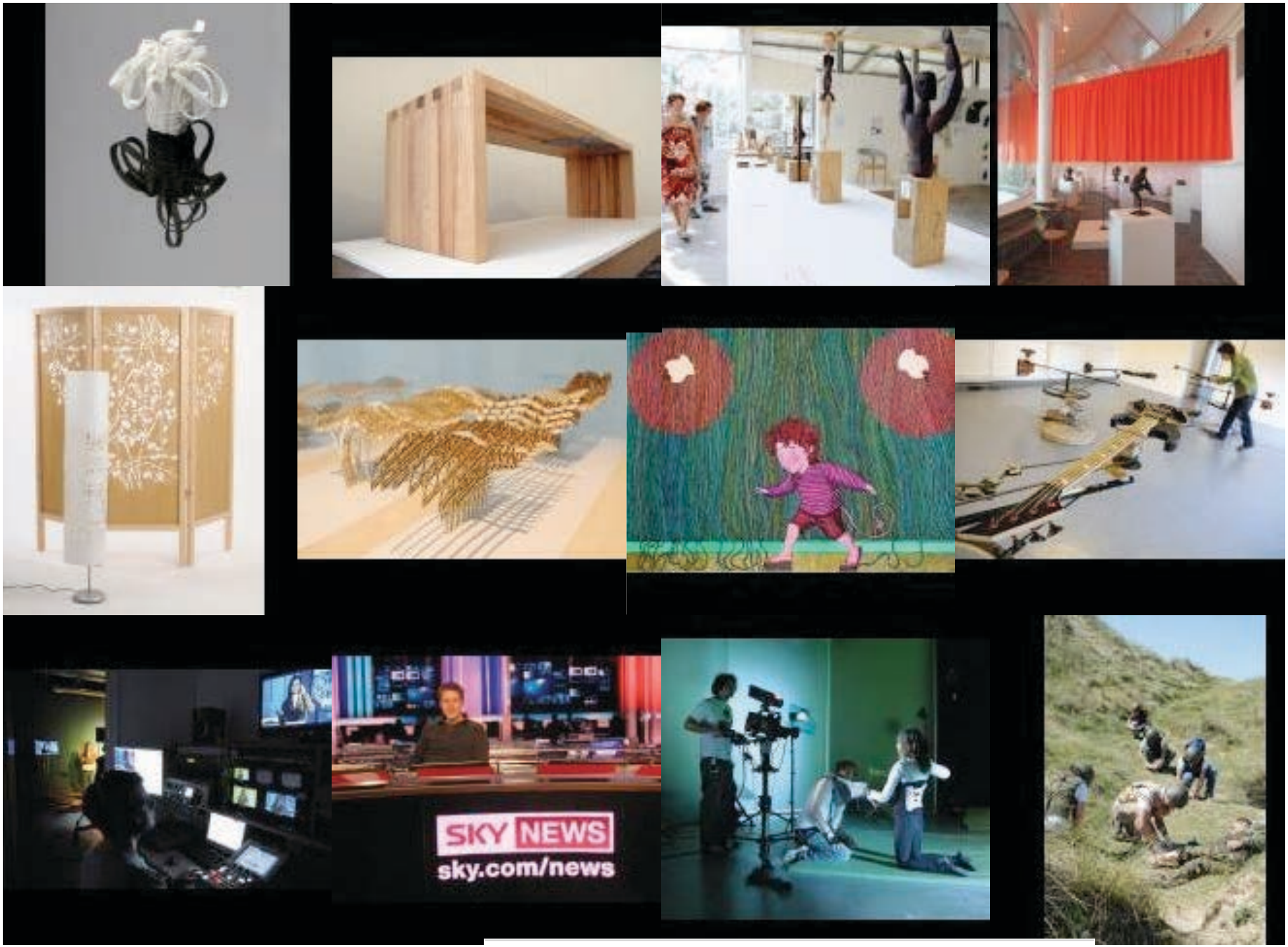
Smart technologies and systems as drivers for economic growth and social improvement in Cornwall

Assoc Prof **David Hawkins**
Associate Dean (Research and Innovation)
Falmouth University

European Regional Development Fund
Investing in your Future
European Union
European Social Fund
Investing in jobs and skills
convergence
for economic transformation
Falmouth University

Research and Practice

- Specialist University College with a full range of courses across Art, Design, Media and Performance
- Research themes within the Academy for Research and Innovation of Sustainable Design and Digital Economy
- Current research projects include: Superfast Broadband, Digital Manufacturing, Smart Buildings, Sustainable Transport, Health and Well-being, Digital Crafts, Design Agency, University of the Village
- Located in the far South West of the UK with mining heritage, strong tourism and marine industries, relative geographical isolation, good natural resources, limited industrial capacity

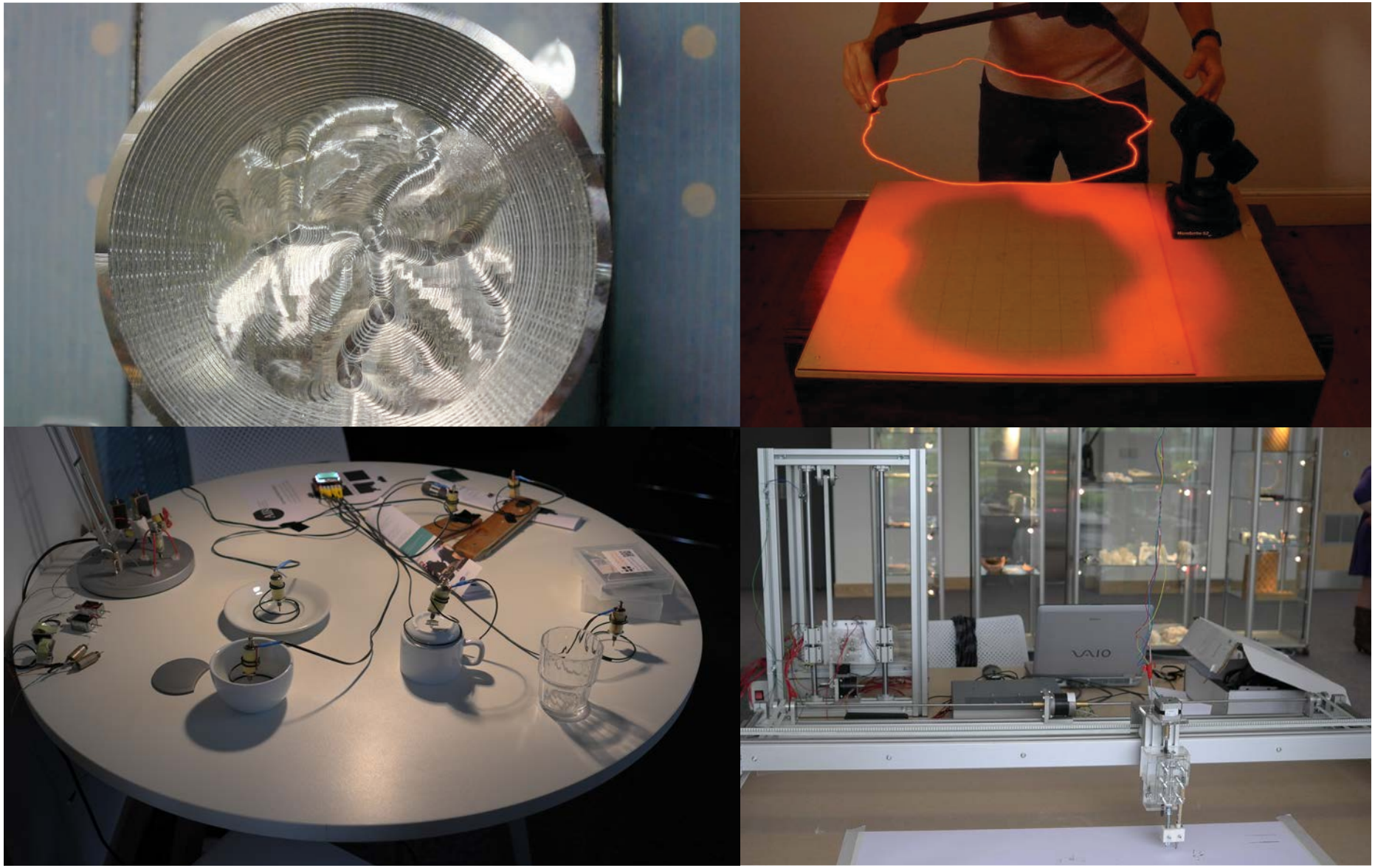


European Regional Development Fund
Investing in your Future

European Union
European Social Fund
Investing in jobs and skills

convergence
for economic transformation

Falmouth University



5-axis milling, Hacker Space, Mechanical Drawing, etc. as part of digital manufacturing network

European Regional Development Fund
Investing in your Future

European Union
European Social Fund
Investing in jobs and skills

convergence
for economic transformation

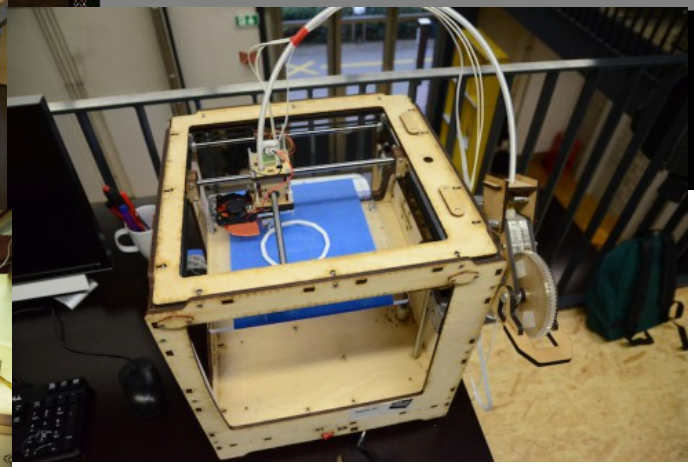
Falmouth University

Fab Foundation

search...

MAIN MENU

- Home
- Fab Charter
- Fablabs
- Fab Academy
- Forum
- Fablab Projects
- Contacts
- Links
- Login



FABLAB NETWORK

FabCentral

FABWIKI

/fablab

Fab Lab Bcn

Fab Lab
Innovation Center Iceland

ARO Fablab
KENYA WEST

European Regional Development Fund
Investing in your Future

European Union
European Social Fund
Investing in jobs and skills

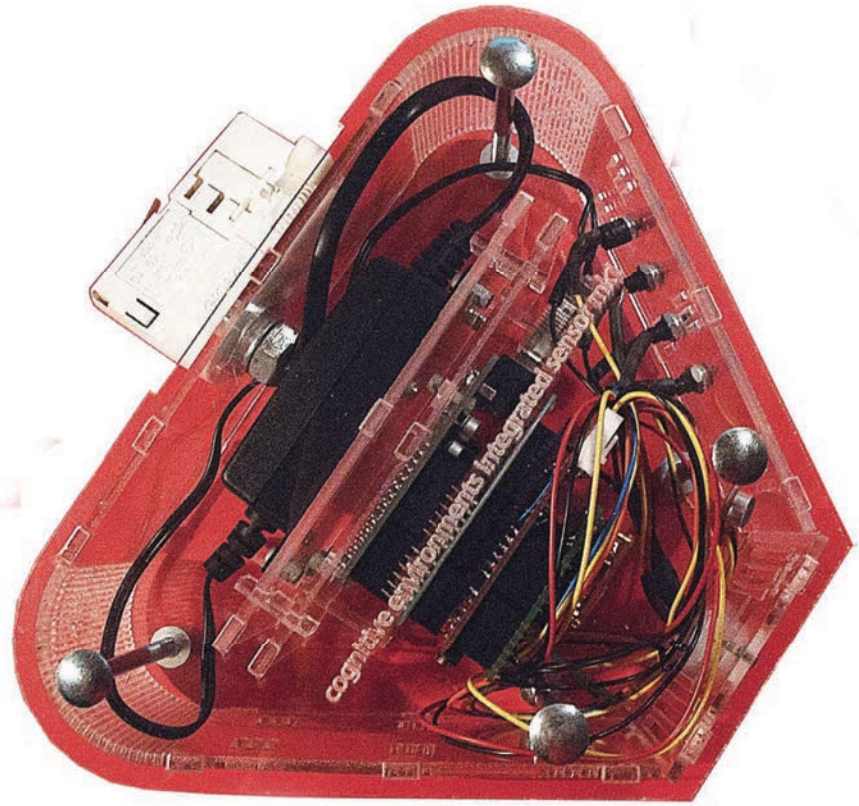
convergence
for economic transformation

Falmouth University

Cognitively Enabled Built Environments

Ian Biscoe (PhD Researcher)
ib144197@falmouth.ac.uk
cognitiveenvironments.wordpress.com

Can the embedding of ubiquitous computing technology into architectural practice and the fabric of the built environment deliver measured improvements in usability, comfort and efficiency?



Bee Research Facility

Darkroom environment for natural observation of honey bees
Engineered timber structure with sensing/computing in fabric
Transparent beehives with integrated sensors
All aspects of bee activity and human observation recorded
PhD Research : architecture/ubiquitous computing test bed

Integrated Wireless Sensor Unit

Environment & Occupant Sensing for PhD Research
Monitors: CO2, Temperature, Humidity, Ambient Light
Audio Levels / Spectrum Analyzer
Area Movement (PIR)
ZigBee 802.15.4 wireless network : configuration/reporting
Mounts directly to industry standard 3-rail lighting tracks

European Regional Development Fund
Investing in your Future
European Union
European Social Fund
Investing in jobs and skills
convergence
for economic transformation

Falmouth University

HEAD CAST LAB

ANIMATION | BROADCAST

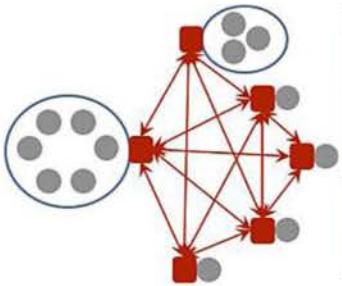
Remote operation of digital animation characters over Superfast Broadband for real-time performance capture and broadcast

Superfast Broadband

Vconect

"Vconect: enabling the best quality of experience for ad hoc video communication between groups."

- Service-aware network
- Smart mediation
- Seamless with social networking
- Interactive telepresence for performance



Headcast Lab
Tremough Innovation Centre,
Tremough Campus, Penryn, Cornwall TR10 9TA
www.headcastlab.tv

Vconect is a project within the Seventh Framework Programme (FP7) and receives funding from the European (FP7/2007-2013) under grant

European Regional Development Fund
Investing in your Future
European Union
European Social Fund
Investing in jobs and skills
convergence
for economic transformation
Falmouth University
COOPERATION

Wadebridge Renewable Energy Network
investing the benefits of Renewable energy within the locality

WREN

European Regional Development Fund
Investing in your Future

European Union
European Social Fund
Investing in jobs and skills

convergence
for economic transformation

Falmouth University

Green Cornwall Executive

Smart Cornwall Steering Group

-LEP member (Chair)
-Green Cornwall
-CC Natural Resources
-Community Group
-WPD
-Smart Grid GB
-Academic

Support
Jonathan Adey
(Programme lead)
Independent Consultant

Soft Market Testing Expert Group
Private sector reps

Delivery

Public Sector

Communities

Private Sector

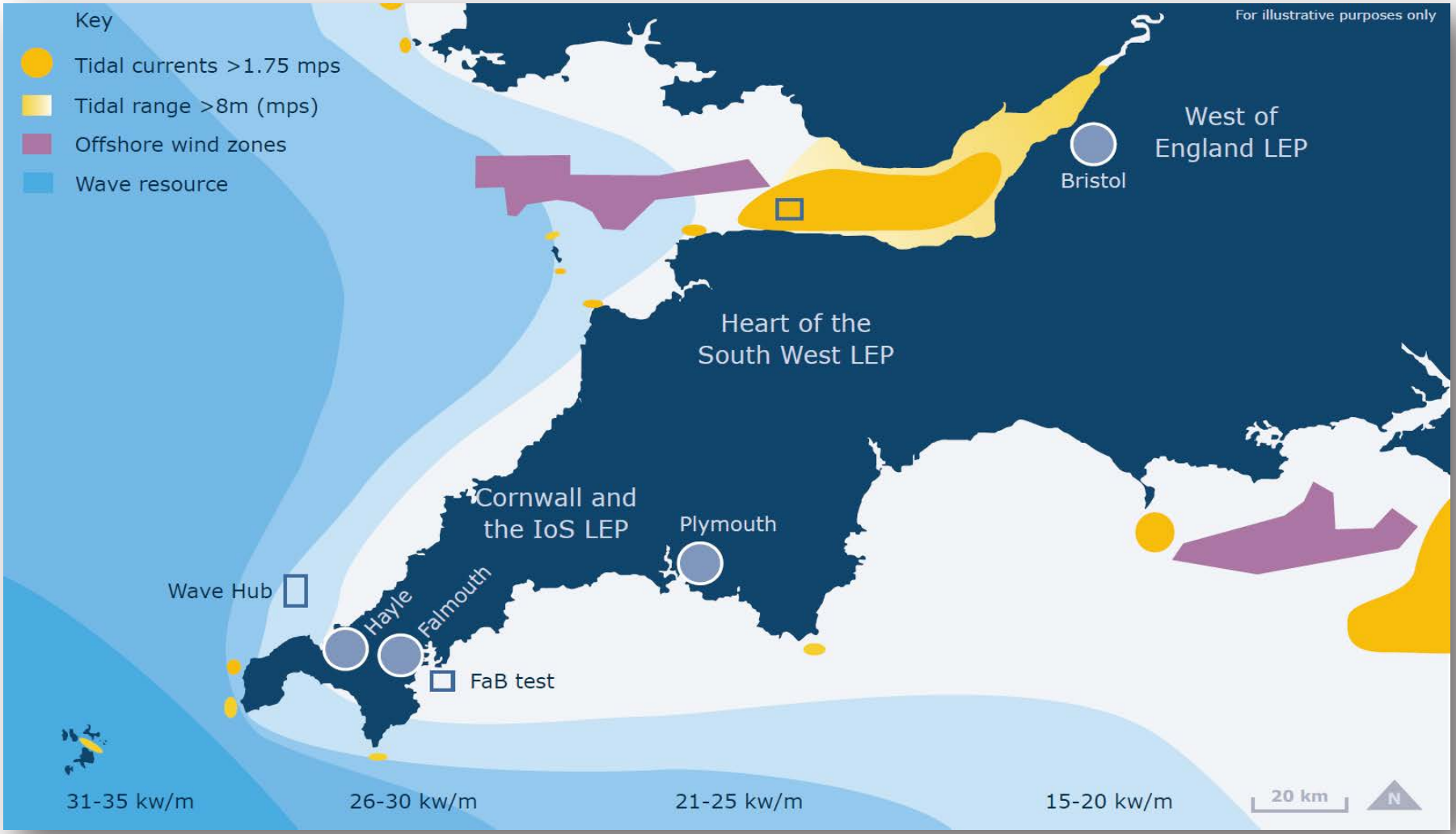
European Regional Development Fund
Investing in your Future

European Union
European Social Fund
Investing in jobs and skills

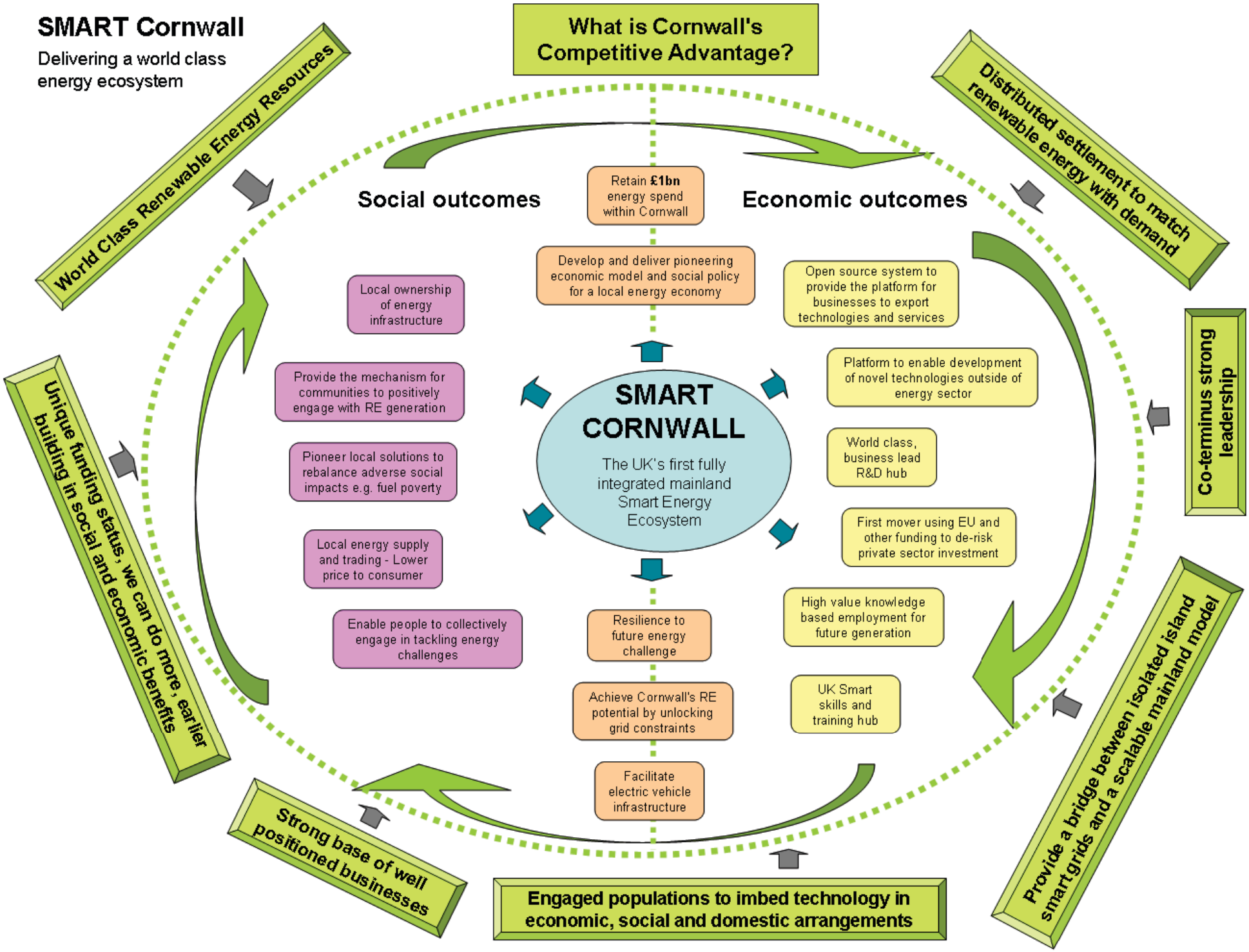
convergence
for economic transformation

Falmouth University

Marine Renewables



European Regional Development Fund Investing in your Future
European Union European Social Fund Investing in jobs and skills
convergence for economic transformation

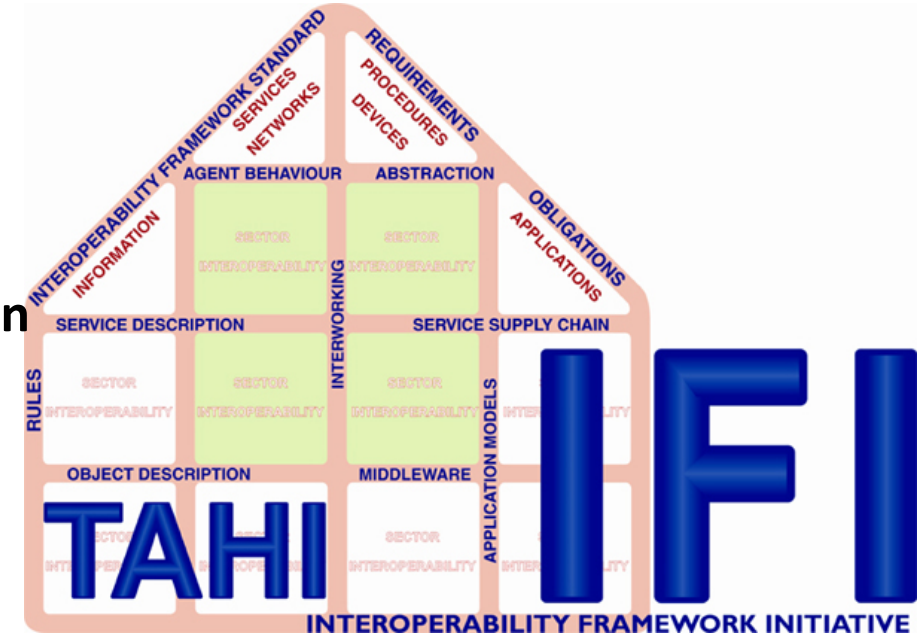

SMART Cornwall
Delivering a world class energy ecosystem
What is Cornwall's Competitive Advantage?
World Class Renewable Energy Resources
Distributed settlement to match renewable energy with demand
Co-terminus strong leadership
Provide a bridge between isolated island smartgrids and a scalable mainland model
Engaged populations to imbed technology in economic, social and domestic arrangements
Strong base of well positioned businesses
Unique funding status; we can do more, earlier building in social and economic benefits
Social outcomes
Economic outcomes
Retain £1bn energy spend within Cornwall
Develop and deliver pioneering economic model and social policy for a local energy economy
Resilience to future energy challenge
Achieve Cornwall's RE potential by unlocking grid constraints
Facilitate electric vehicle infrastructure
Local ownership of energy infrastructure
Provide the mechanism for communities to positively engage with RE generation
Pioneer local solutions to rebalance adverse social impacts e.g. fuel poverty
Local energy supply and trading - Lower price to consumer
Enable people to collectively engage in tackling energy challenges
Open source system to provide the platform for businesses to export technologies and services
Platform to enable development of novel technologies outside of energy sector
World class, business lead R&D hub
First mover using EU and other funding to de-risk private sector investment
High value knowledge based employment for future generation
UK Smart skills and training hub
SMART CORNWALL
The UK's first fully integrated mainland Smart Energy Ecosystem

TAHI INTEROPERABILITY FOR SMART HOMES AND COMMUNITIES

European Standard for Interoperability in the home

- UK project team responsible for formulation of a **European Standard for Interoperability** in the home under **TAHI's Interoperability Framework Initiative (IFI)**
- Worked with a National Standards Body and created a **CENELEC Workshop Agreement (CWA)**
- CENELEC CWA: "**Interoperability framework requirements specification for service to the home (IFRS)**" (CWA 50560)

  – June 2010, Brussels
- In process towards full European Standard in 2012/13



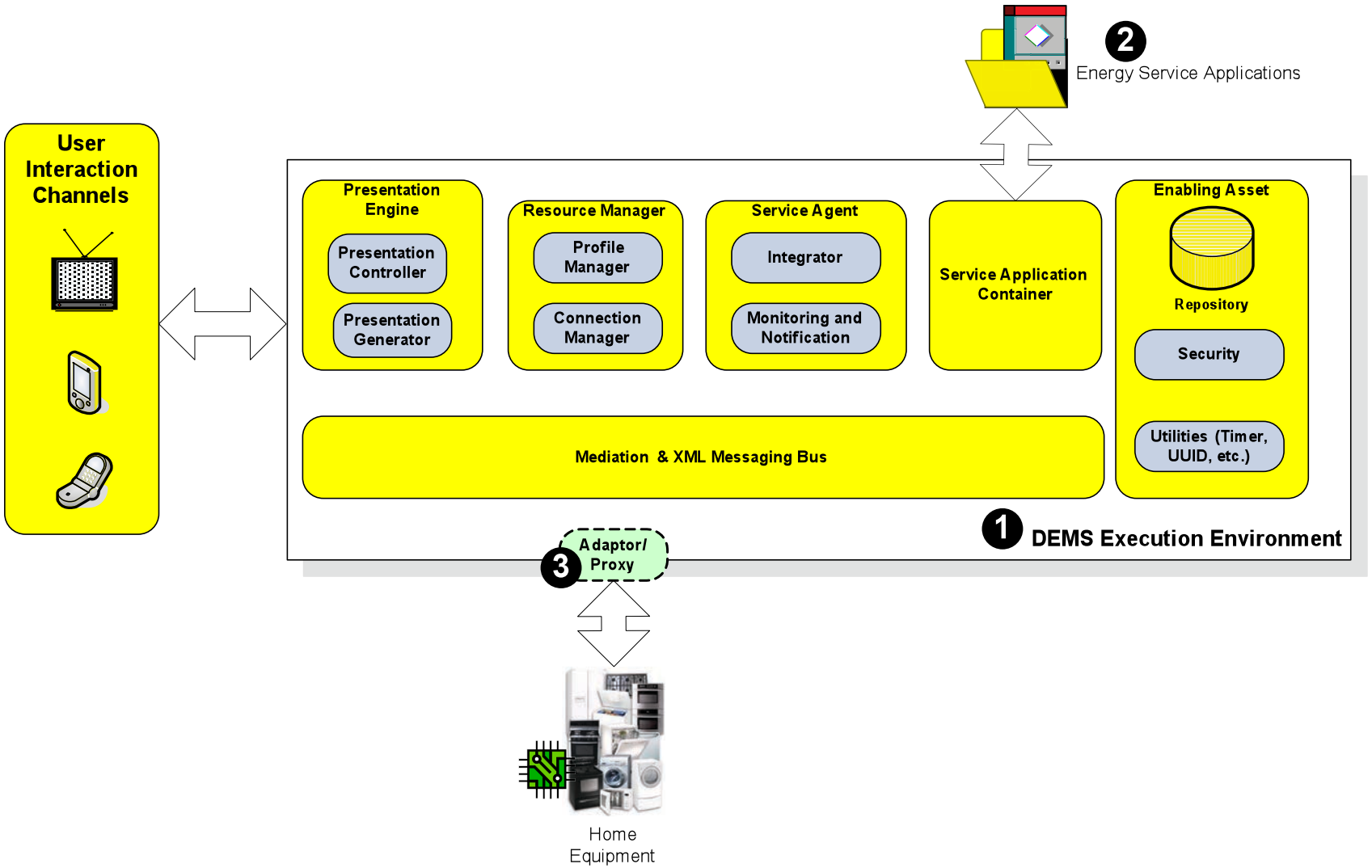
CENELEC
European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

European Regional Development Fund Investing in your Future
European Union European Social Fund Investing in jobs and skills
convergence for economic transformation

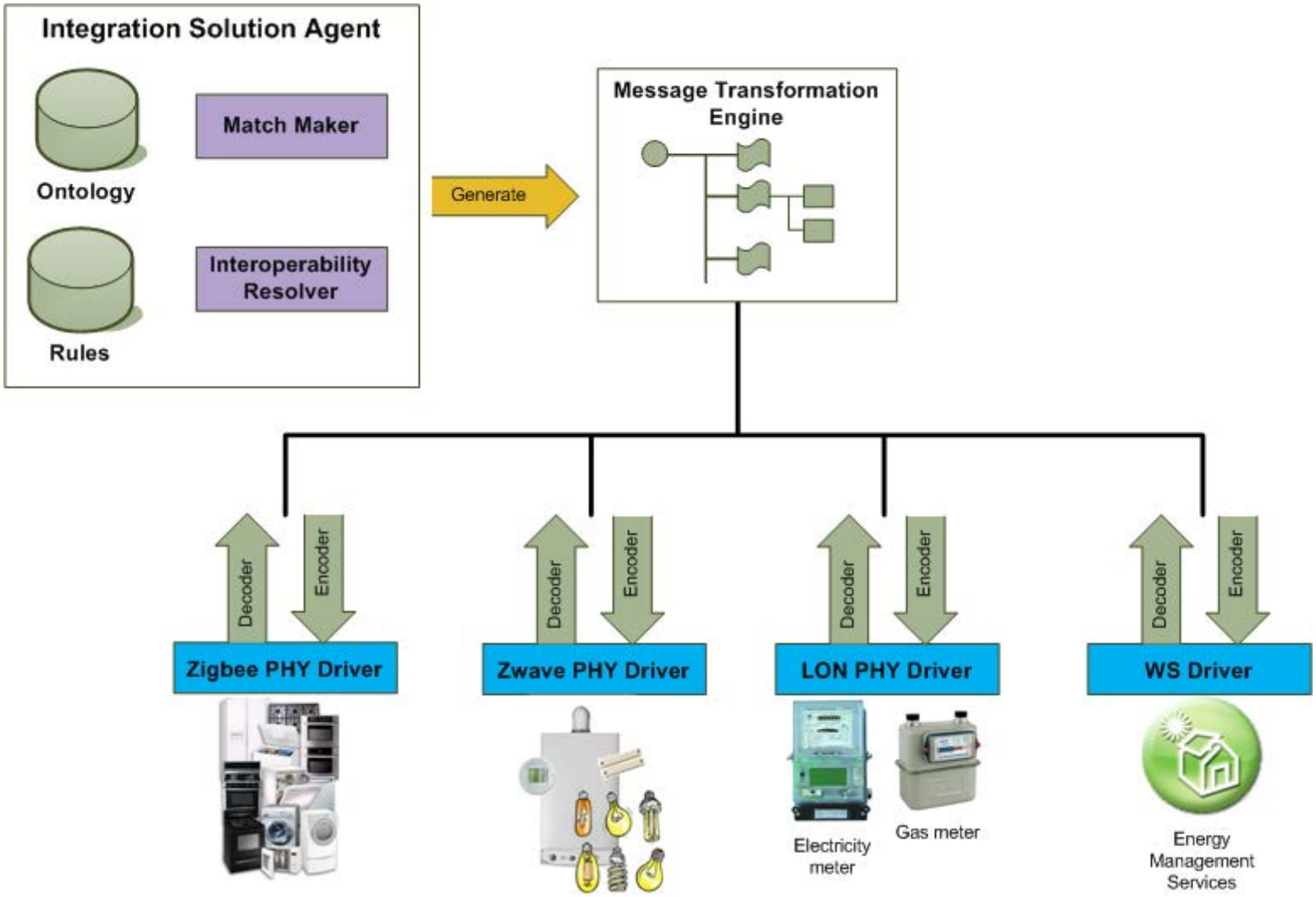
University College FALMOUTH

Smart Home Open Platform - Energy management 'services' trial



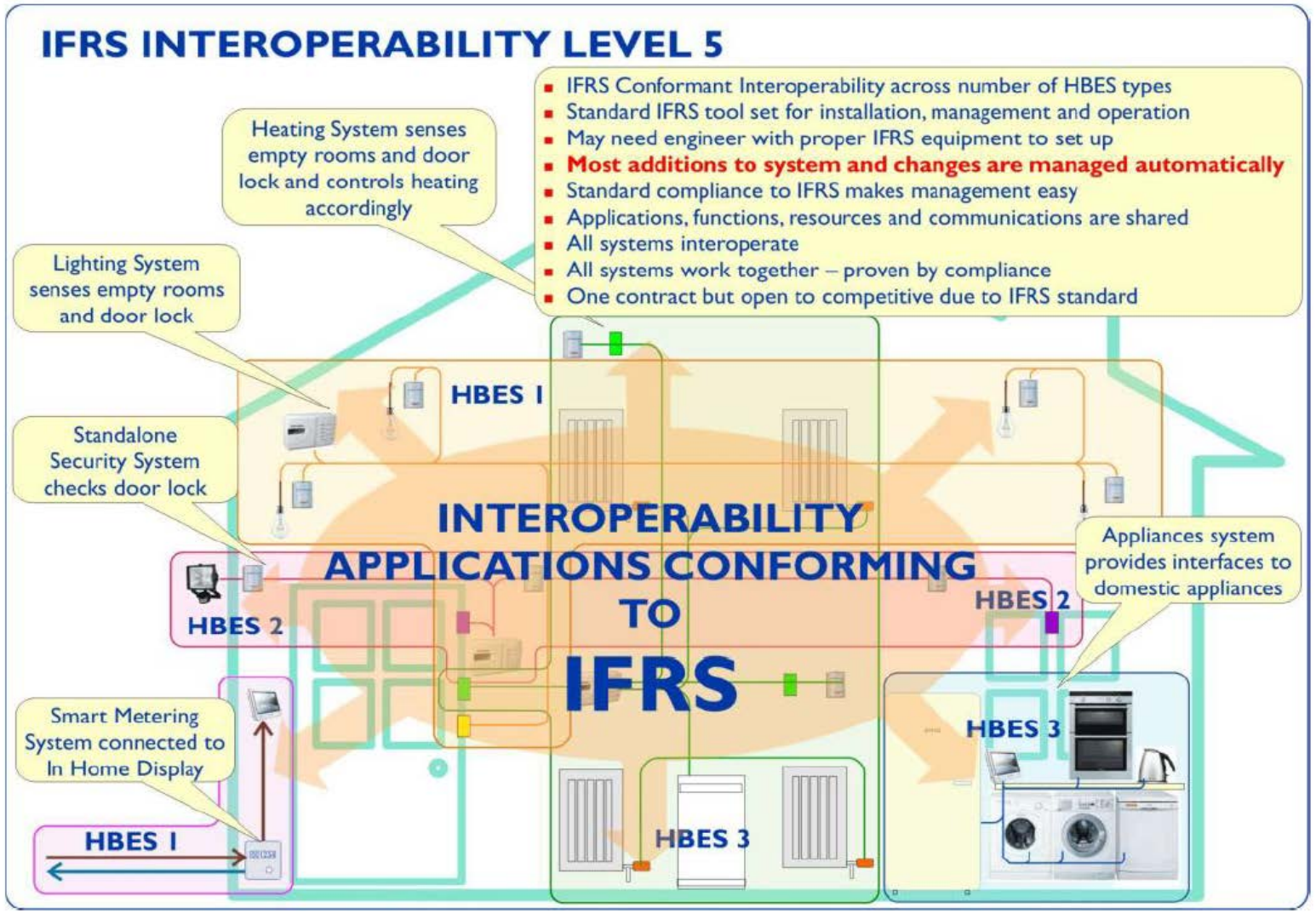
European Regional Development Fund Investing in your Future
European Union European Social Fund Investing in jobs and skills
convergence for economic transformation

Smart Home Open Platform - facilitating 'Interoperability

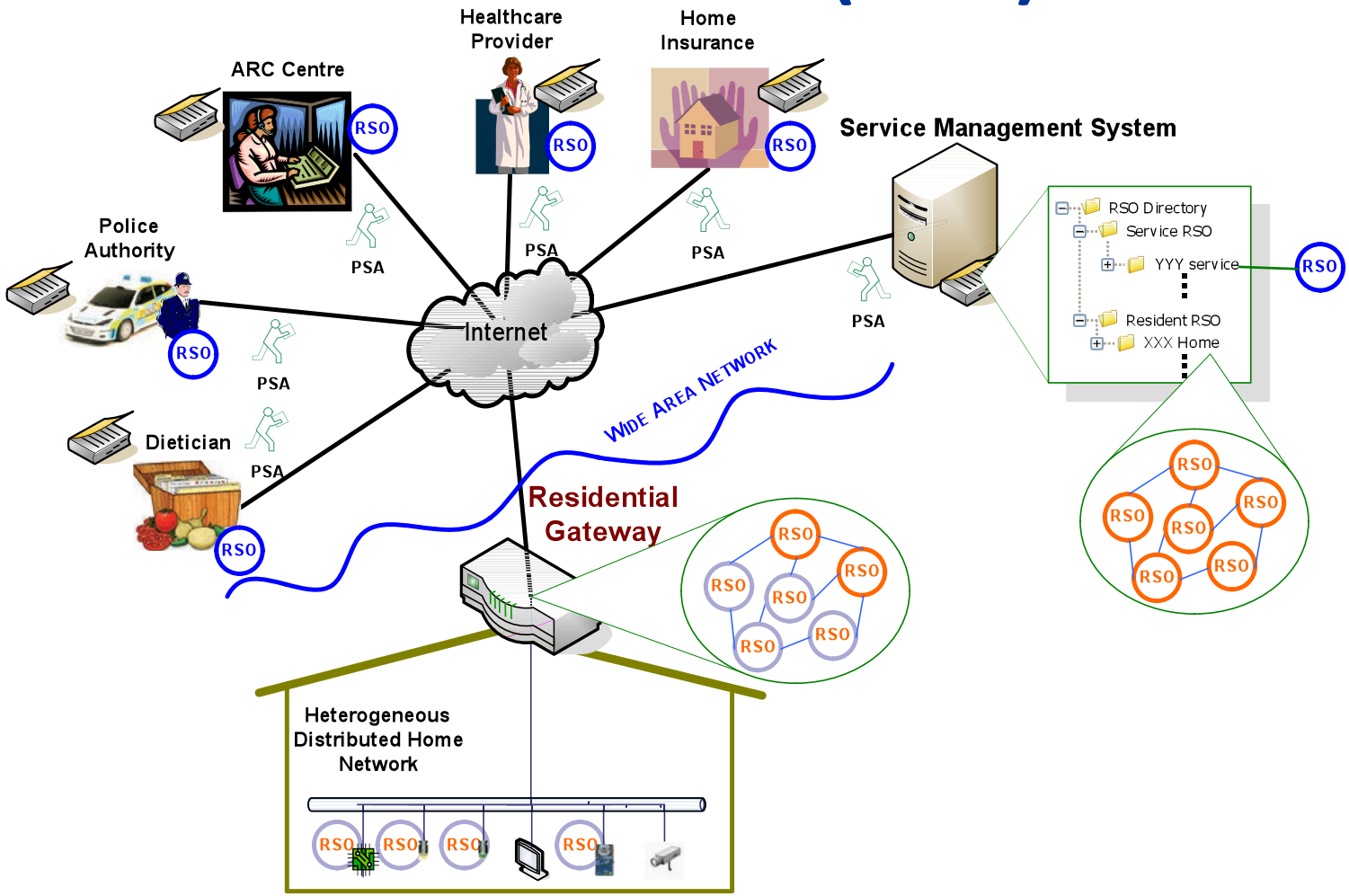


European Regional Development Fund
Investing in your Future
European Union
European Social Fund
Investing in jobs and skills
convergence
for economic transformation

Interoperability is ability of two or more networks, systems, devices, applications or components to exchange information between them and use the information so exchanged



TAHI OPEN ARCHITECTURE (TOA)



European Regional Development Fund
Investing in your Future
European Union
European Social Fund
Investing in jobs and skills
convergence
for economic transformation

University College Falmouth

EPSRC Engineering and Physical Sciences Research Council

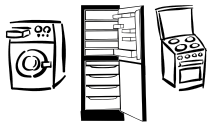
Technology Strategy Board
Driving Innovation

DEMS TRIAL

PHASE 1

Monitor consumption

PHASE 2



Install energy efficient appliances and boilers in each home

5 trial homes

3 test homes

Trial participant standard of living & lifestyle not affected

Monitor consumption

Commercially viable products

Knowledge

Monitor consumption

PHASE 3

Apply intelligence to further reduce energy consumption

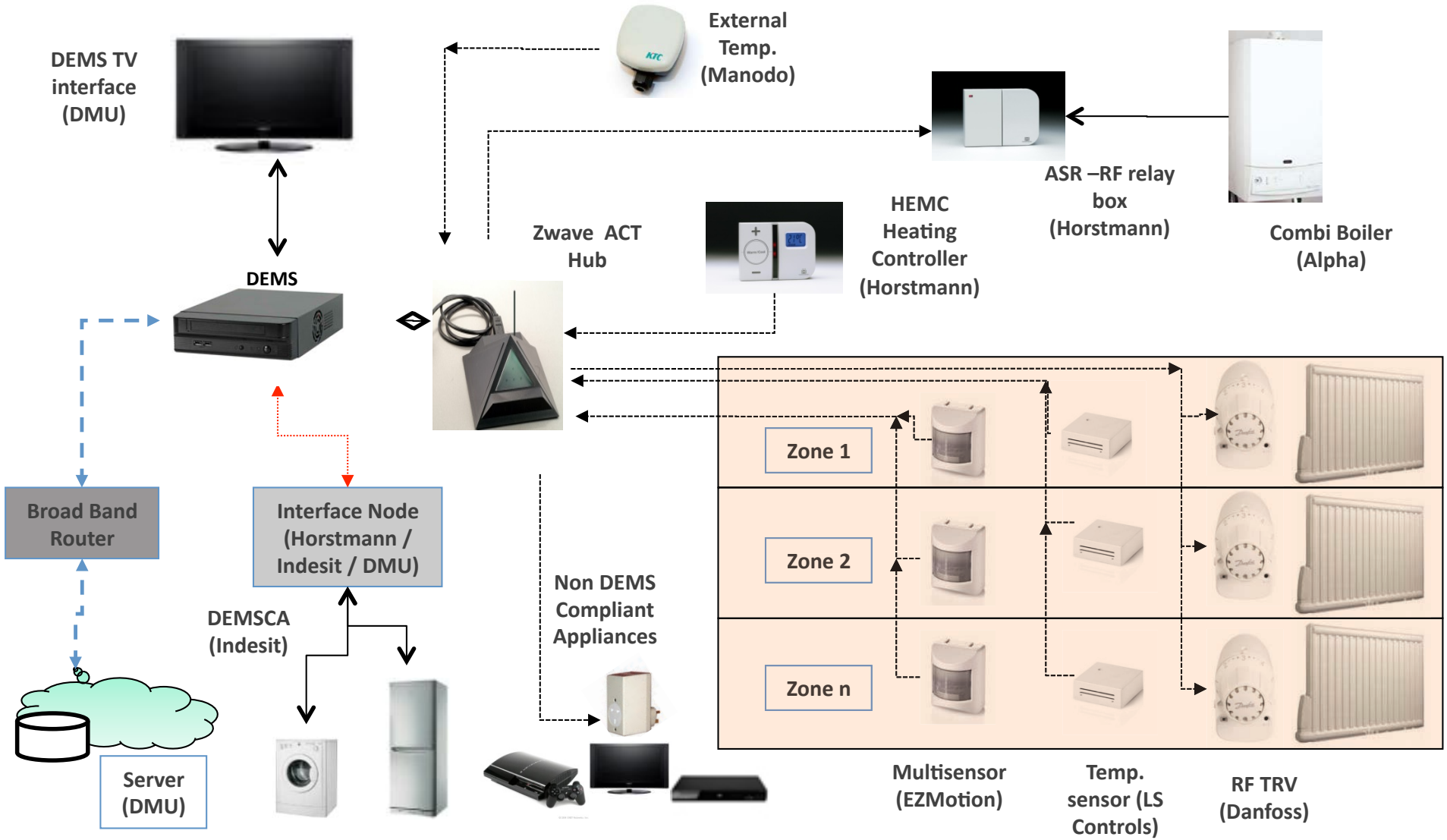
European Regional Development Fund
Investing in your Future

European Union
European Social Fund
Investing in jobs and skills

convergence
for economic transformation

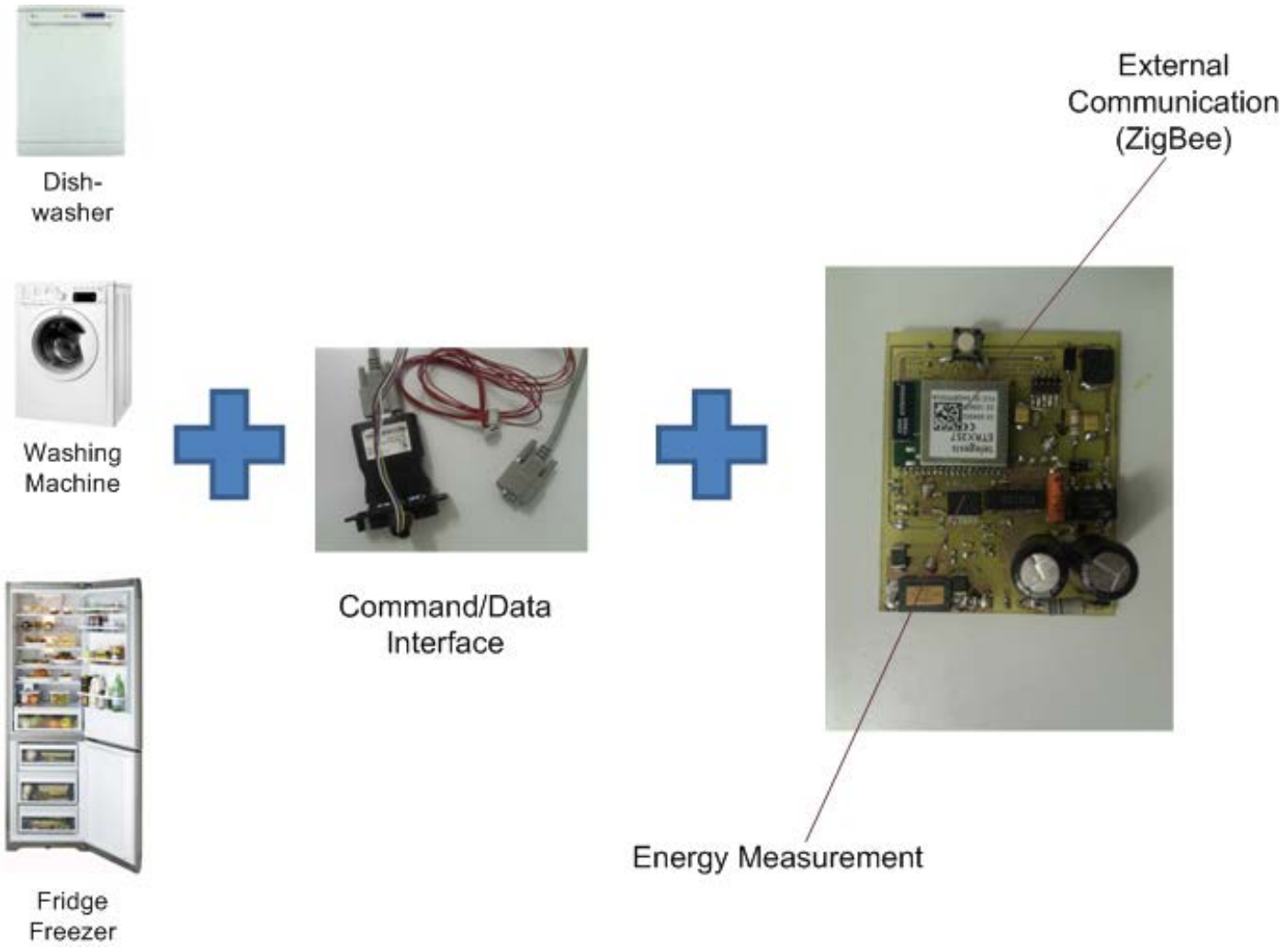
University College FALMOUTH

DEMS IMPLEMENTATION



European Regional Development Fund Investing in your Future
European Union European Social Fund Investing in jobs and skills
convergence for economic transformation

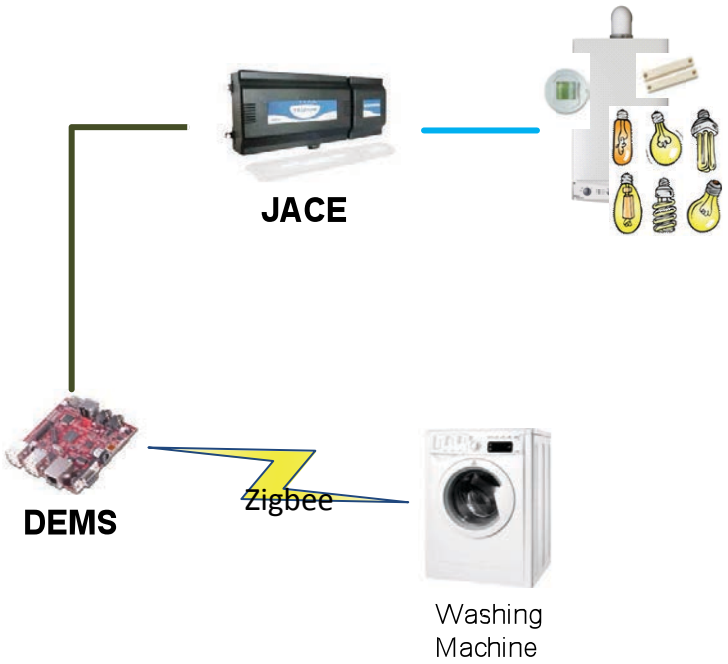
Smart appliance implementation



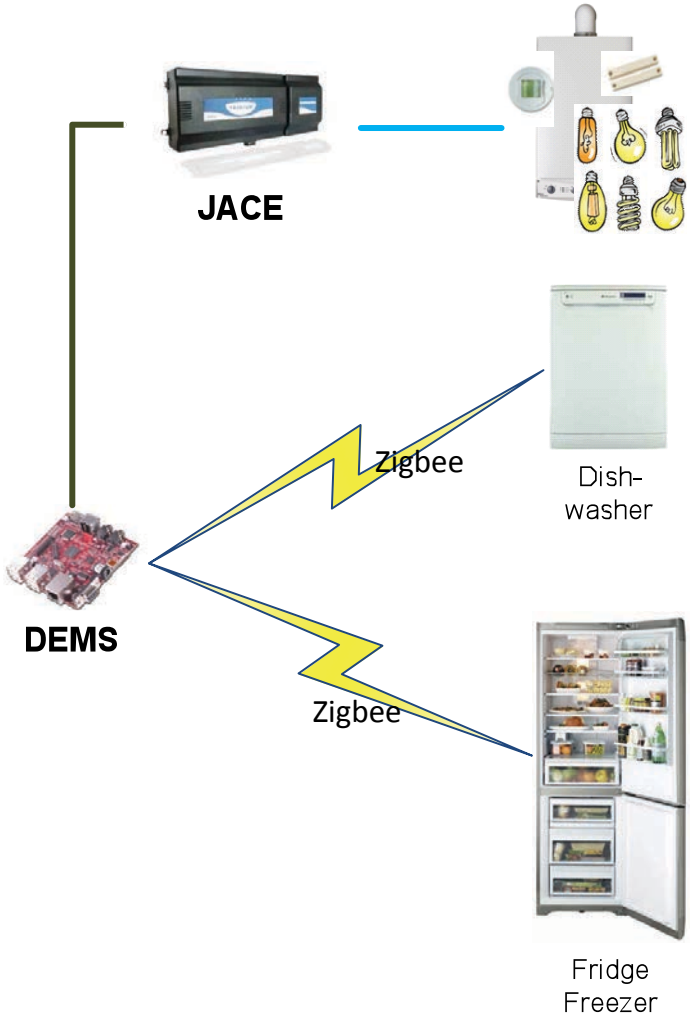
Demonstrator houses at BRE

University College FALMOUTH

Hanson EcoHouse



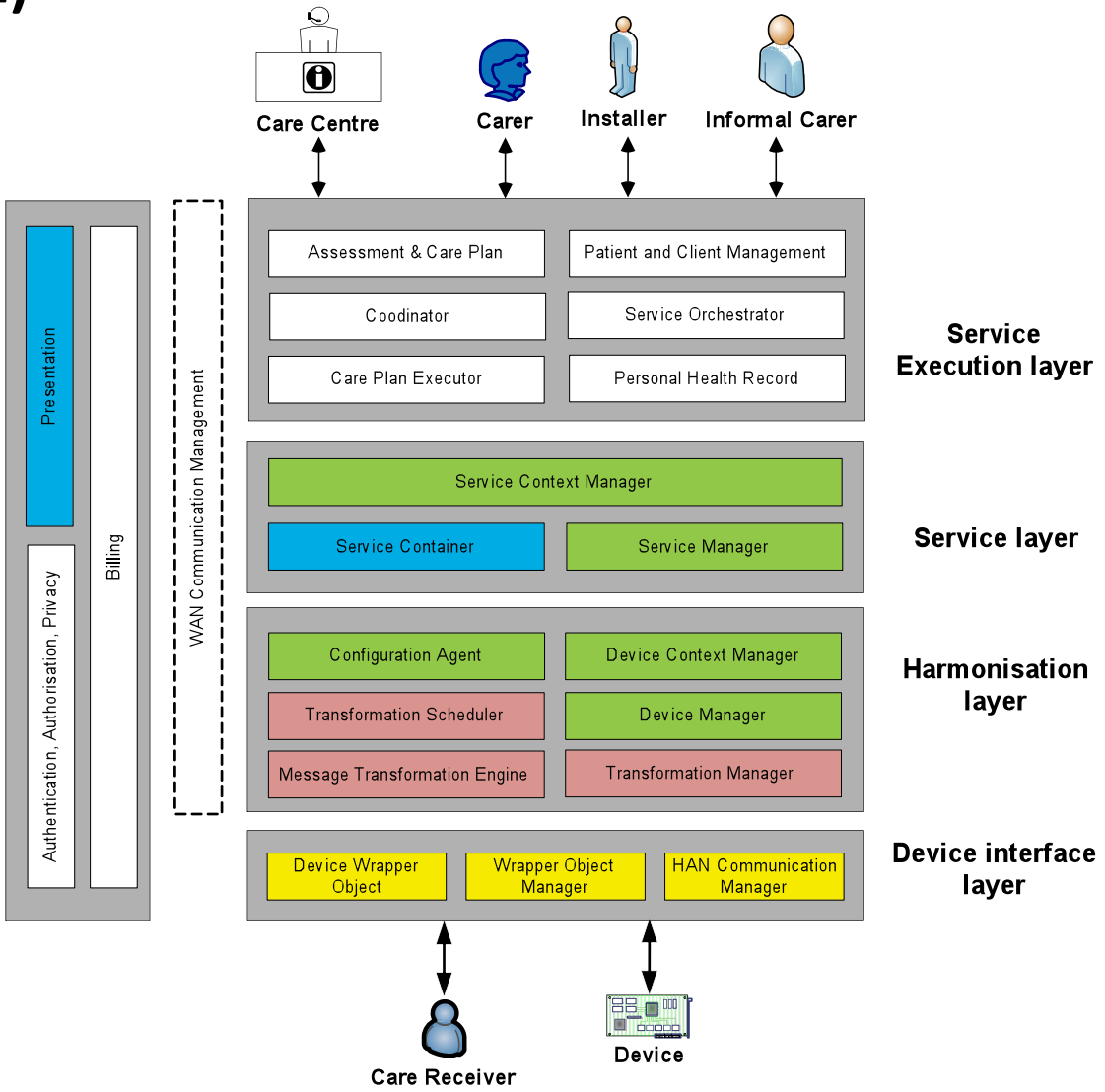
Visitor Centre



European Regional Development Fund
Investing in your Future
European Union
European Social Fund
Investing in jobs and skills
convergence
for economic transformation

SMART HOME OPEN PLATFORM CARE SERVICES TRIAL (ICARE)

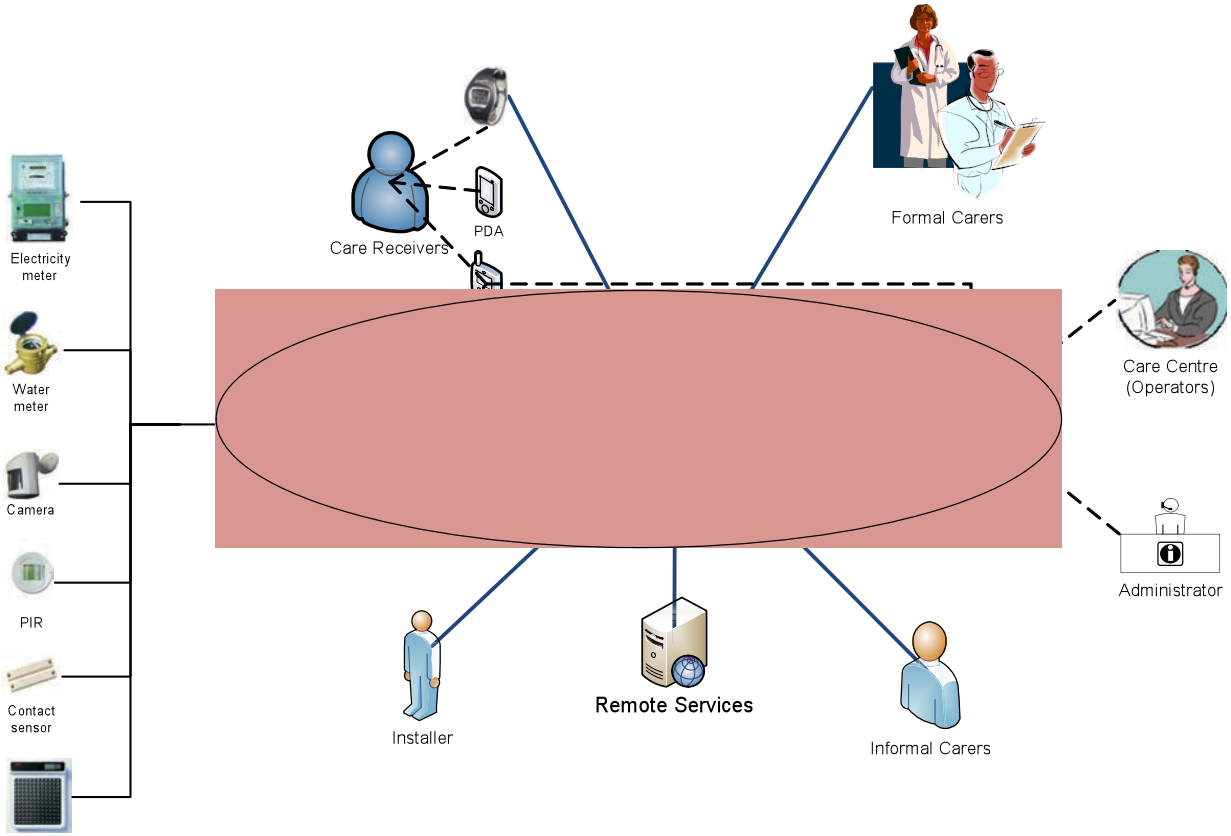
University College FALMOUTH



European Regional Development Fund Investing in your Future
European Union European Social Fund Investing in jobs and skills
convergence for economic transformation

University College FALMOUTH

iCARE Trial Structure



European Regional Development Fund
Investing in your Future
European Union
European Social Fund
Investing in jobs and skills
convergence
for economic transformation

What is Telecare?

- Offering remote care of elderly and physically less able people, providing the care and reassurance needed to allow them to remain living in their own homes. The use of sensors may be part of a package which can provide support for people with illnesses such as dementia, or people at risk of falling.
- Most telecare mitigates harm by reacting to untoward events and raising a help response quickly. Some telecare, such as safety confirmation and lifestyle monitoring have a preventive function in that a deterioration in the telecare user's wellbeing can be spotted at an early stage.
- Telecare is different from telemedicine and telehealth.

European Regional Development Fund
Investing in your Future
European Union
European Social Fund
Investing in jobs and skills
convergence
for economic transformation

Telecare Equipment Examples (1)

Bed occupancy sensor

Provides an early warning by alerting that the user has left their bed and not returned within a pre set time period, indicating a possible fall - can also be programmed to switch on lights, helping people find their way to and from bed easily.

Bogus caller button

When users are concerned about bogus callers or have already been a bogus caller victim. It is usually mounted on the inside of the front door or door frame. Can generate either silent or noisy alarm calls Monitoring centre can remind user to check visitor's ID. It can also be used as a fixed point panic button.

Carbon Monoxide (CO) detector

where there is a risk of a carbon monoxide e.g. blocked flue or fault in a fuel burning appliance. It detects carbon monoxide at relatively low levels. Particularly useful for when service users are sleeping downstairs.

Enuresis - night-time incontinence sensor

detects incontinence in bed. Consists of sensor mat located under the sheet and a control unit.

Epilepsy sensor

generates an alarm when tonic-clonic seizures are detected in bed. It consists of a sensor under the sheet and a controller.

European Regional Development Fund Investing in your Future
European Union European Social Fund Investing in jobs and skills
convergence for economic transformation

Telecare Equipment Examples (2)

Fall detector

automatically raises an alarm call when a fall is detected. Also has a manual activation button. It detects falls using a two stage detection process based on orientation and impact. It is worn on the body using a clip or via pouch and elasticated waist band. 100m range gives greater cover than a pendant. It can be useful in larger properties or farms.

Flood detector

provides early warning of potential floods, useful where forgetfulness is becoming an issue. Often placed under sink in bathroom

Gas detector

where there is concern that gas may be left on and not lit e.g. gas cooker. Mains powered detector detects gas and raises an alarm call.

Gas shut off solution

where there is risk of gas being left on, unlit and the need for the gas supply to be turned off. The solution detects gas, shuts off the supply (usually to the cooker) and raises an alarm call. Solution consists of control unit with key switch, shut off valve, natural gas detector and a radio transmitter. Particularly of benefit for those with cognitive impairments and as a solution works best when can be provided early, so maximising the benefits to the service user.

Telecare Equipment Examples (3)

Heat detector

Often used in Kitchens to detect fire .Generates an alarm call when high temperature (54O- 62OC) is detected. It may be a requirement for some landlords.

Medication dispenser

where there is a concern that a service user is forgetting to take their medication or is taking their medication inappropriately. Provides audible and visual alerts to the service user each time medication should be taken.
The dispenser has a 14 or 28 dose carousel. The dose compartments are larger for the 14 dose unit meaning more tablets can be put in each compartment. The unit can raise an alarm call if tablets are not taken.

Motion sensor (PIR)

Used either as part of an inactivity system, part of an intruder system, part of a virtual sensor, or as part of an Activities of Daily Living assessment tool (ADLife).

Minuet watch

designed for those who are reluctant to wear a traditional style personal pendant. It combines a watch and a personal pendant functions. Able to use own watch strap.
Discrete option for domestic violence cases

Telecare Equipment Examples (4)

Paging solutions

where there is a carer in the same property who will be able to respond to the alarm. It is also for the service user where usual forms of alarm indication are not suitable.
It consists of a pager with charger and vibrating pillow pad and an optional flashing beacon. If the call is not answered by the carer the call may be automatically sent to the monitoring centre.

Property exit sensor

where there is a risk that the user may exit the property at an inappropriate time of day. It raises a call if the user exits the property and doesn't return within a relatively short time period. It consists of controller wired to motion sensor and magnetic contacts.

Radio pullcord

fixed alarm call point. It can be strategically placed to provide the user with a convenient means of summoning help in an emergency. It can also be programmed to answer the phone.

Reminders

where a user just needs a prompt e.g. to be reminded to take their medication, lock their doors etc. It requires a Lifeline Connect+ and messages to be recorded, usually by family. Lifeline Connect says "reminder" and bleeps, the service user presses the green key to play the message.

Smoke detector

Smoke detectorUses - where additional assistance is required when smoke is detected. It provides both a local audible alert and raises an alarm call.
It is particularly suited for service users with issues over mobility and cognitive or sensory impairment.

Telemedicine

Telemedicine is the use of telecommunication and information technologies in order to provide clinical health care at a distance. It helps eliminate distance barriers and can improve access to medical services that would often not be consistently available in distant rural communities. It is also used to save lives in critical care and emergency situations.

European Regional Development Fund
Investing in your Future
European Union
European Social Fund
Investing in jobs and skills
convergence
for economic
transformation

Categories of Telemedicine

Telemedicine can be broken into three main categories: store-and-forward, remote monitoring and (real-time) interactive services.

- **Store-and-forward** telemedicine involves acquiring medical data (like medical images, biosignals etc.) and then transmitting this data to a doctor or medical specialist at a convenient time for assessment offline. It does not require the presence of both parties at the same time. Dermatology (cf: teledermatology), radiology, and pathology are common specialties that are conducive to asynchronous telemedicine.
- **Remote monitoring**, also known as self-monitoring or testing, enables medical professionals to monitor a patient remotely using various technological devices. This method is primarily used for managing chronic diseases or specific conditions, such as heart disease, diabetes mellitus, or asthma. These services can provide comparable health outcomes to traditional in-person patient encounters, supply greater satisfaction to patients, and may be cost-effective.
- **Interactive telemedicine** services provide real-time interactions between patient and provider, to include phone conversations, online communication and home visits. Many activities such as history review, physical examination, psychiatric evaluations and ophthalmology assessments can be conducted comparably to those done in traditional face-to-face visits. In addition, "clinician-interactive" telemedicine services may be less costly than in-person clinical visit

Telemedicine Examples

- **Telenursing** - the use of telecommunications and IT in order to provide nursing services whenever a large physical distance exists between patient and nurse, or between any number of nurses.
- **Telepharmacy** - providing pharmaceutical care to patients at remote locations where they may not have physical contact with pharmacists. It encompasses drug therapy monitoring, patient counseling, prior authorization, refill authorisation, monitoring formulary compliance with the aid of teleconferencing or videoconferencing.
- **Telerehabilitation** (or *e-rehabilitation*) is the delivery of rehabilitation services over telecommunication networks and the Internet. Most types of services fall into two categories: clinical assessment (the patient's functional abilities in his or her environment), and clinical therapy.
- **Telemedicine for trauma triage** - using telemedicine, trauma specialists can interact with personnel on the scene of a mass casualty or disaster situation, via the internet using mobile devices, to determine the severity of injuries.
- **Telemedicine for intensive care unit (ICU) rounds** - also being used in some trauma ICUs to reduce the spread of infections.

Specialist Care Delivery

- **Telecardiology** ECGs, or electrocardiographs, can be transmitted using telephone and wireless.
- **Telepsychiatry** also utilises videoconferencing for patients residing in underserved areas to access psychiatric services. It offers wide range of services to the patients and providers, such as consultation between the psychiatrists, educational clinical programs, diagnosis and assessment, medication therapy management, and routine follow-up meetings.
- **Teleradiology** is the ability to send radiographic images (x-rays, CT, MR, PET/CT, SPECT/CT, MG, US...) from one location to another. high-speed broadband based Internet enables the use of new technologies for teleradiology: the image reviewer can now have access to distant servers in order to view an exam.
- **Telepathology** the transfer of image-rich pathology data between distant locations for the purposes of diagnosis, education, and research. including the rendering histopathology tissue diagnoses, at a distance.
- **Teledermatology** probably one of the most common applications of telemedicine and e-health used to exchange medical information (concerning skin conditions and tumours of the skin) over a distance using audio, visual and data communication.
- **Teledentistry** use of information technology and telecommunications for dental care, consultation, education, and public awareness.
- **Teleaudiology** to provide audiological services and may include the full scope of audiological practice.
- **Teleophthalmology** delivers eye care through digital medical equipment and telecommunications technology.
- **Telesurgery** bility for a doctor to perform surgery on a patient even though they are not physically in the same location. Remote surgery combines elements of robotics, cutting edge communication technology such as high-speed data connections and elements of management information systems.


Smart Green Utopia
스마트 그린 유토피아
주상복합건물
(지하형변전소)
Multipurpose Building
(Underground-type substation)
초전도케이블
Superconducting Cable
풍력발전단지
Wind Farm
지능형변전소
Intelligent Substation
스마트 팩토리
Smart Factory
태양광발전단지
PV Farm
전기에너지 주택
Electrical Energy Homes
원자력발전소
Nuclear Power Plant
전기자동차
Electric Vehicle
지열(히트펌프)
Geothermal Heat(Heat Pumps)
직류송전시스템(HVDC)
High-Voltage Direct Current
지능형전력망 자동복구
Self Healing

Integrated Solution from LS (Korea)

KT Control Room, Seoul

K-MEG, more detail

European Regional Development Fund
Investing in your Future
European Union
European Social Fund
Investing in jobs and skills
convergence
for economic
transformation

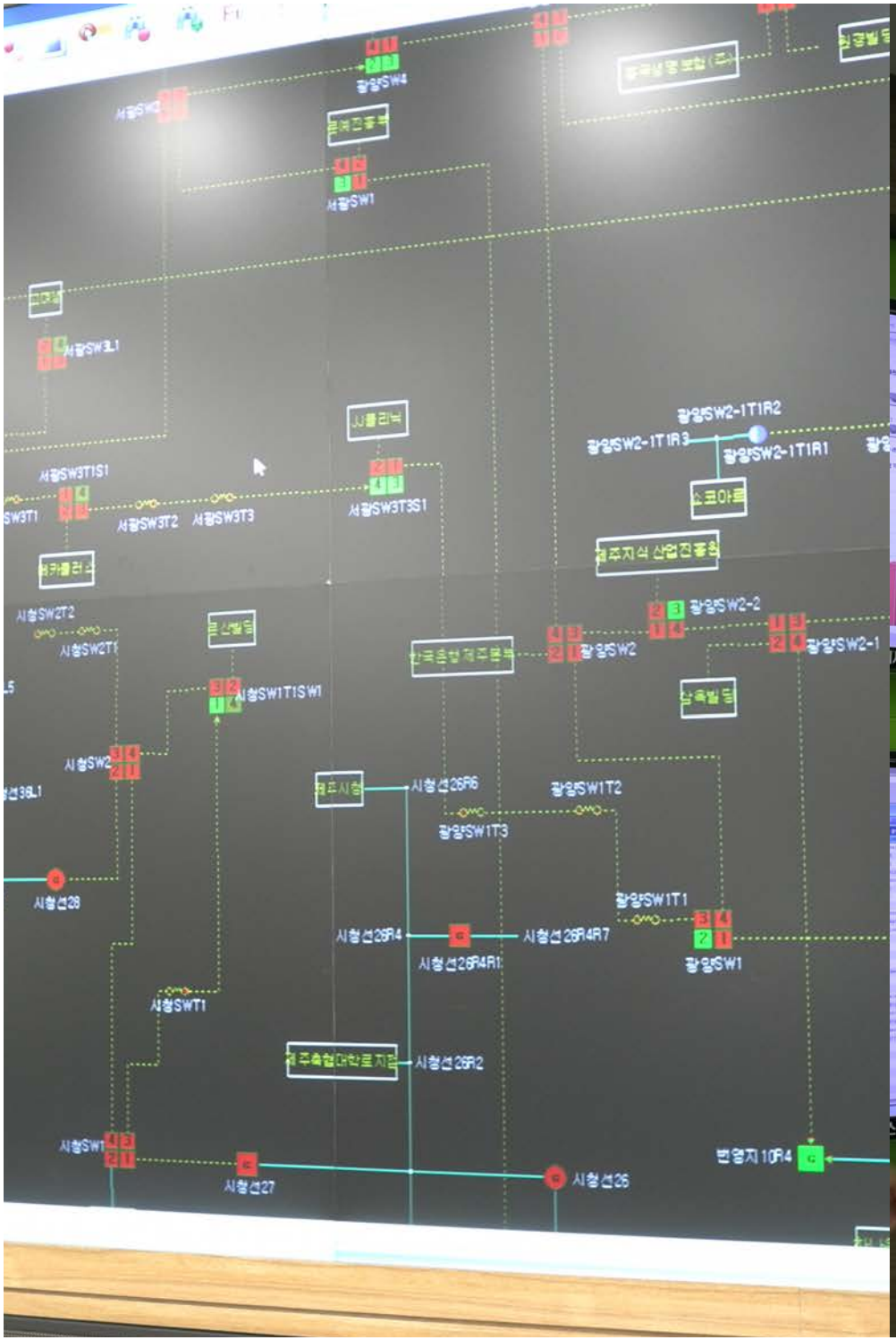
Micro-grids on Jeju Island

European Regional Development Fund
Investing in your Future

European Union
European Social Fund
Investing in jobs and skills

convergence
for economic
transformation


SK telecom
김녕리(371)
김녕해수욕장
당처물동굴
월정리해변
묘산오름
김녕사굴
한동환해장성
SK telecom
월정리(108)
IDEACO
행원리(209)
만장굴
세인트포CC
olleh kt
평대리(197)
세화항군
IDEACO
한동리(178)
구좌읍
토끼섬
LG전자
하도리(164)
지리조트
olleh kt
세화리(270)
LG전자
상도리(42)
비자림
뛰꾸부니오름
IDEACO
덕천리(48)
안친오름
사근이오름
당오름
LG전자
중달리(130)
세화송당
개발구역
거친오름
용눈이오름
Map
Satellite
IDEACO
송당리(121)
이재수의난
촬영지
문석이오름
칡오름
수산리
Prev. Day
Prev. Month
Demand


광양SW4
서광SW2
서광SW1
서광SW3L1
JJ플리넥
서광SW3T1S1
서광SW3T1
서광SW3T2
서광SW3T3
서광SW3T3S1
광양SW2-1T1R2
광양SW2-1T1R3
광양SW2-1T1R1
쇼코아트
광주지식산업진흥원
광양SW2-2
광양SW2-1
광양SW2
시청SW2T2
시청SW2T1
시청SW1T1SW1
시청SW2
시청28
시청26R6
광양SW1T2
광양SW1T3
시청26R4
시청26R4R7
시청26R4R1
광양SW1T1
광양SW1
시청SWT1
시청26R2
시청SW1
시청27
시청25
변영지10R4


Security Management
침입차단시스템F/W1
3D시각화 분석시스템

Energy use summary screen

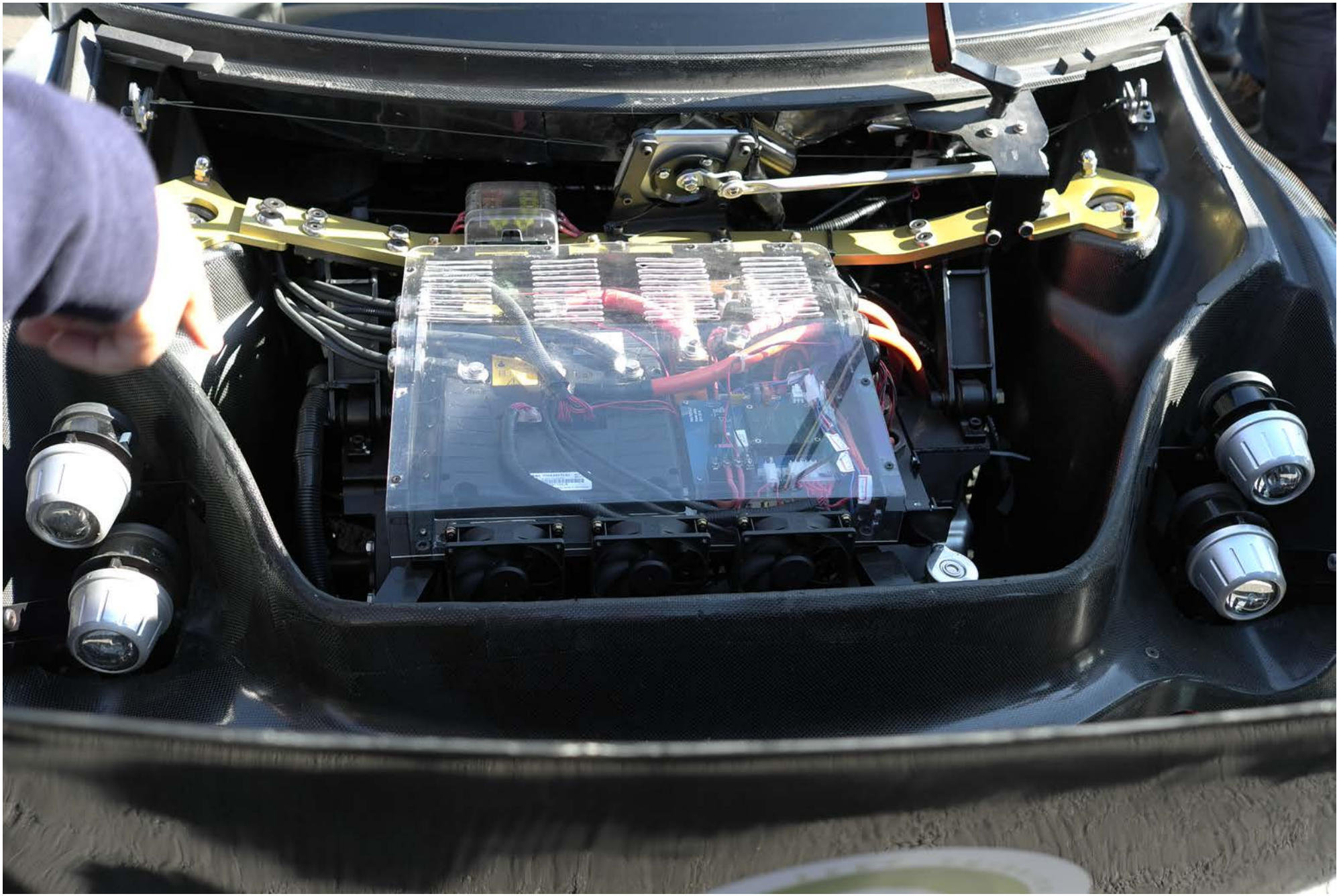

IIIPNE
POWER & ENERGY
SOLUTION
EVC+
EV QUICK CHARGER


EMERGENCY
EV
CHARGING
(주)제주전기자동차서비스

EV charging station

Selection of small EVs

Retro-fit EV components



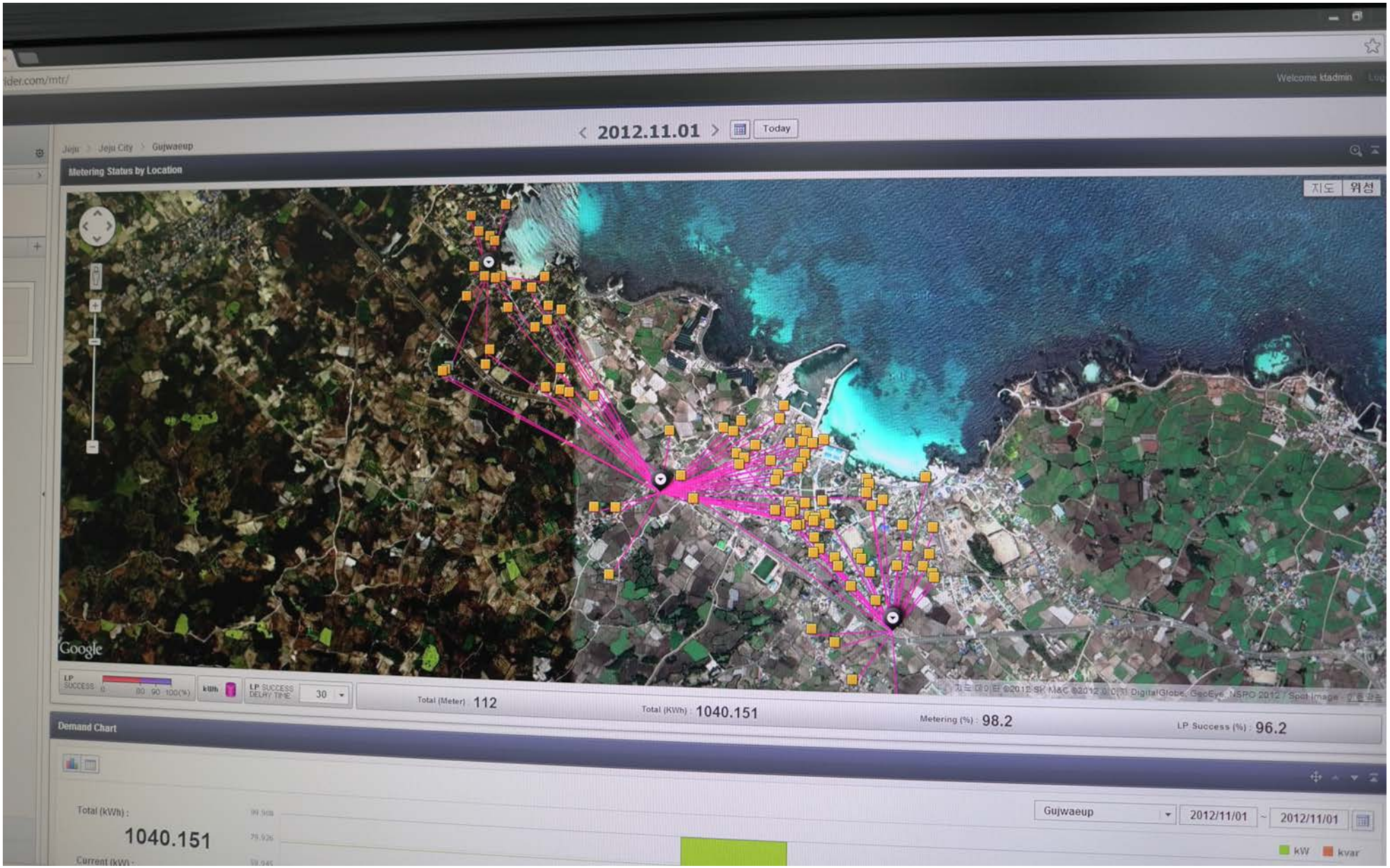
Electric-assist HPV


지식경제부
스마트그리드 제주실증사업


智慧能源感測與辨識系統
統一超商、資策會網多所、寶碩科技 合作研發
雲端能源平台 http://www.lems.com.tw

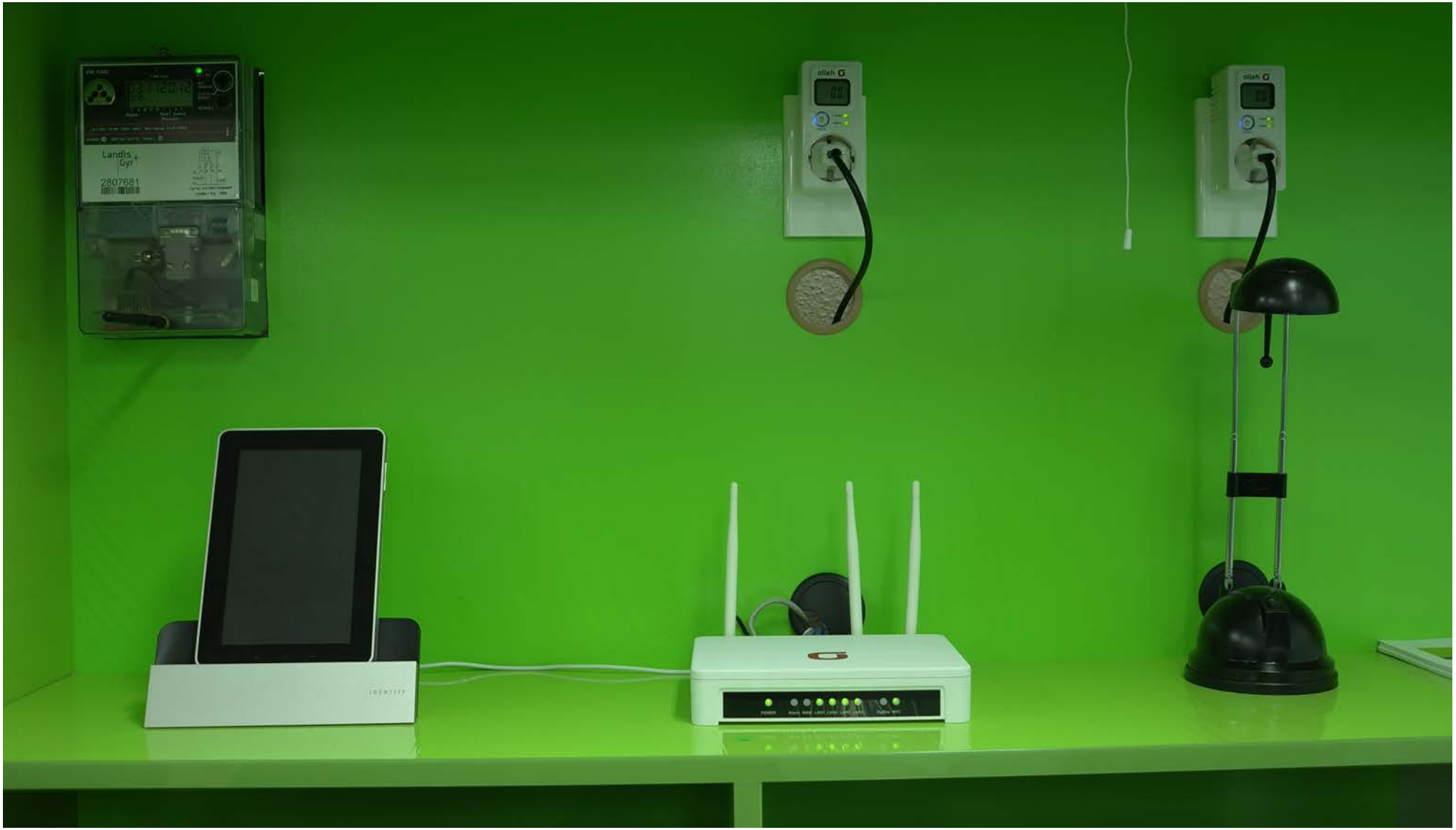
KT’s Jeju Island control centre

Micro-grid co-ordination



Load Profiles

Smart Meter, sockets




제주 스마트 그리드 실증단지 kt 컨소시엄
저 장 장 치 7KW
ESS
Samsung ESS
SAMSUNG SDI
SAMSUNG


세계적인 녹색성장의 새로운 모델,
Carbon Free Island Jeju
by 2030
JEJU
제주를 Carbon Free Island로 구축
산업구조 고도화로 도민소득 증대 및 일자리 창출
청정환경과 첨단기술이 공존하는 고부가가치 산업 육성
3단계
탄소 없는 섬 조성(2030)
화석연료 사용 없는 세계적 녹색성장 도시 구축
2단계
탄소 없는 섬 기반 구축(2020)
신재생에너지(50%), 스마트그리드, 전기자동차 운행
1단계
탄소 없는 섬 시범모델 구축(2012)
가파도 Carbon Free Island 구축, WCC 참관 코스화
새로운 태평양 시대의 지정학적 요충지
제주도의 우수여건
풍력, 태양광 등
녹색에너지 자원 풍부
세계 유일의 UNESCO 3관왕
세계 7대 자연경관
스마트그리드 실증단지
인프라 기 구축
연간 1,000만 명 관광객
– 청정 관광지, 녹색성장 학습장
대한민국 유일의
특별자치도 국제자유도시
행원리 풍력단지
동광리 태양광 마을
가파도
Carbon Free Island
구축계획
2GW 해상풍력단지 개발, 신재생에너지로 100% 전력공급
'30년까지 10조원이 투자되는 2GW 해상풍력단지 조성


오늘 전력 시세 1,000원
마지막 업데이트 | 2012.10.31 | 오전 08:30
70%
전기자동차
현재사용전력
50%
태양광충전정보
100
원/kWh
판매중
전력판매
사용내역
기기/조명제어
요금고지서
절전도우미
요금절감참여
날씨정보
마일리지
오늘
이달
130 KWH
3,500 원
외출모드
취침모드
모드
설정
SAMSUNG
EN TECHNOLOGIES
SK-ESS
제주 실증단지용


KCTV HD
Smart Saving
¢ 0.00 /kWh
Accumulated
$ 04535
D Zoom
SAMSUNG


SAMSUNG LED LAMP
만지지 마세요.
전구가 매우 뜨겁습니다.
일반전구
삼성 LED 전구
주백색
삼성 LED 전구
전구색

Next Steps

- SFBB
- E-Health
- Digital technologies, digital making, smart buildings
- Front-end technology implementation – control, monitoring
- Data acquisition and analysis – big data
- Behavioural and cultural change
- Policy influence, business models, revenue, incentives
- Local load solution vs large utility
- Energy storage solutions, hydropower, e-car, domestic
- Distributed energy generation vs centralised grid
- Water, water grid, smart metering, demand management

Potential areas of interest

- Design of equipment and interfaces – especially with human factors and usability in mind (this includes aesthetic, social and cultural issues)

- Testing and further developing practical integrated approaches:

- information flow (including uses of broadband)
- power generation and distribution (energy supply and security)
- private and public transport, food production (agriculture, horticulture, domestic gardens, co-operatives and local sharing/distribution)
- digital manufacturing at craft and medium scale for local consumption and distribution (including furniture, products, clothing, artwork, textiles, etc)
- entertainment and social functions, health and well-being

Further Contacts

Professor Philip Moore
Pro-Rector (Research & Innovation)
Director – Academy of Innovation and Research (AIR)
University College Falmouth,
prmoore@falmouth.ac.uk

Tel: +44 (0)1326 255 700
Mob: +44 (0)797 953 0363

Assoc Prof David Hawkins
Associate Dean (Research)
AIR
University College Falmouth
Cornwall, UK

david.hawkins@falmouth.ac.uk

(Cell) +44 (0)7768 427189

European Regional Development Fund Investing in your Future
European Union European Social Fund Investing in jobs and skills
convergence for economic transformation
University College FALMOUTH