

Adaptation and Transformation

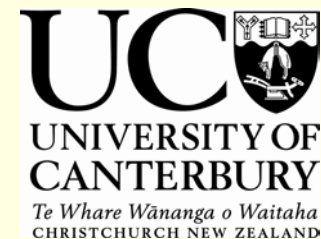
Susan Krumdieck, Mechanical Engineering

Andre Dantas, Civil Engineering

Shannon Page, Research Associate



Land Transport **NZ**
Ikiiki Whenua Aotearoa



What will your great-grandchildren say about us?



Thank God they did that..

What the Hell were they thinking?

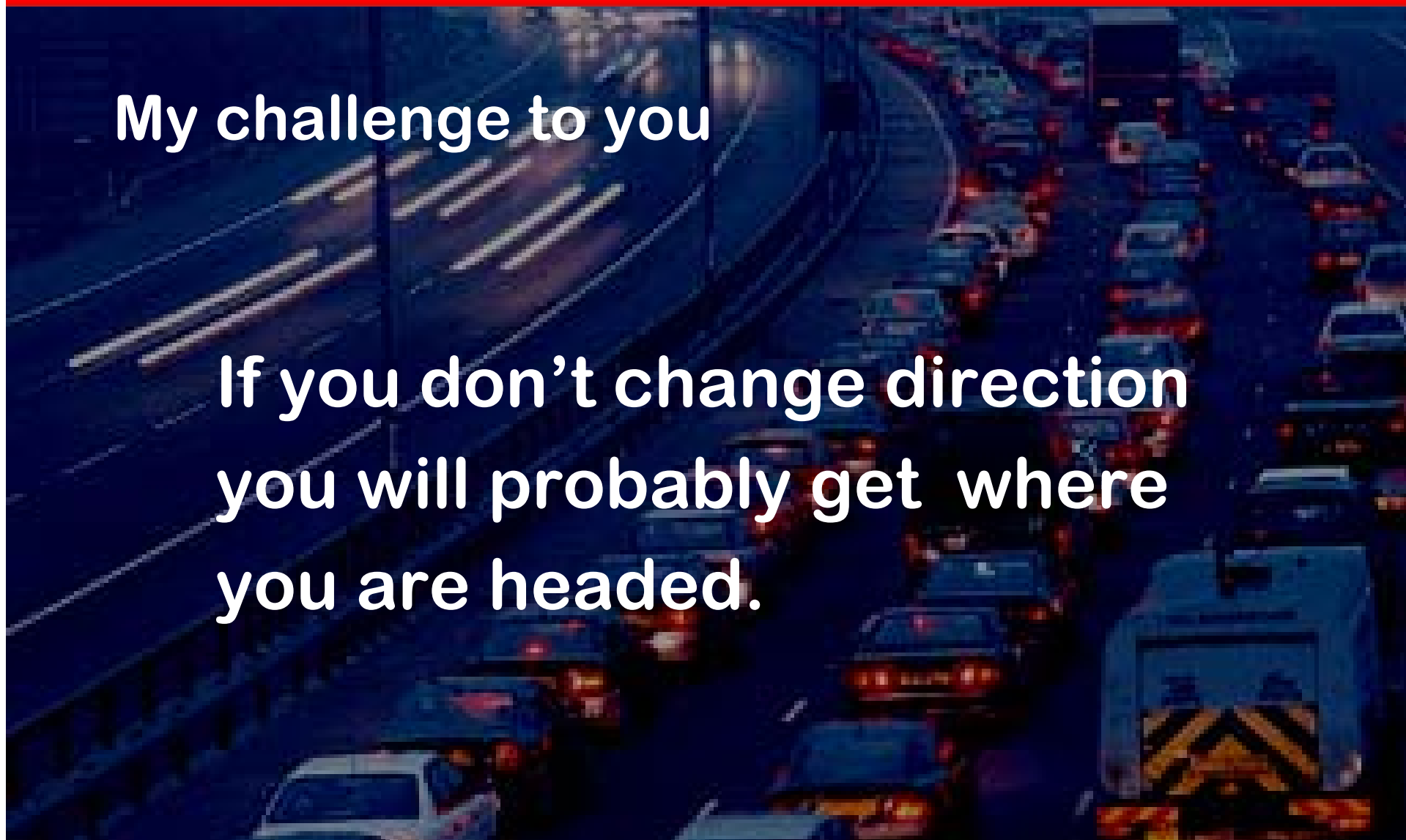
“If you don't know where you are going,
any road will take you there.” - Lewis Carroll

BACK
TO THE FUTURE

Transportation Conference 2006
IPENZ Transportation Group Workshop & Conference

My challenge to you

**If you don't change direction
you will probably get where
you are headed.**

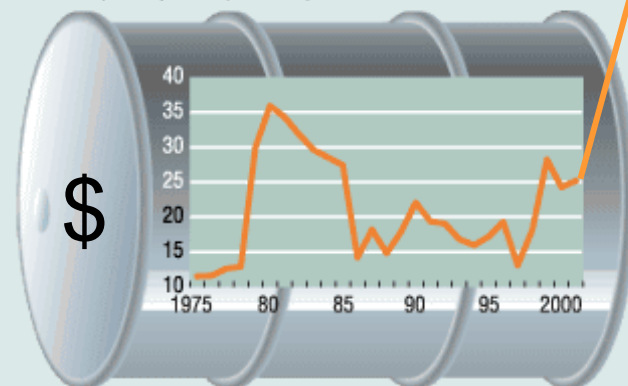


There are indications that...

Your current Transport Engineering approach may not have a future.



World oil prices (dollars per barrel)



Source: IMF, World Economic Outlook database and staff estimates.

Mistress of Doom?



Curriculum Vitae

Dr. Susan Krumdieck

BS, MS, PHD (University of Colorado at Boulder)

MECHANICAL ENGINEERING

- Variable Speed Wind Turbine Controls
- Solar Hot Water System Design & Certification
- Building Energy Efficiency & Energy Management
- Combustion Biomass Fuels
- Materials for Solid Oxide Fuel Cells
- Monitoring System for PEM Fuel Cells





The Current Mechanical Engineering approach isn't going to lead to a sustainable future either.

Sustainability? Is it about Vision?



Sustainability Engineering

Adaptation
To mitigate RISKS
to wellbeing



Two Projects

Transformation
To a system with managed
environmental and supply
RISKS



An aerial night photograph of a multi-lane highway. The scene is illuminated by the headlights and taillights of numerous vehicles, creating a dense pattern of red and white lights. A large white truck is visible in the lower right quadrant. The overall color palette is dominated by dark blues and blacks, punctuated by the warm colors of the vehicle lights.

Sustainability Engineering: RISK Management

Risk to our Wellbeing (and our Children's, and their Children's...)



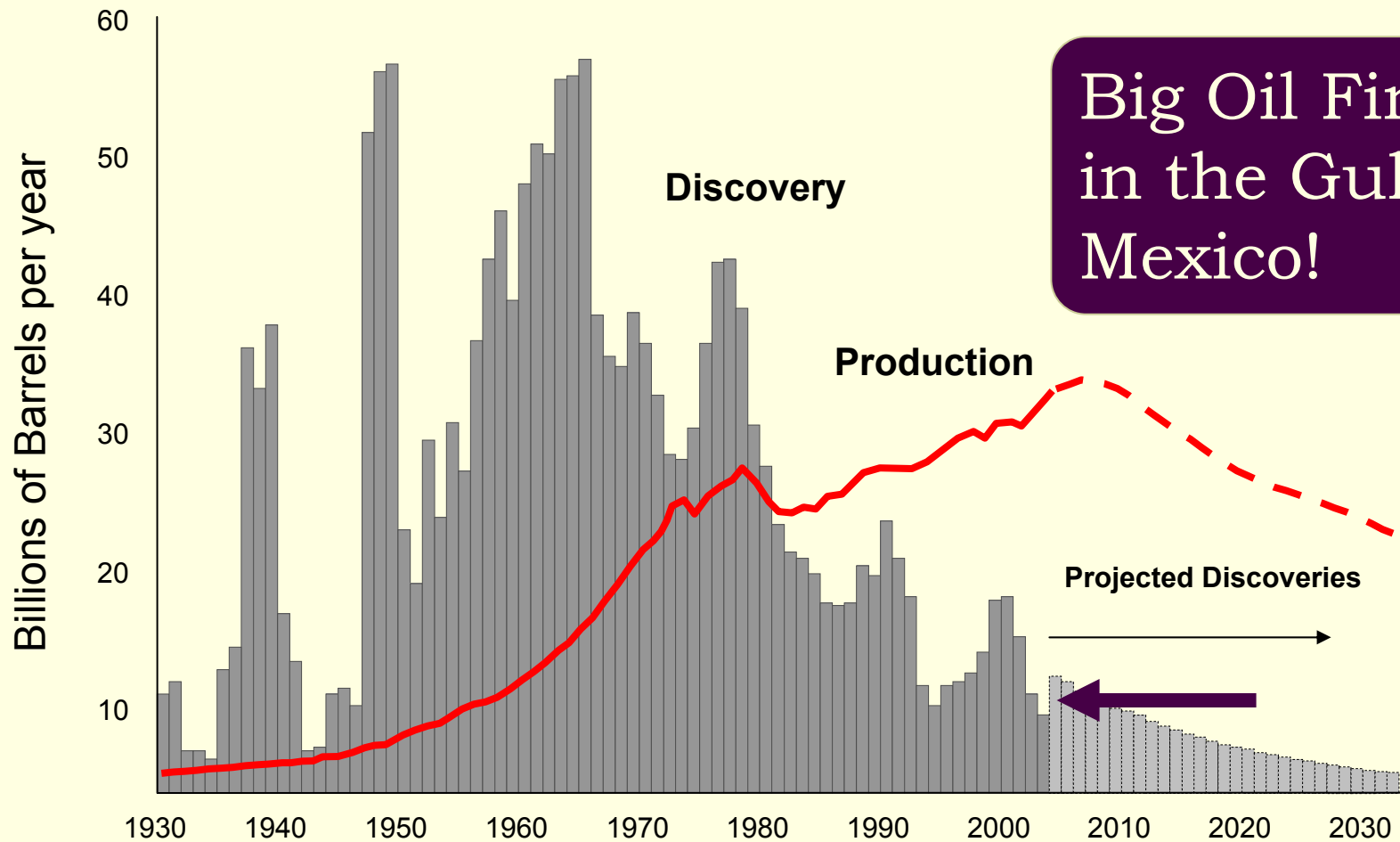
Oil Supply Shortfall

Environmental Catastrophe



Facts about Oil Resources

Global Oil Production will Peak and Decline

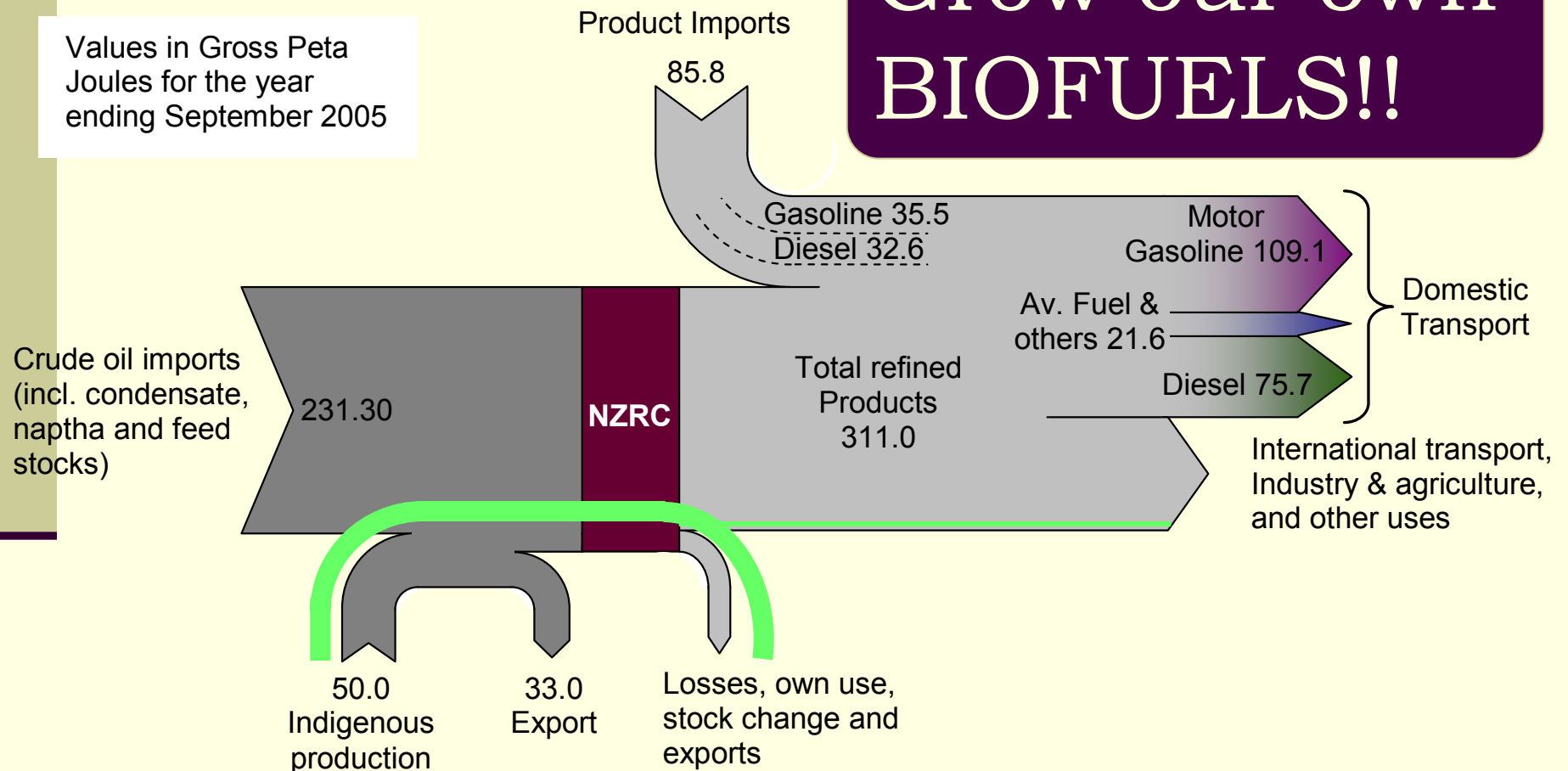


Big Oil Find
in the Gulf of
Mexico!

Facts about NZ Oil Supply

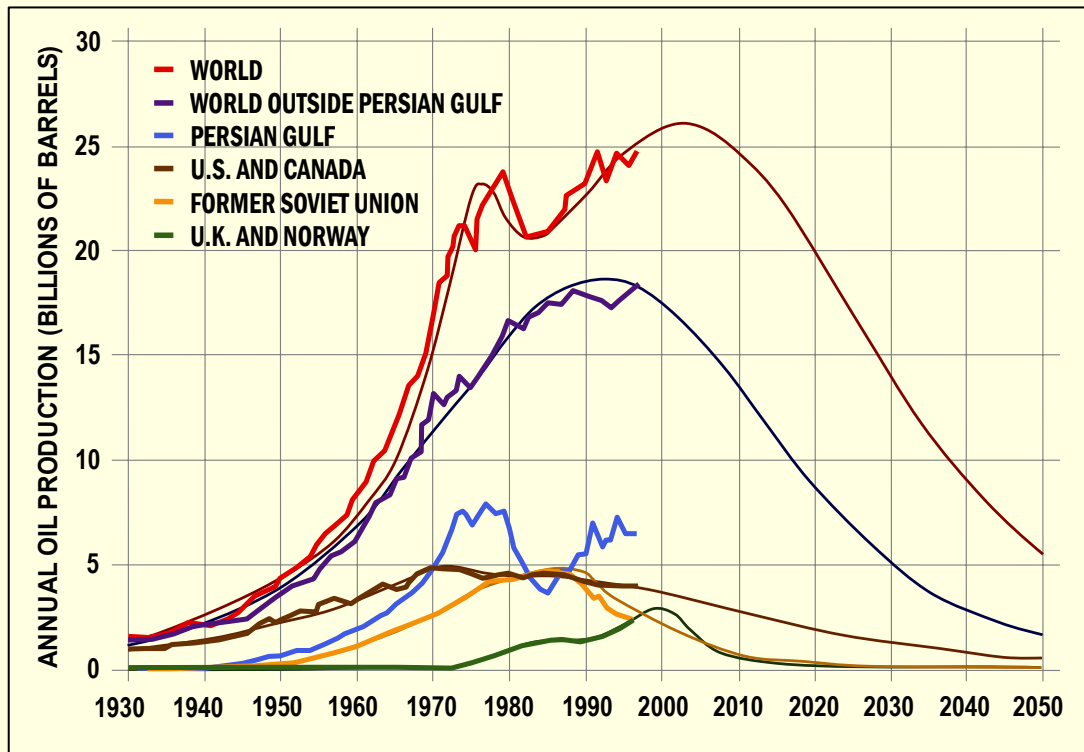
Grow our own
BIOFUELS!!

Values in Gross Peta
Joules for the year
ending September 2005



New Zealand is Dependent on World Oil Market

Probability of Fuel Shortfall



Shortage
20% Below 2005

2020 **8%**

2025 **60%**

2030 **91%**

MED Energy Outlook: BAU
37% Fuel Increase by 2030

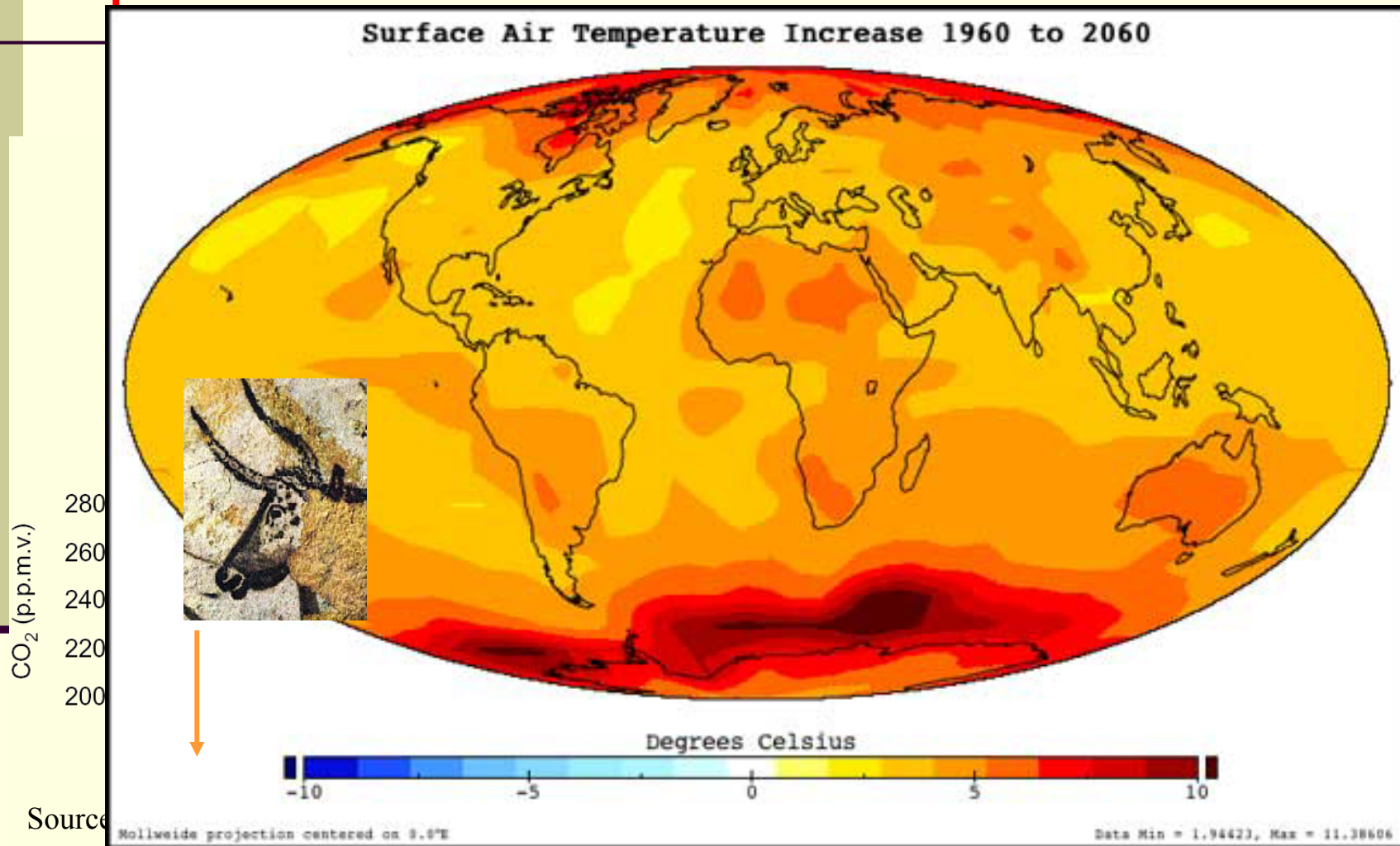
Post Peak Oil Supply Decline

Shortages

Atmospheric Chemistry Facts

← IEA Optimistic Target 2030

550 ppm



There is no up-side

An aerial photograph of a multi-lane highway at night, showing heavy traffic with many cars and trucks. The scene is illuminated by streetlights and vehicle headlights, creating a dense pattern of lights. The text "Adaptation to Mitigate Risks" is overlaid in white, bold, sans-serif font in the center of the image.

Adaptation to Mitigate Risks

Adaptation:



Curtail Fossil Fuel Consumption

15% decrease in fuel imports per year to meet RSNZ Energy Panel target for risk mitigation

HOW?!?

\$1.2 Billion per year to spend on the solution

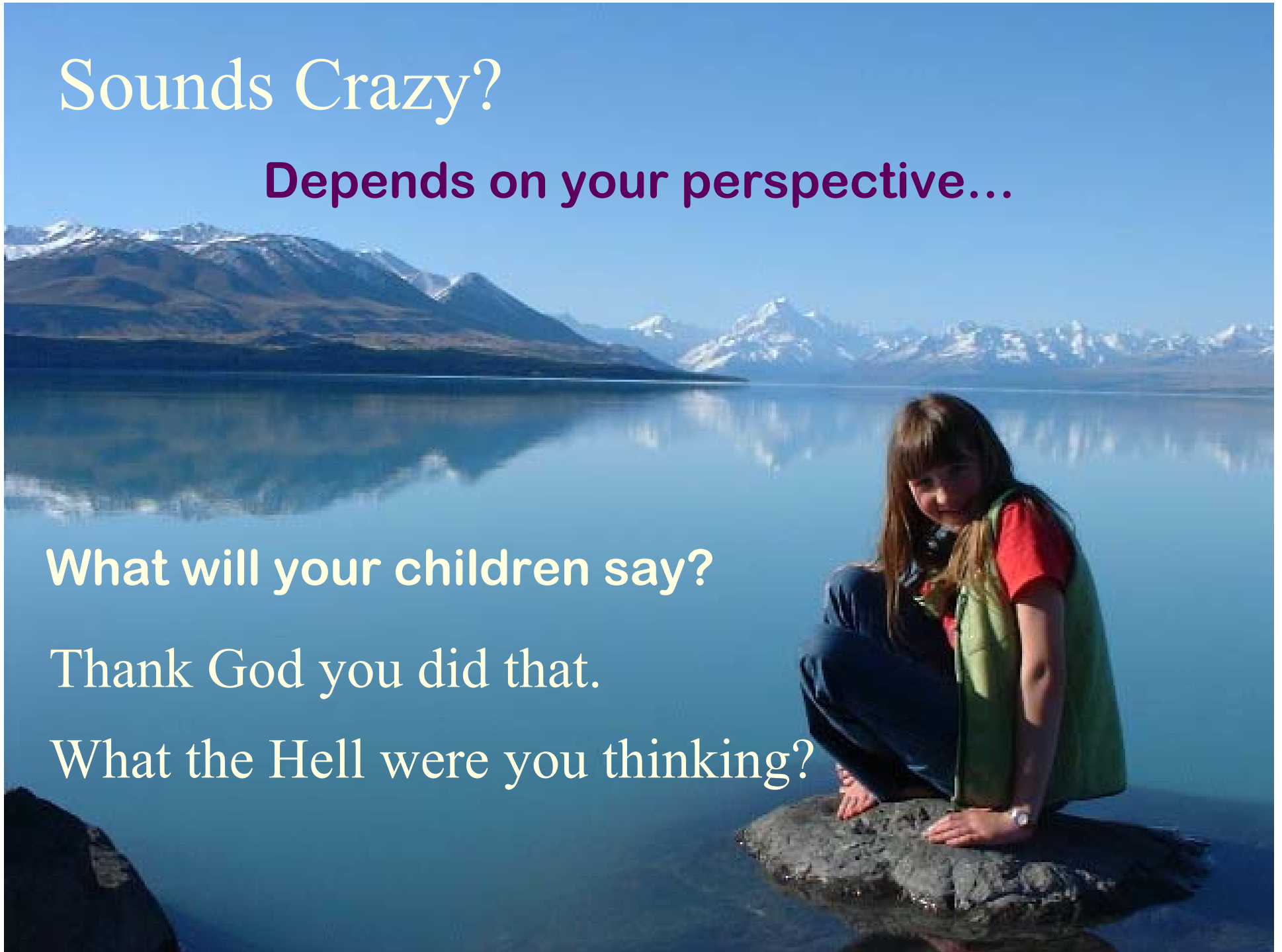
Sounds Crazy?

Depends on your perspective...

What will your children say?

Thank God you did that.

What the Hell were you thinking?



An aerial photograph of a multi-lane highway at night, showing heavy traffic. The scene is illuminated by the headlights and taillights of the cars, creating a dense pattern of light. The highway has several lanes in each direction, separated by a median. The text "Transform to a Low Risk System" is overlaid in white, bold, sans-serif font across the center of the image.

Transform to a Low Risk System

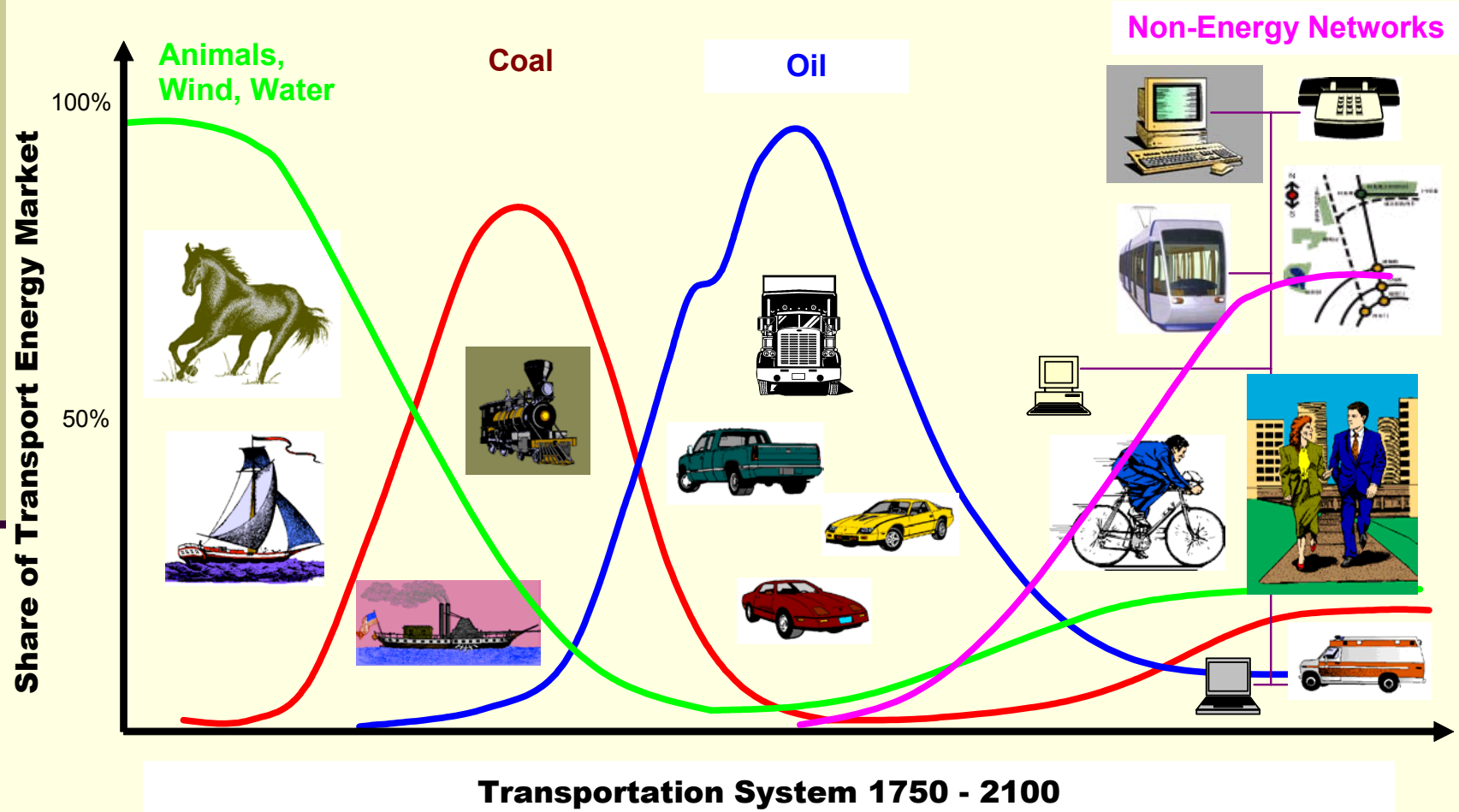
Transformation:



De-Carbonized Forms Production, Trade and Activities



Transformation Engineering Research



What will your great-grandchildren say about us?



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Conclusion
Curtail Fossil Fuel Consumption

Recommendations

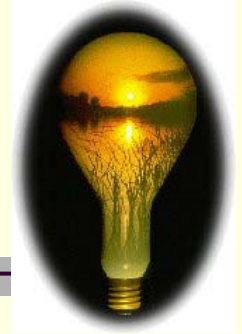
Research is needed to determine HOW to curtail fossil fuel use while ensuring wellbeing and productivity.

Urgently need to get talented, creative engineers working on this problem!



Advanced Energy and Material Systems Lab

New Research Results



Energy Risk to Activity Systems as a Function of Urban Form

Land Transport New Zealand Research Report

A. Dantas, S. Krumdieck and S. Page, (2006).

Energy reliance, urban form and the associated risk to urban activities

M. J. Saunders, S. Krumdieck, A. Dantas, *Road & Transport Research*, Vol 15 No 1 (2006) 29-43.

Performance-Objective Design for Energy Constrained Transportation System

A. Dantas, S. Krumdieck, A. Hamm, M. Saunders, S. Minges, *Journal of Eastern Asia Society for Transportation Studies*, 6 (2005) 3276-3292.

Assessing the risk to suburban activities associated with transport energy availability as a function of urban form

A. Dantas, S. Krumdieck, M. Saunders, Transportation Research Board 85th Annual Meeting (Washington D.C. January 22-26, 2006) CD-ROM.

2020: Energy Opportunities, Report of the Energy Panel of the RSNZ (2006)