

## **NOT EVERYTHING IS MADE OF SILICON**

The new - technologies approach for the smart economy

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## Aim of the talk:-

To show that through sensible use and adaption of emerging new technologies, the smart economy can manufacture all sorts of things at home it was not economic or practical to do before. This leads to a sensible, increased level of technology uptake throughout society, but without the price tag of using silicon microelectronics as its basis.



Outside conventional Si electronics there is a whole world of new technologies which can help open up the modern smart economy.

These are based on an ecosystem that allows:-

Communication to all and all to communicate

Measurement of things hard or expensive to measure before
 The generation of useful information at a realistic price, and its easy dissemination

The efficient production of energy to allow many of these things to happen



## Communication

Huge potential as we all know but communication to all is not easy

UHF radio "backhaul" is an older technology but is now finding its place as it can be installed quickly and easily all over the place









GaAs circuits are easier and cheaper to make than Si. Today's much higher frequencies (up to 100 GHz is now common) give UHF radio a new life

# ASSOCIATES



UHF radio systems can be made locally with sensible investment and they offer a realistic communication backbone to all the country



#### Communication to all wherever they are!



#### Two very different uses but both from same base technology





Wireless for all:-

In Russia by 2015 all towns with 40,000 or more people will have LTE networks with 100% coverage wherever they are. This will include aerials on street lights, walls, everywhere. All made locally.

WiMax is for places big and small. Again it's not a new idea, but now it's viable. Same basic technology!



And it could all be made here!!

Information is power!! We all have need for greater measurements in

The home
The workplace
The countryside
Cars and other transport

So why not make sensors the cheap mass-production way and adapt them for the requirements of a smart economy

- 2 simple technologies:-
- 1) MEMS –
- Printed/Plastic electronics



#### MEMS – MicroElectroMechanical Systems- are silicon based mass-produced sensors

They use microelectronics technology but far less complex – much smaller factories and much less cost







BUT for simpler applications why not use printed electronics – circuits and sensors using organic semiconductors and printed onto plastic.



Simple circuits, sensors and memory can be made this way making possible measurements and information previously impractical or too expensive to collect.



## Very cheap to make using roll to roll technology







We can go further and create displays that are flexible and make all sorts of applications affordable.







#### You can produce these displays on a large scale.





This is an automated factory (currently biggest in the world) for plastic electronics. Looks expensive, but actually it cost about 10% of the price of a silicon IC plant.



#### Lighting - LEDs are good!

#### Use LED based lights at home, on the street, on signs – many places



You are certainly already using them, but why not make them? The smart economy is taking care of its own lighting needs in new ways, such as this.



#### Lighting - Organic LEDs (OLEDS) are very good!

OLEDs offer the potential for inexpensive panel lighting. They are:-

•Made from organic semiconductors similar to the plastic displays

•Cheap to make on a mass production basis





#### ...... and can be made on large areas for architectural use on walls



Low power – great for energy-sensitive applications: - cars and planes for example

OLEDs are a hot topic right now. Many big players are entering the field but it's still wide open

#### POWER - same organic-based technology has a role here too Organic photovoltaics -OPV







OPV cells can be printed on long plastic rolls. Not that complex.

Efficiency is less than Si based cells, but they are cheaper to produce

They are flexible and perhaps best suited for :-

a) Very small areas in consumer devices

b) Large areas (on warehouse roofs for example) for local power



## So in summary - imagine just one idea

## MEMS flow sensor + UHF radio circuits to transmit data + OPV solar cells



= a low-power water monitoring unit you can place anywhere; and because they are low-cost you can have many, many more than before. SO your information is better, your choices are better-informed and the results more useful to all society.



So in conclusion we can say:-

The smart economy will use a range of new and expanding technologies to enable a whole ecosystem to evolve; where really useful electronics and electronic functionality need not be expensive or overly complicated; AND it could all be done in Brazil!