

Challenges and Opportunities in the Low Carbon Transition

Maitland Mackie

CBE, LLD, FRAgS, DBA, BSc Ag, MA Hons Econ



Hidden Agenda

Ice-cream & crisps
are terrible businesses to be in

Don't do it



Purpose

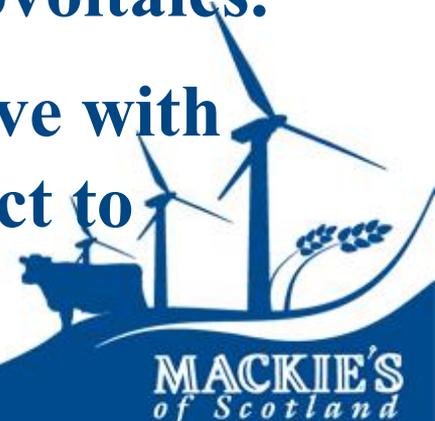
To establish

- **That we are at the cusp of a life changing revolution in energy supply.**
- **That all energy can/will come from renewable sources in 20 to 30 years.**
- **The unique opportunity to decentralise and democratise the energy supply industry.**
- **That Scottish and UK Govs have a key role to play. But are currently selling the pass!**



The Rationale Behind the Renewable Energy Revolution

- **Efficient renewable energy will soon be cheaper than conventional energy –**
At 10% per year rise, price doubles every 7 years
The unsustainability of the exponential function!!
- **Price will only stabilise when renewables come on stream fast enough to close the gap between conventional energy supply and demand.**
- **The world is on an exponential curve of discovery in capturing renewables – Particularly photovoltaics.**
- **Large onshore turbines already competitive with new conventional generating plants –subject to carbon capture techniques.**



The Financial Fundamentals of Wind Power

Capital Cost of a 3 Mega Watt installation **£3,600,000**

Output - 1/3 capacity (with 1mw+ turbines on sites of 7m/s wind speed)

1000kw x 24hrs x 365 days x 11p **£ 963,600**

Costs Site rent **£ 40,000**

Maintenance **£ 80,000**

Interest at (6%) **£216,000**

Insurance **£ 10,000**

Depreciation (20yrs) **£180,000** **£ 526,000**

Net Returns 12.1% after 6% interest **£ 437,600**

1. Better and better as depreciation can pay off loan cap.
2. Marginal cost/Kw - 4p (ex depreciation)
3. Gross cost/Kw - 6p
4. Running cost/Kw - 1p (sun and wind is free!)



The Effect of Say 80% Gearing i.e. 20% Shareholding, 80% Borrowed

Capital cost Shareholders (20% of £3.6M) £ 720,000
Borrowing instruments £2,880,000

Output - 1/3 capacity (with 1Mw+ turbines on sites of 7m/s wind speed)
1000kw x 24hrs x 365 days x 11p **£ 963,600**

Costs - Site rent £40,000
Maintenance £80,000
Interest on £2.88M (10%) £288,000
Insurance £10,000
Depreciation (20yrs) £180,000
£ 598,000

Net Returns to the business **£ 365,600**

Equates to 50% on shareholder capital – what Govs (and farmers) are letting slip away

A relatively small local shareholding requirement

10% interest – the bankers dream



The Rationale Behind the Renewable Energy Revolution

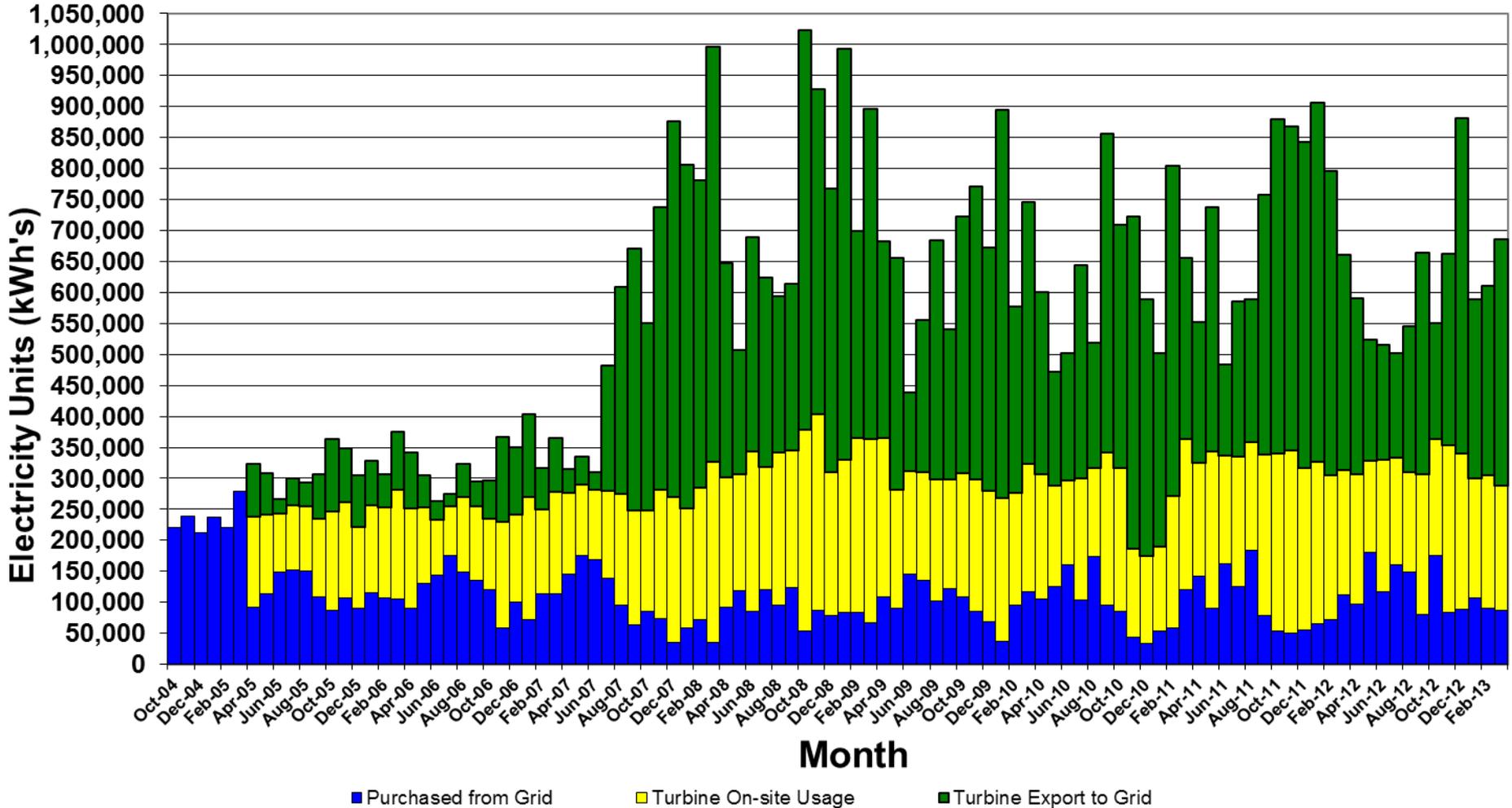
The key element –

We are on an exponential curve of discovery of the means of storing the surpluses.



Powering the Business (October 2004 to February 2013)

A Unique Picture



Note the huge potential of the green to be a source of H2 and H3, (here, there and everywhere)

The Rationale behind the Renewable Energy Revolution

Storage media

- **Battery power development – including vehicles**
- **Heat and freezing storage**
- **Compressed air**
- **Smart grid**
- **The Biggie - the game changer –
Hydrogen and ammonia – available everywhere**



The Rationale of the Renewable Energy Revolution

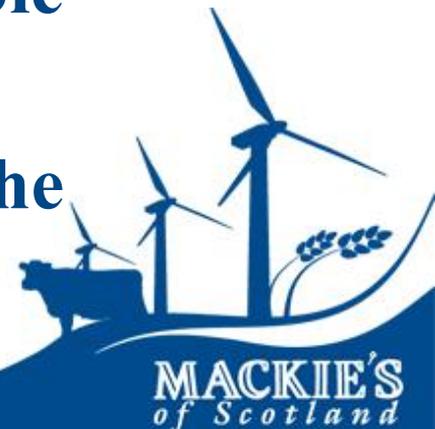
Storing surplus RE – (partic H2 and NH3)

- **Fills the intermittency electrical supply gap -**
- **H2, NH3 and CH4 directly powers transport, heat, freezers**
- **NH3 particularly useful power storage – safe low pressure**
- **Anhydrous NH3 available everywhere for fertiliser**
(half the world's food comes from ammonium nitrate)

Small/medium scale H2 tech now available

NH3 coming shortly!

Scottish Enterprise financing a study on the practicalities of ubiquitous H2 & NH3



Imagine a world totally powered by Renewables!!!

- It is unlimited – until the Sun goes out
- It is ubiquitous – here there and everywhere
- Its base zero price never rises - sun sends no bills
- No man made CO₂ into environment
- Available everywhere delivers a peaceful World
- Fossil fuels a sunset industry & Nuclear is history!
- Owned by the people everywhere revolutionises the energy industry –

**Decentralises and naturally
democratises it!**



An Aside on Nuclear Energy

Not a renewable energy

- In mid-20th century - envisaged as the new major energy source that would reduce dependency on the world's finite politically embattled oilfields.
- The basic technologies on renewable energy, were then known and crudely operational.
- E.g. 1970 Hudson Institute paper on solar power!
- Wonder what the world's energy industry would look like today, if the billions and billions spent on nuclear, had been spent on – R E development and installation instead!



Politicians/landholders – step up to the mark!

- **Giving away – 10 times the rent received (slide 5)**
12 Gws now in train in Scotland – 75% owned by 6 international companies - £2billion slipping away !
- **The Forestry commission debacle!**
- **The challenge – to keep ownership local, in the hands of local individuals, businesses, communities their organisations and institutions**
- **Germany – 50% in local site owner ownership.**
- **Government needs to much more constructively facilitate.**
- **The aesthetic factor.**



Useful reads

For appreciation of the unlimited potential of Renewable energy

‘The energy imperative’

Hermann Scheer

For understanding of the “exponential function” a youtube lecture by Prof Albert A Bartlett, The Unsustainability of the exponential function at –

www.youtube.com/watch?v=F-QA2rkpBSY

For hope that we stop multiplying-

Geographical Magazine, December 10 issue – ‘Population 7 billion’

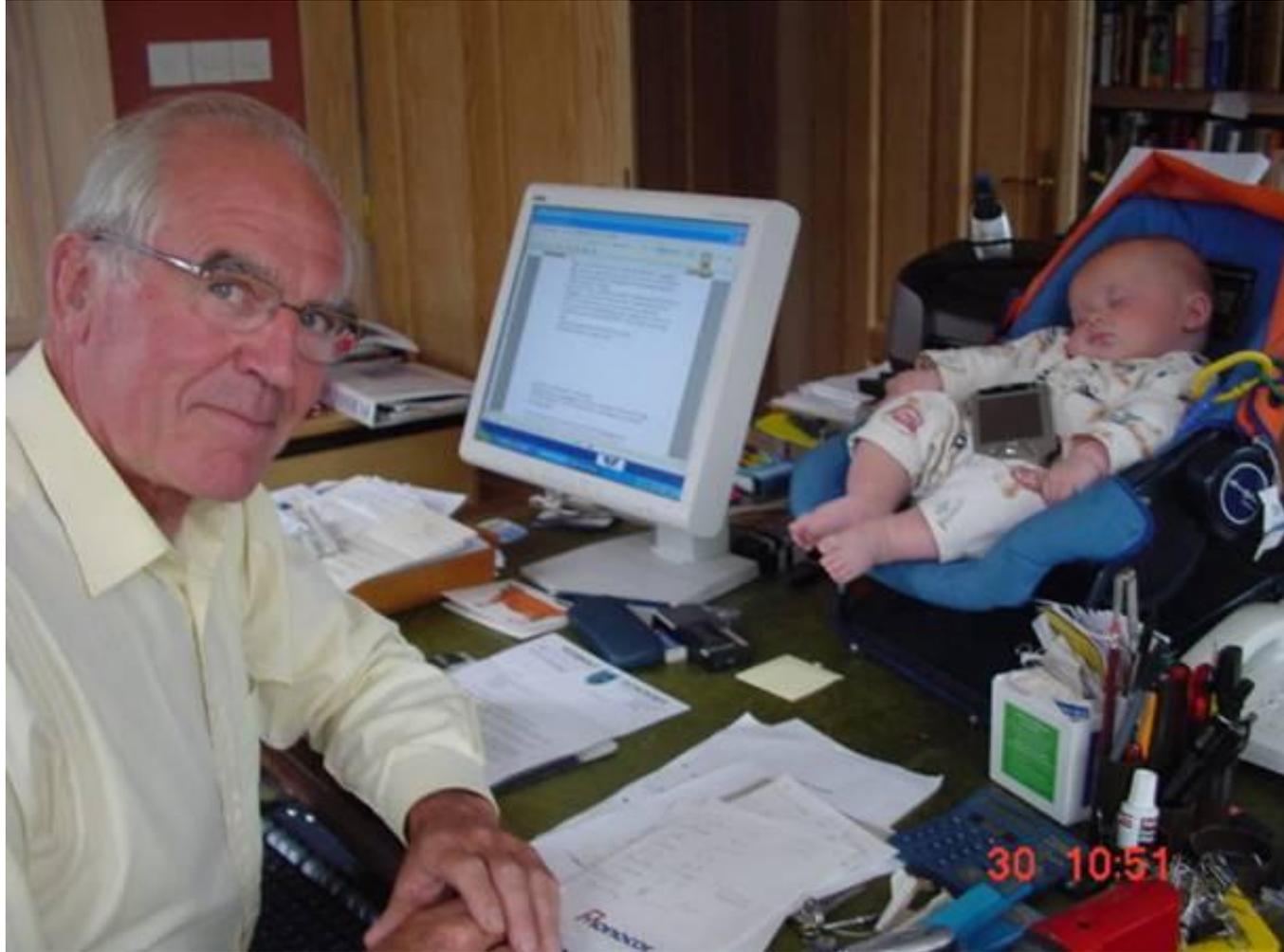
– excellent article on the potential for world population to stabilize naturally (but at circa 9 to 12 Billion)

Excellent Guardian article by Ashley Seager – 1st June 2013

“Renewable energy is clean, cheap and here – what’s stopping us?”



We have an overriding duty to the next generation



MACKIE'S
of Scotland