

PRESENTED BY

**OPTIMAL ENERGY**  
imagineering mobility





# ELECTRIC VEHICLES

# WHAT CHALLENGES ARE WE FACING?



- The 6.5 billion people in the world today are consuming 1.4 earths, i.e. the global community is living 40% above its means
- Today 80 percent of the world receives only about 20 percent of the resource flow, i.e. this majority will require more consumption, not less.
- The supply is finite, but demand is growing exponentially – 9 billion by 2050, all striving to live like westerners
- We are borrowing from the future to prosper and grow today.
- **Our current way of life is not sustainable**



# NEW PARADIGM NEEDED:

*Use the present to improve the future*

# CURRENT TRANSPORT LANDSCAPE



- ~800,000,000 vehicles in the world, doubling by 2030
- >50% of world live in cities, 75% of city transport is by car
- Overwhelmingly dependent on fossil fuels
- Transport causes ~ 1/3 of energy CO<sub>2</sub> emissions in the world
- 50% of all crude oil goes to Transport (and increasing!)
- Energy security concerns around crude oil worsening
- Market insecurity → price volatility → economic instability
- **Alternatives needed!**



# THE ALTERNATIVE: SUSTAINABILITY

- Kyoto, Copenhagen, etc – Negotiating for a sustainable future
- **Mother Nature does not negotiate**

# A MASSIVE OPPORTUNITY:



*“Renewable energy, as a reaction to peak oil and climate change, is probably the most important economic boon that will occur in our lifetimes.” - Craig Shields*

*“Renewables are nothing less than the re-industrialisation of the whole planet.” - John Doerr*

*“No power on earth can stop an idea whose time has come” – Victor Hugo*

# THE CHALLENGE:



- **Beat the global climate change crisis**
- **Make business sense now**

# THE SOLUTION:



**Create a business & product that**

- **meets all sustainability goals**
- **Is attractive to the mass market**
- **Is affordable to the mainstream**
- **makes business sense now**

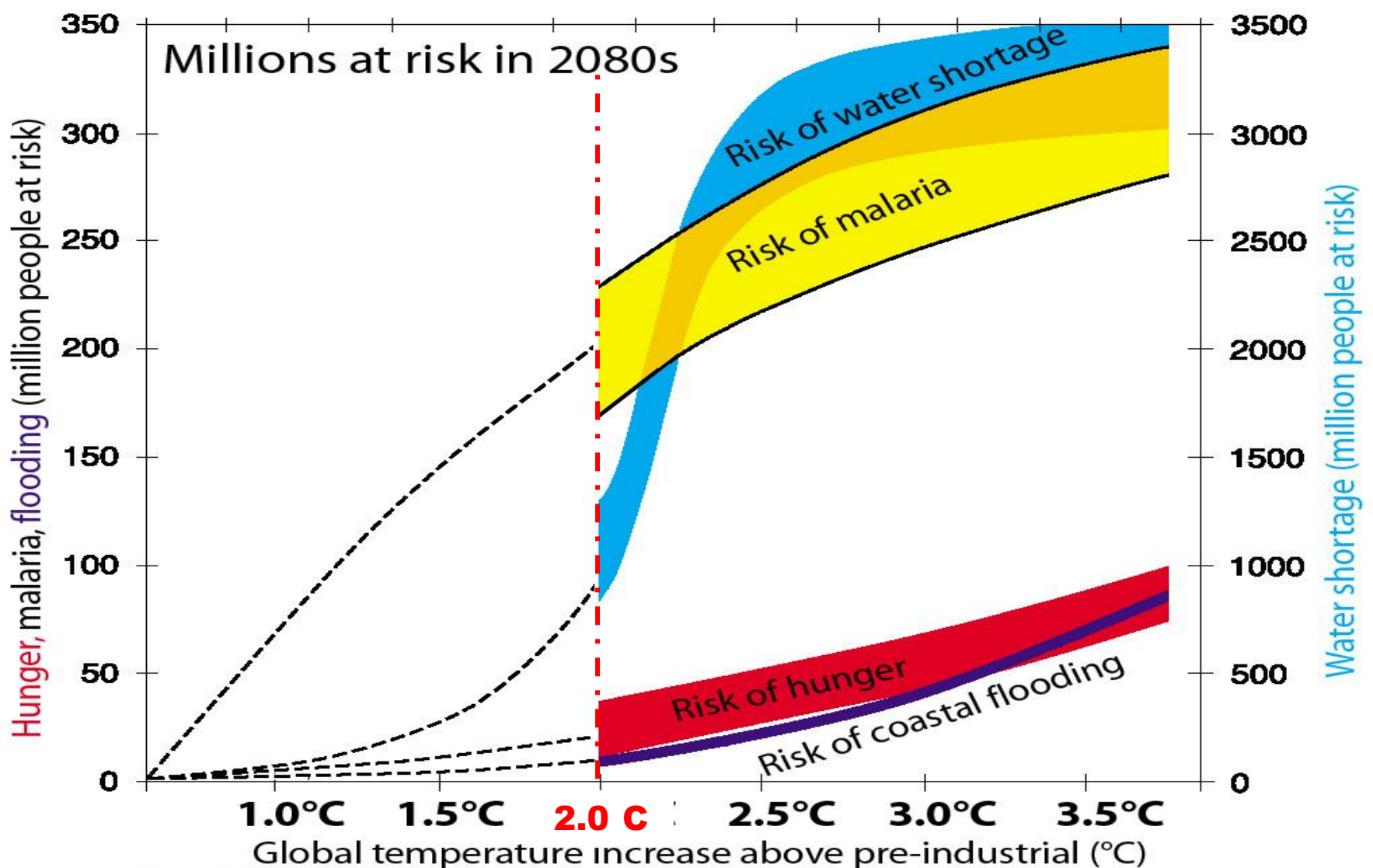
# WHY BEHAVIOUR CHANGES:



- The status quo is threatened
- Legislation & incentives
- The alternative saves money
- The alternative is more attractive

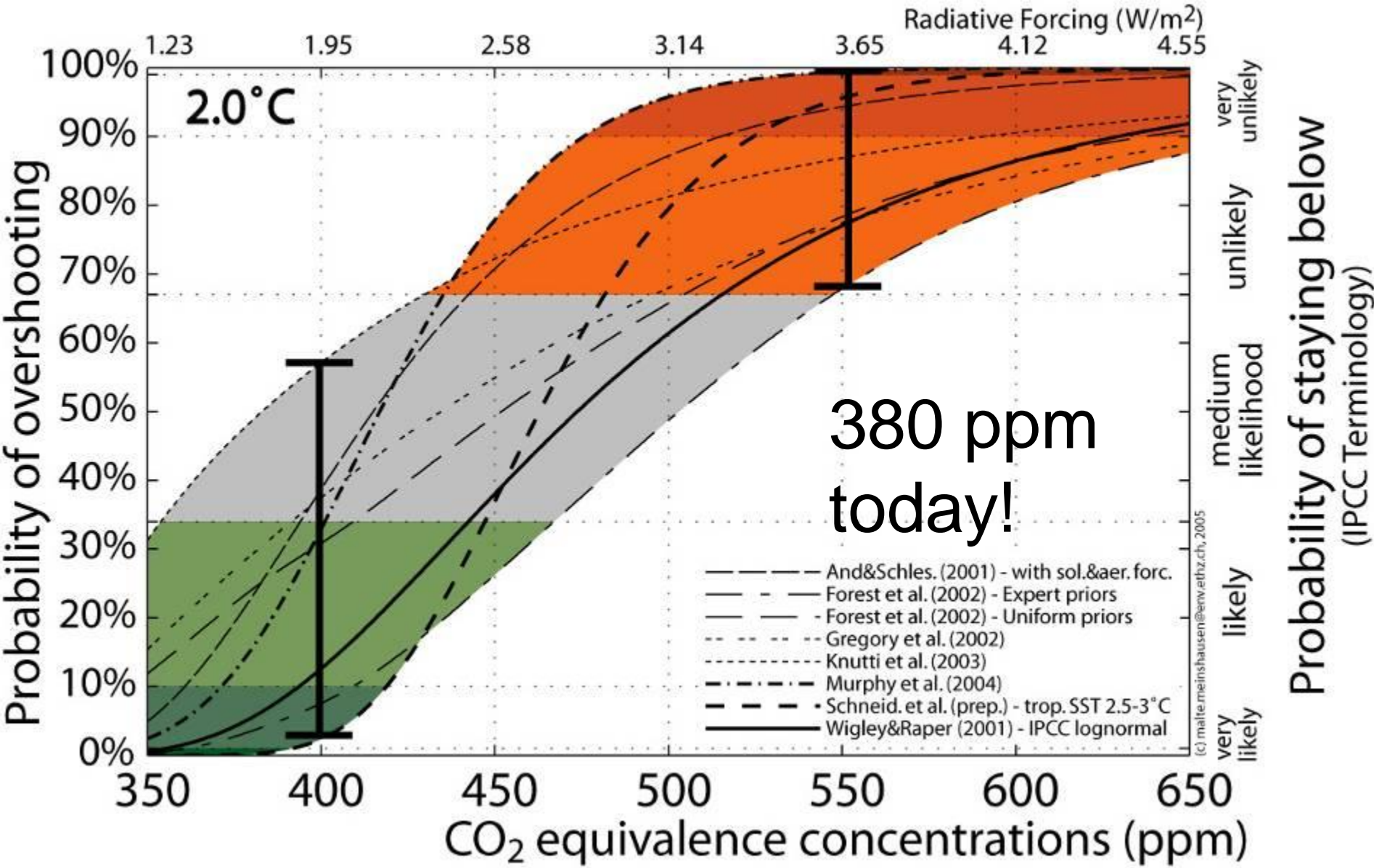
# THREAT? GLOBAL WARMING

## The Importance of 2 C



Sources: Parry et al. (2001) "Millions at Risk" Glob. Env. Change. Graph adapted by M. Meinshausen.  
Note: The original graph presented temperature levels above 1990, not above pre-industrial. Thus, a 0.6°C temperature difference has been added. Furthermore, the original graph presented temperature levels in 2080 for different CO<sub>2</sub> equivalence (f) stabilization scenarios. For a climate sensitivity of 2.5°C (as underlying the work of Parry et al.), the 2080 temperature level for the S550 CO<sub>2</sub>eq emission path has been about 1.4°C above 1990 (2°C above pre-industrial).

# RISK OF OVERSHOOTING 2 C – 50%!

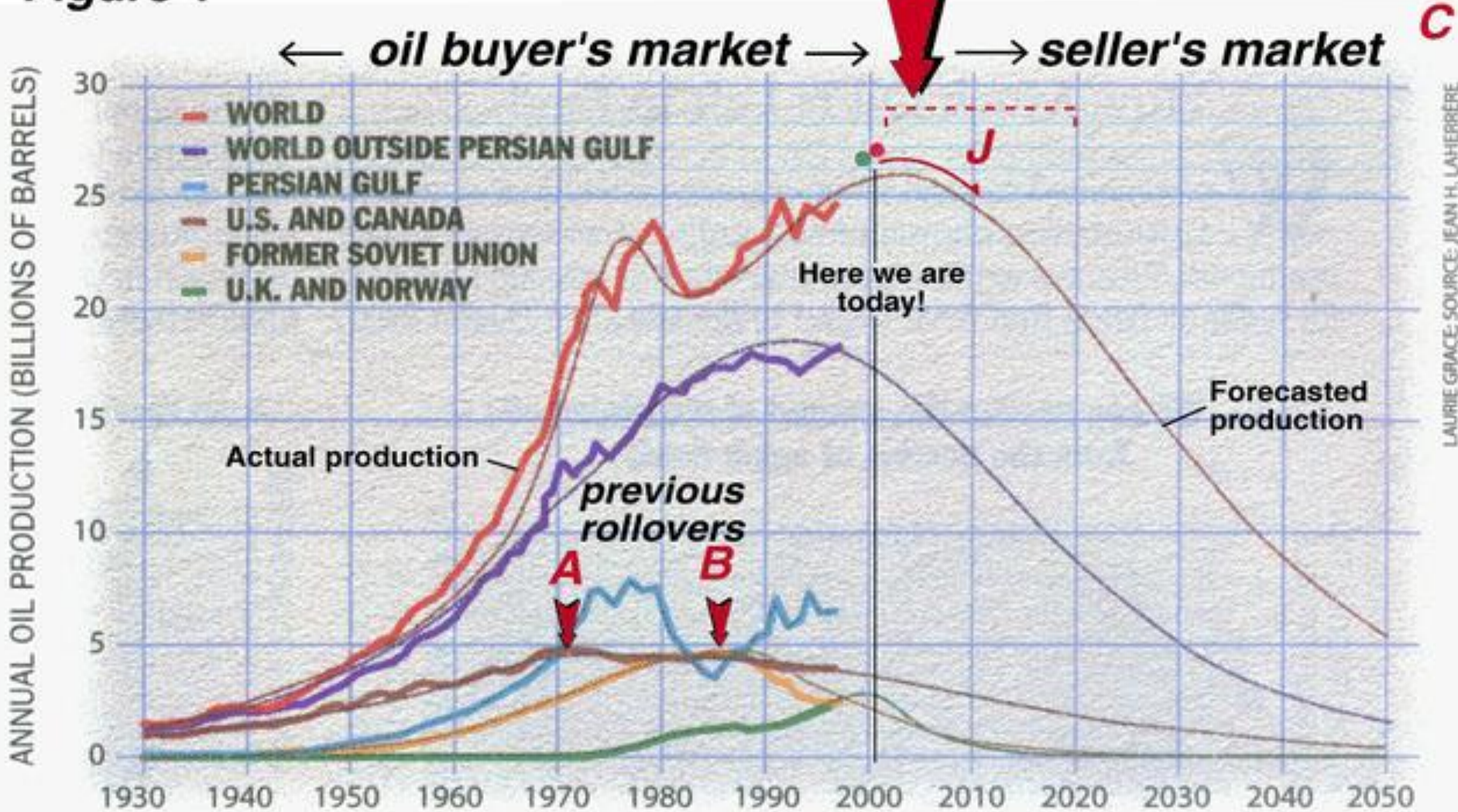


# THREAT? - ENERGY SECURITY

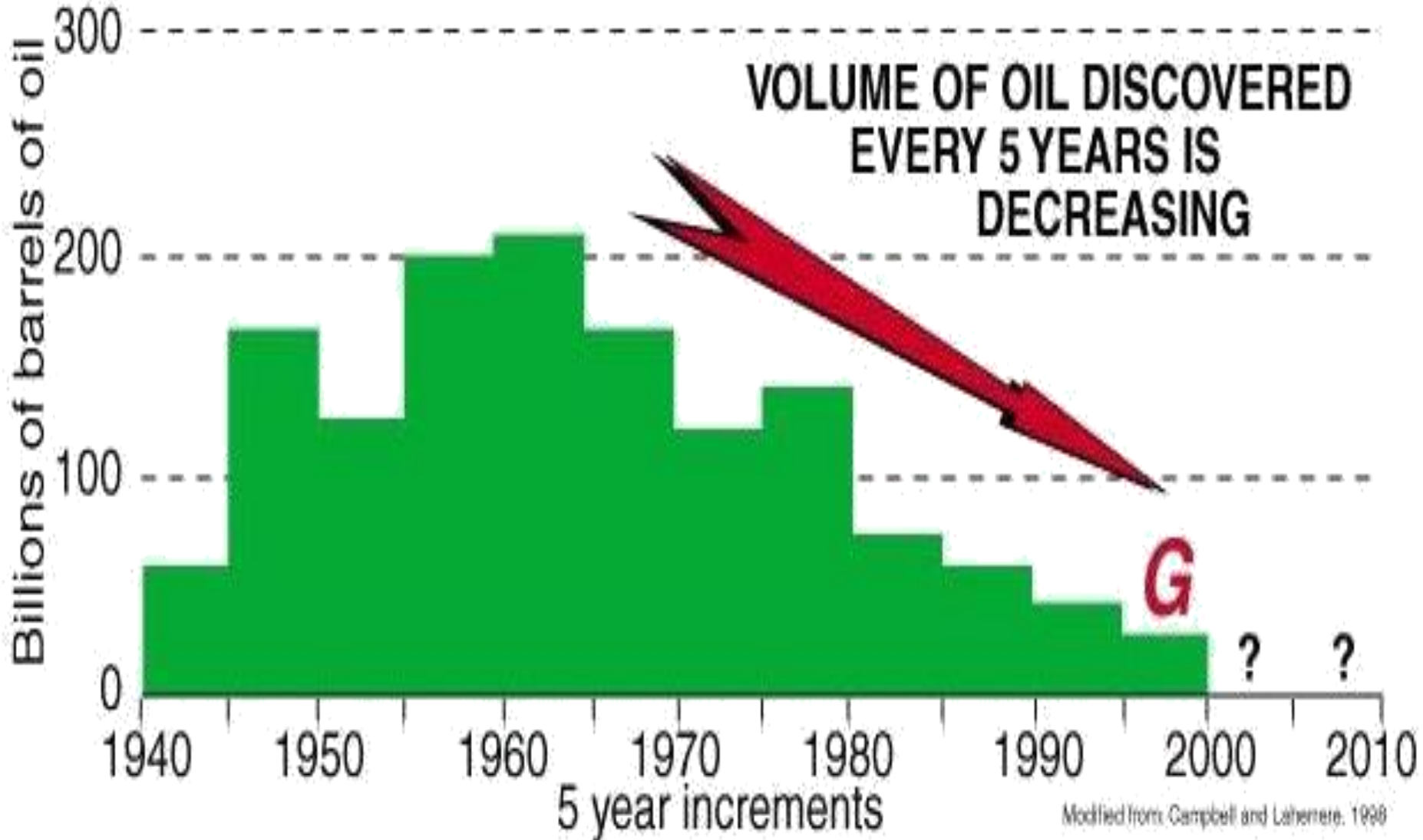


## THE BIG ROLLOVER

Figure 1



# THREAT? ENERGY SECURITY



# LEGISLATION?



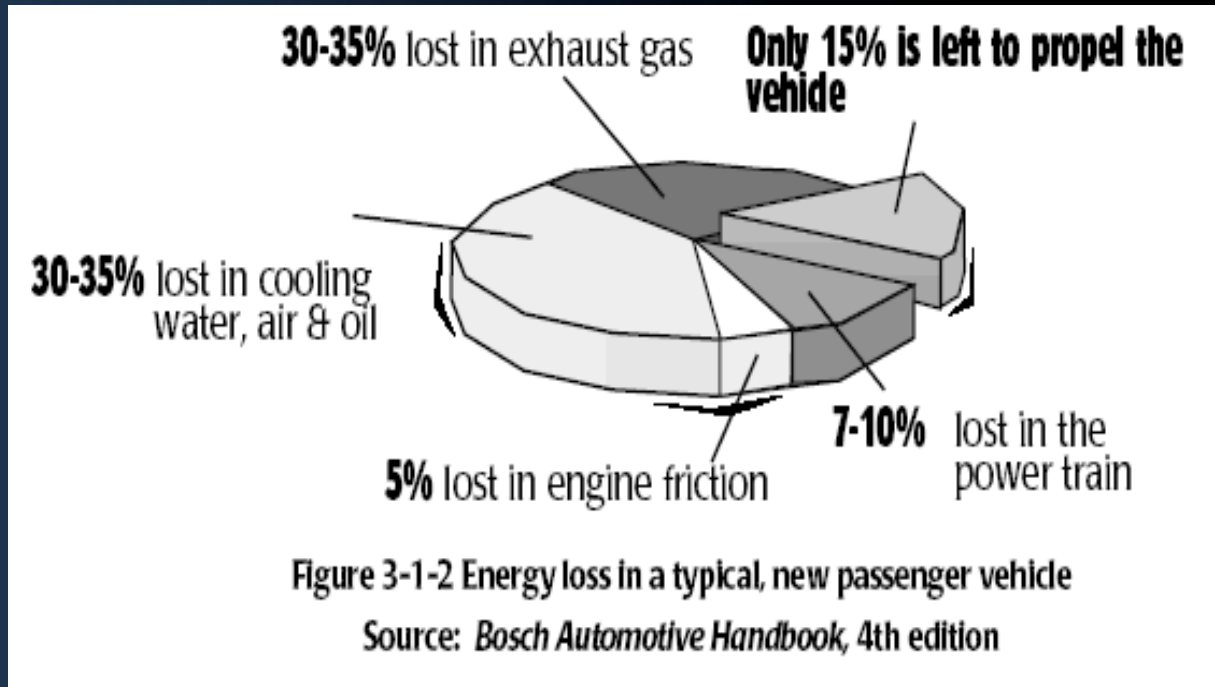
Examples of international government support:

- USA: 1000 000 plug-ins by 2015,
- USA: Advanced Technology Vehicles Manufacturing Loan Program (ATVMLP): \$25 billion in loans
- France: 5 000€, Monaco: 9 000€, Japan: 800 000¥ rebate
- UK: 5000£ subsidy; London: free parking, license, registration, exempt from congestion charge
- Spain: 1 000 000 EV's by 2014
- C40 cities
- South Africa: IMC formed specifically to support South African EV
- Israel: 70% tax on ICE vehicles, 10% on EV
- Denmark: 180% tax on ICE, 0% on EV!

# SAVING MONEY?



ICE:  
~15%



EV:  
~75%

Charger (90%) x Battery (92%)  
x electronics/motor (90%)

Electric energy cost per km is 5-10% of petrol/diesel cost per km

# ATTRACTIVE ALTERNATIVE?



- No compromise – safety, performance, utility
- Beautiful styling
- Cost competitive
- Trusted technology

# VISION

## Optimal Energy's Vision:

To establish and lead the electric vehicle industry in South Africa, and to expand globally.



# ELECTRIC VEHICLE FREQUENTLY ASKED QUESTIONS

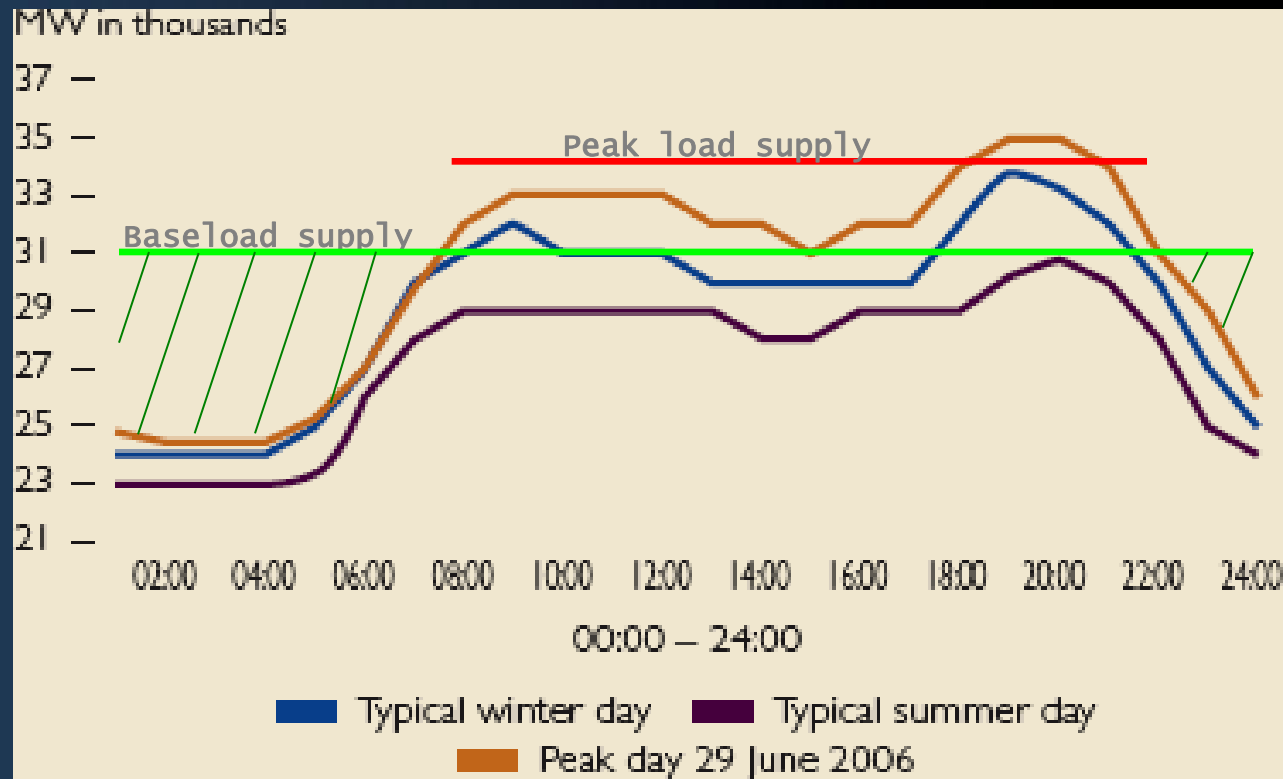
- Where does the energy come from?
- Are batteries good enough?

# ENERGY SECURITY

## SA ENERGY USE



SA has a peak electrical power problem, NOT a total electrical energy problem - there are not enough users or storage at night (off-peak)



Enough electrical energy off-peak for 8m cars doing 20 000km/y – only 7m cars in SA!

# BATTERIES



1. **Performance** – from **1200kg** (1994) to **250kg** (2006)
2. **Charging** – existing 15A supplies or 3-phase fast charge (~1/2h)
3. **Cost** - \$600/kWh in 2002, \$300/kWh now, \$150/kWh in 2012?, \$20/kWh???
4. **Environmental** – Li-based batteries recommended by EU (EC FP6 SUBAT)
5. **Suppliers** – Multiple (>60) serious Li – battery suppliers in the world, Lithium abundance, lithium is not consumed
6. **User patterns** – 80% of all urban drivers drive less than 90km/day; 75 % of (EU) urban transport is in cars
7. **Batteries & renewables** – the new oil?

# Why Optimal Energy?



- The car business = the engine business
- Massive legacy investments in engine technology and infrastructure
- Most money made after sales; mostly engine related
- Difficult for traditional carmaker to make a business case without an engine
- Market forecast 6 -> 30 million EV's by 2020 - >10% of global car production
- i.e. for the first time in 100 years, there is a real opportunity for new carmakers

# The Product



## Urban Electric Vehicle

- Design by Keith Helfet
- Complies with UN ECE safety standards, designed to Euro NCAP 4/5
- 5 seater urban vehicle – M/B/C segment
- Top speed: limited to 135km/h
- Range: 300km (UDDS cycle)
- Acceleration: 0-100km/h under 15 sec, 0-60km/h in 4.8 sec
- Regenerative braking
- Integrated photo-voltaic (PV) panel
- Quiet, zero emissions
- Convenience: Plug in at home
- Energy cost: <5c/km, vs 80c/km for conventional (petrol/diesel)
- Total cost of ownership: ~25% saving
- Unique retail model





HECZ

JOULE

OPTIMAL ENERGY



One team, best future

HYUNDAI

OPTIMAL ENERGY  
imagineering mobility

ITEKT  
TEKT CORPORATION

ELECTRIC





# The Market

- Launch in South Africa:
  - General urban passenger
  - Corporate & passenger fleets
  - Government (national, provincial, local) and state owned companies (LOI received)
- Exporting from 2013 (growing to 80%)
- Pilot production to start in 2010, volume in 2012
  - Year:                    2010    2011    2012    2013    2014    2015
  - Volume:                pilot fleets    500    30 000    50 000    60 000
- Timing critical



# Opportunities for South Africa

- Global recognition and acceptance of South African car brand will positively influence all of South Africa far into the future
- Reduce imported energy dependence
- Reduce ghg emissions
- Increase exports
- Internationally recognised automotive test & certification facility
- National test labs for batteries and drive trains
- >10 000 permanent jobs

# Opportunities for South Africa

- Electric motor manufacturing
- Battery cell manufacturing
- Battery assembly and testing
- Power electronics at automotive prices (chargers, high power relays, high power fuses, HV connectors, HV cables)
- Electric compressor, peripheral components
- Environmental component test labs – shake, bake, dust, humidity etc.
- Battery handling equipment
- Automotive electronics (ECU's, displays)

# Optimal Energy's Vision for 2020:

- To be an established, profitable OEM with a globally recognised brand, selling a number of electric vehicle models in SA, the UK, EU, Africa and expanding into the Americas and the East.
- To be globally recognised as a technology leader.
- To be the leader of a successful, sustainable EV industry in South Africa.
- To be a major employer, technology establisher and wealth creator in South Africa.

