Have you gone down a Transport Modelling Tunnel?

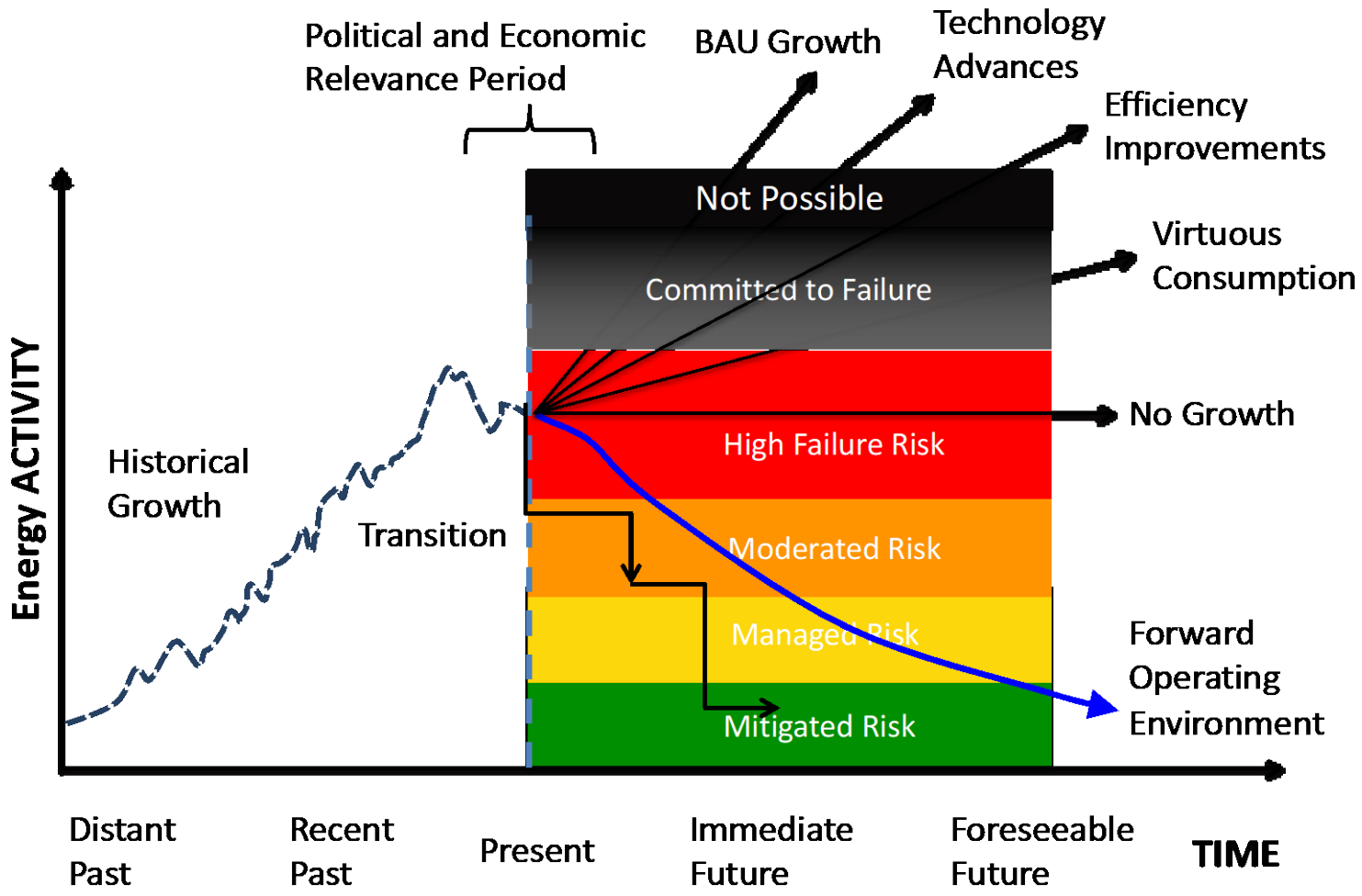
Professor Susan Krumdieck, MNZM, MGATE, FIES

Normal Transport Modelling:
Invest in property development and infrastructure for mobility and the economy will grow

New Normal Modelling:
Households engaging in activities to meet their needs, and adapting to survive, thrive and endure.

Modelling for Needs-Meeting

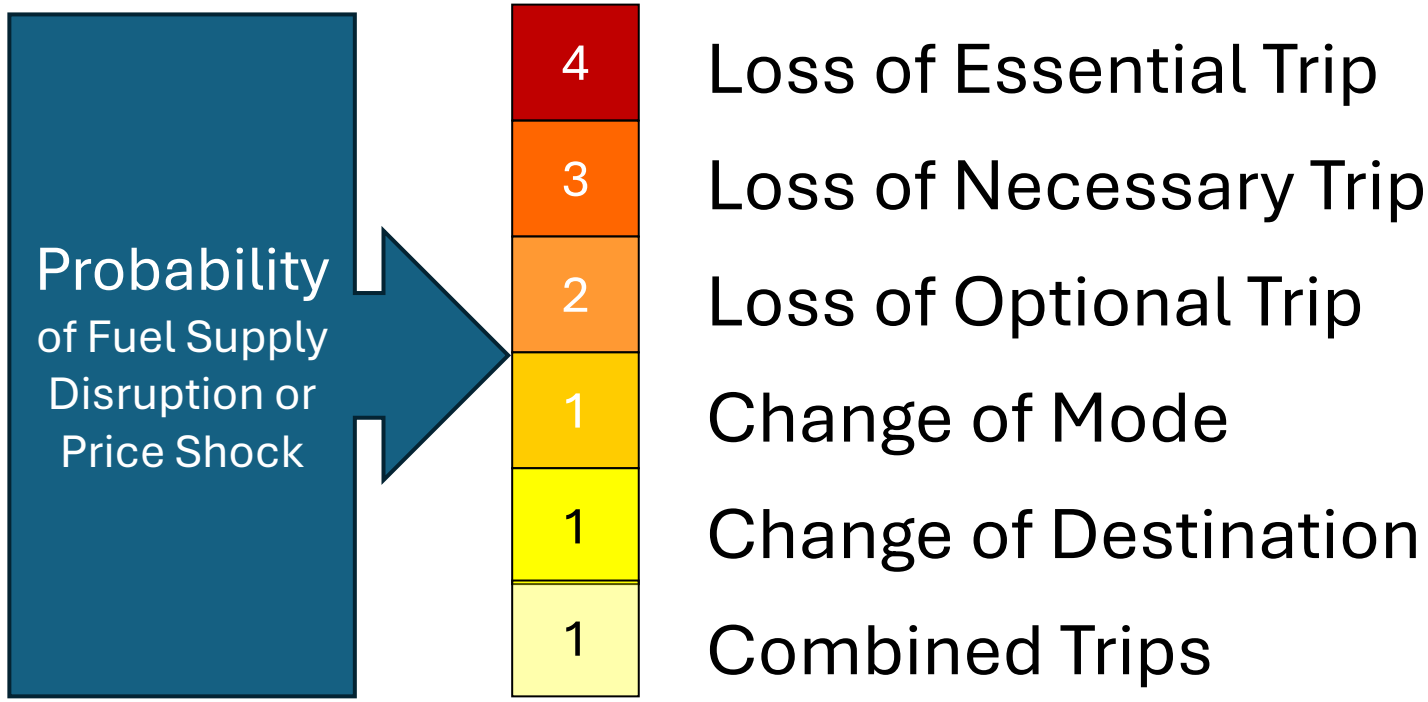
1.0 Risk & Safety



Krumdieck, *Transition Engineering, Building a Sustainable Future* (2020)

Energy Risk to Essential Activities

How vulnerable are needs-meeting transport activities under an energy system failure?



Krumdieck, Page, Dantas, *Trans Res A* (2010)

BBC NEWS

Friday, 15 September, 2000, 11:44 GMT 12:44 UK

School closures worsen in fuel crisis

The number of closed schools has more than doubled
The fuel shortage has forced more schools than ever to close - with forecasts of worse to follow next week.
The Department for Education says that there are 131 schools closed in England on Friday - affecting more than one in 10 local education authorities.

www.news.bbc.co.uk

Chatterjee and Lyons (2002)

Risk Factor Case Study
Christchurch, New Zealand

Centred

$R_e = 0.275$

Sprawl

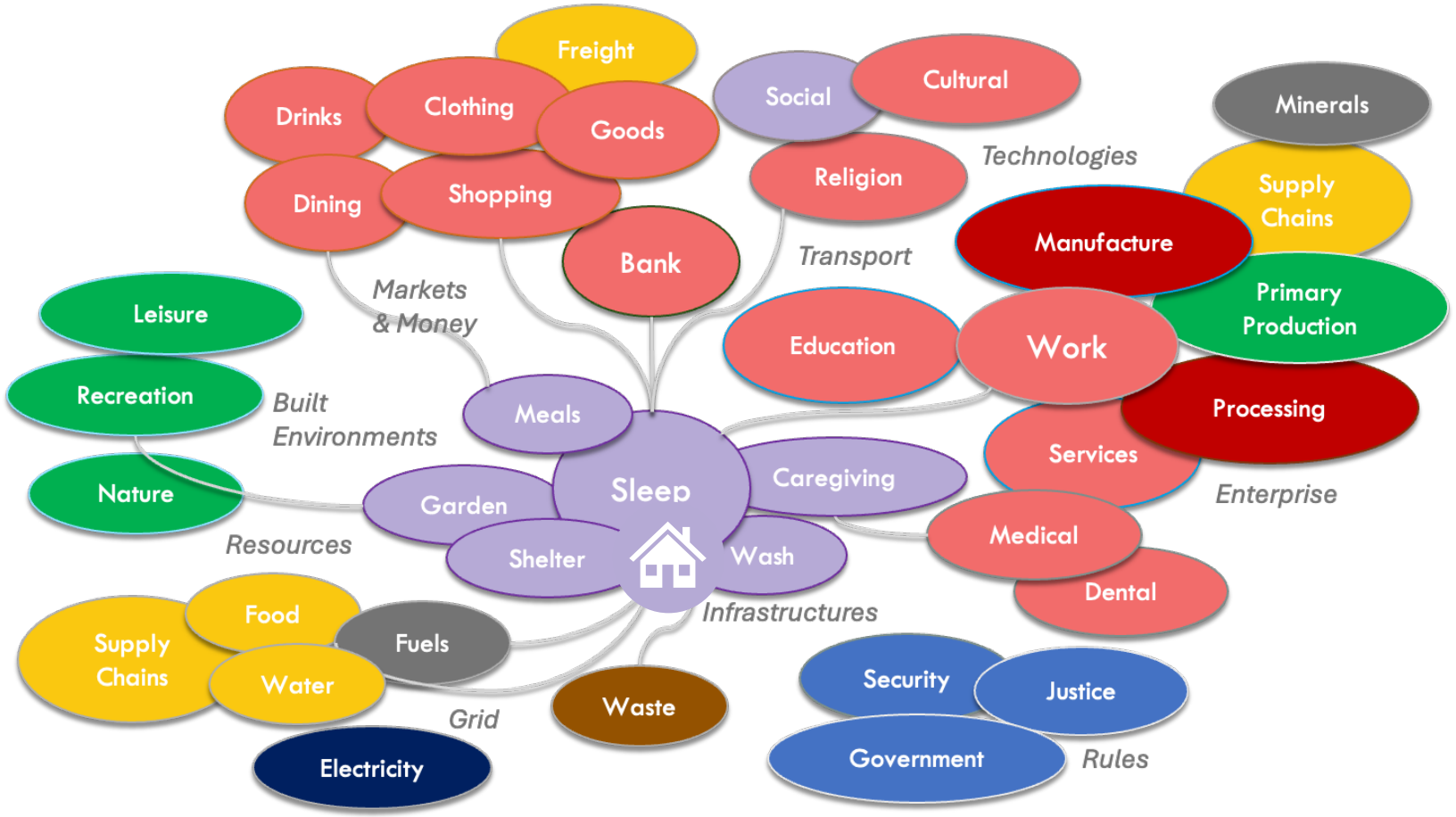
$R_e = 0.621$

Dantas, Page, Krumdieck *Report CCC* (2010)

Needs-Meeting Modelling

2.0 Access-Ability

Needs-Meeting Activities



For a specific household, how many activities can be accessed without fossil fuel?

Household Minimum Energy Access to Activities METAA Modelling*

AMA

Active Mode Accessibility

Geospatial Data

Every house address populated from demographic statistics

1 km along all network routes

Count all Destinations

Use Frequency for 19 Activity Categories

AMA is % of TD reached

ArcGIS

Python AMA Calculation

**not centroid and circle*

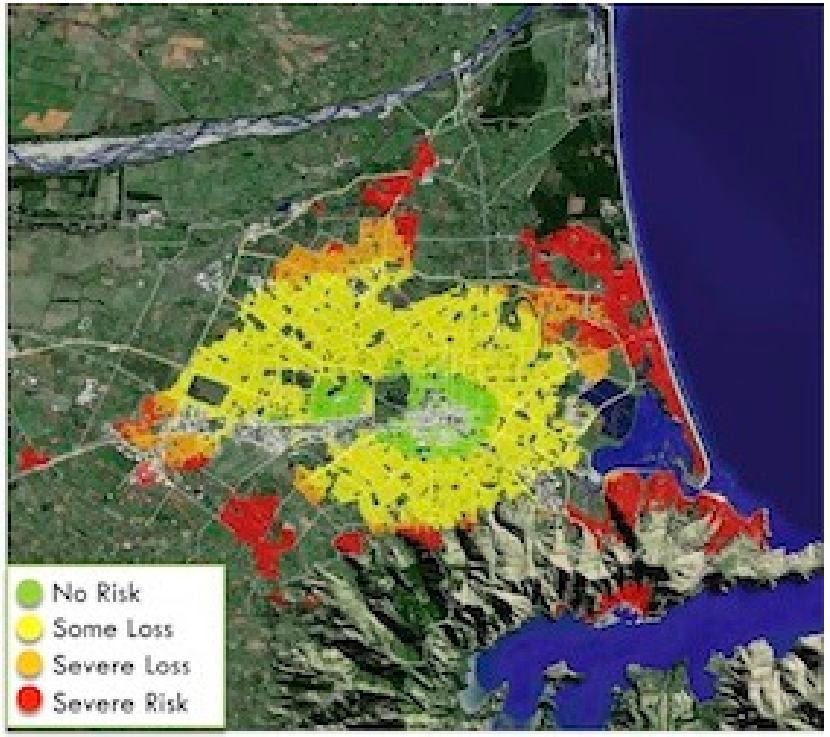
Rendall *et al*. *TRB* (2011)

METAA City – Energy Economic Vulnerability

Household Needs-Meeting Asset Value of Property

Household Risk of property devaluation pressure from fossil fuel downshift

Christchurch, NZ 2010

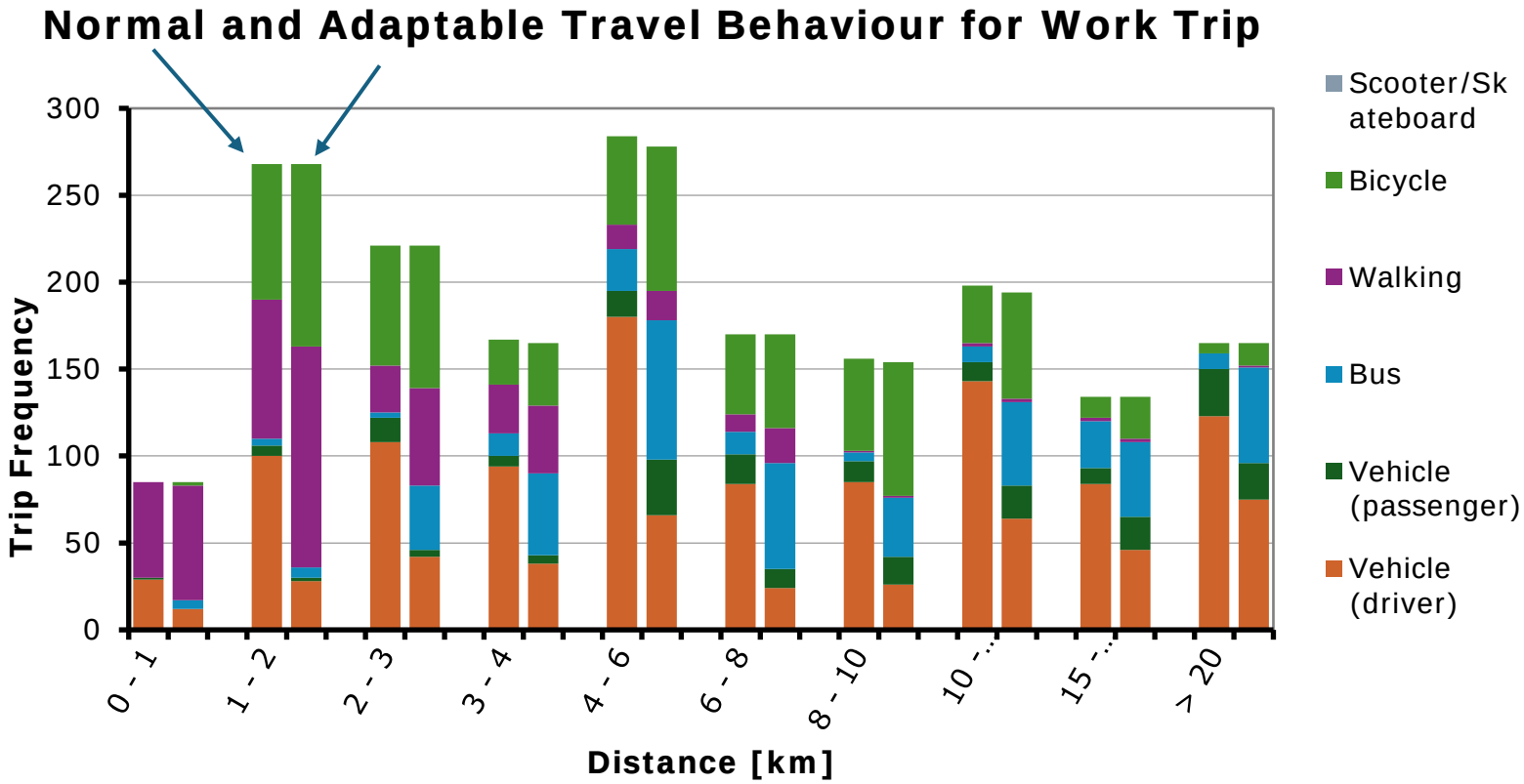


Rendall, Page, Krumdieck, *Energies* (2014)

Needs-Meeting Modelling

3.0 Adaptive Capacity

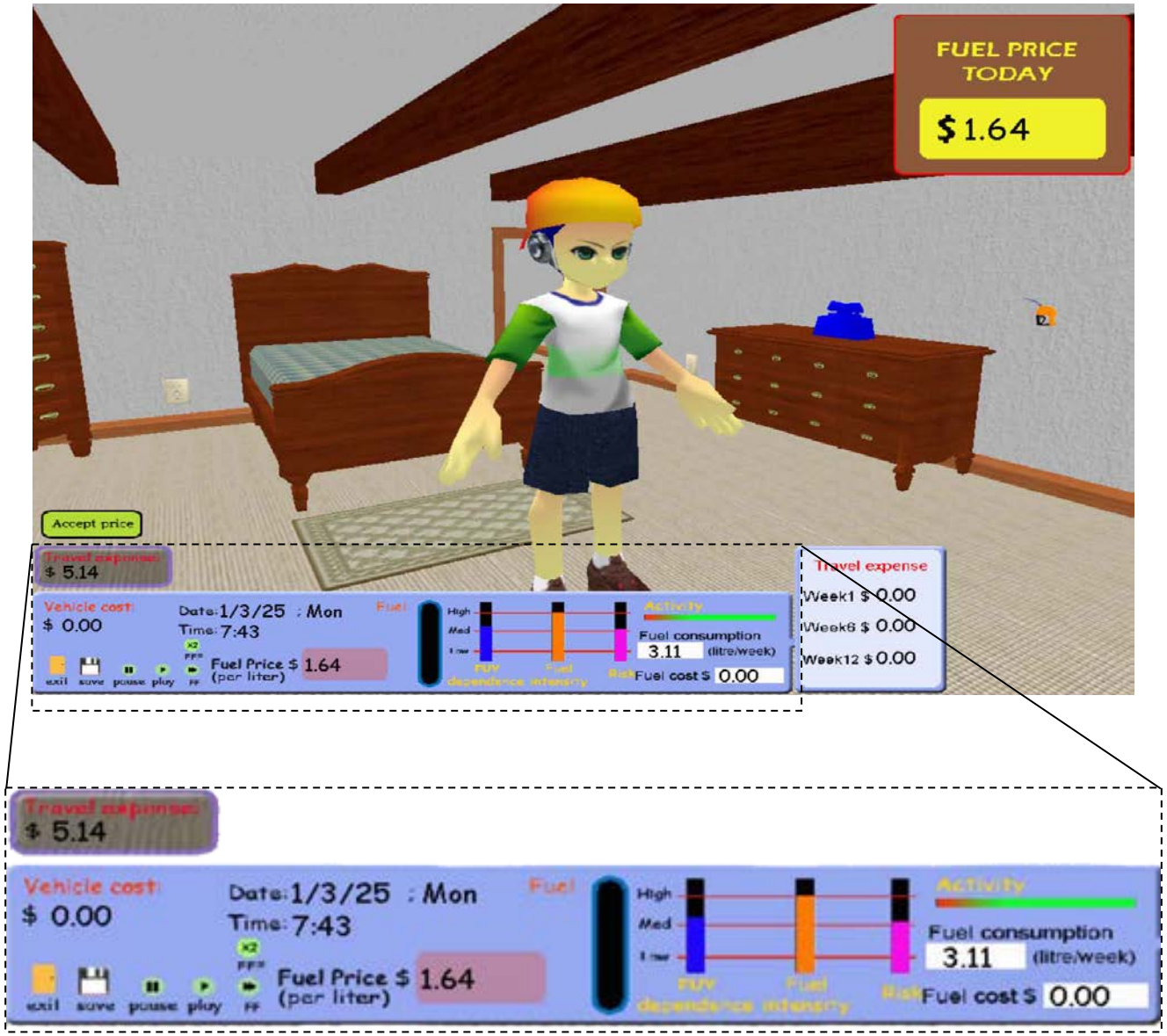
Do you have another way?



Krumdieck, Page, Watcarasukarn, *NZTA Report 486* (2012)

TACA SIM Game Utility

Household Travel Audit



Adaptive Capacity for Fuel Reduction
General Staff ~ 30%
Academic Staff ~ 40%
Students ~ 60%

Watcharasukarn, *et al*. *Simulation & Gaming* (2011)

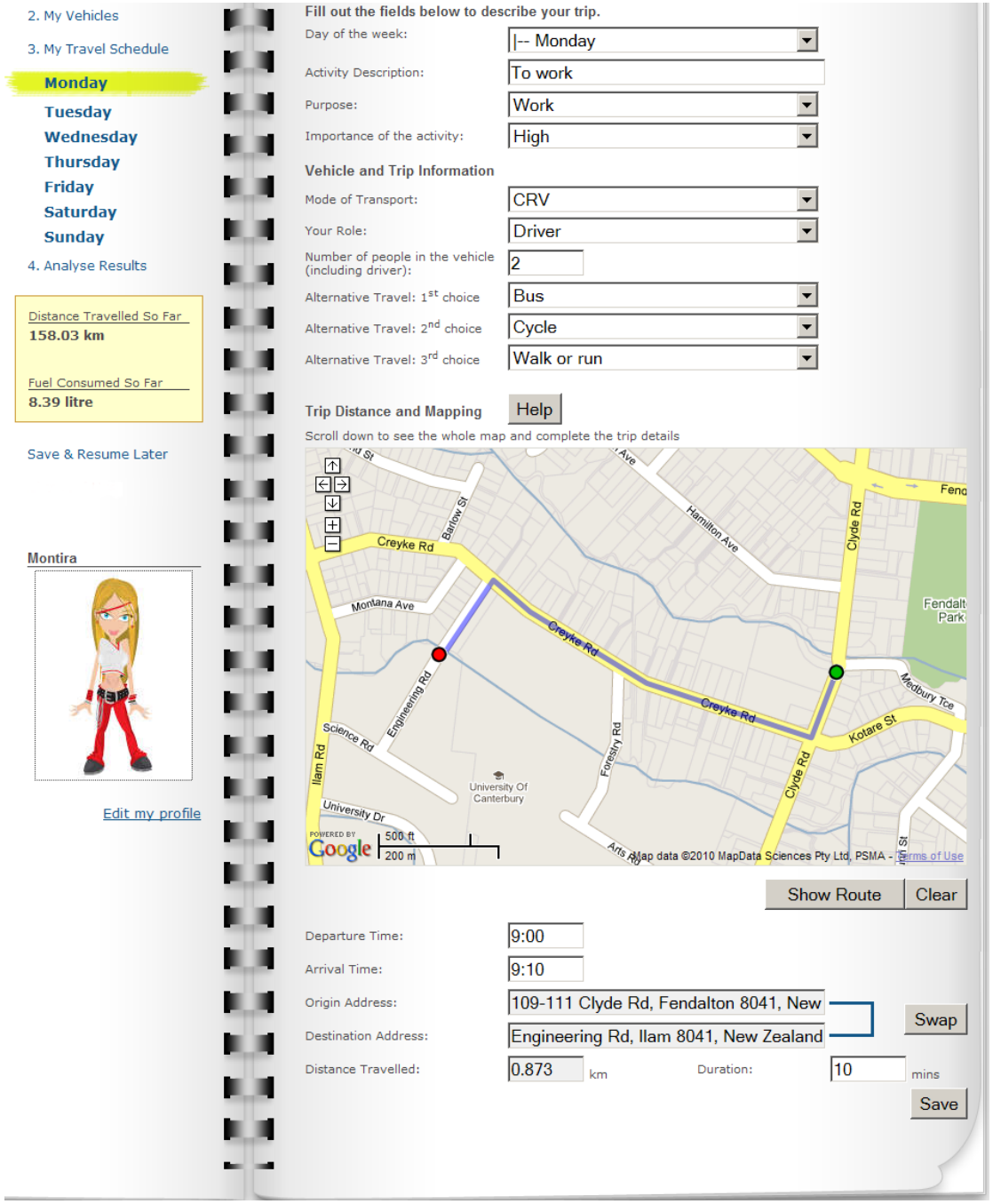
TACA Sim Game Utility

Weekly Activities

Google Map O-D

100% Participation
Avg 20 min
450 participants

Personalized Data Interface
“Fun to do”
“Interesting results”
“I learned a lot, I didn’t know the kid’s school was so close, we will try walking”



Watcharasukarn, Page, Krumdieck, *Trans Res A* (2012)

Validate TACA Sim with Odometer Data

2006

Household VKT derived from
New Zealand Transport Agency (6 monthly) warrant of fitness odometer readings, all cars.

How much driving are households in doing?

25,000

20,000

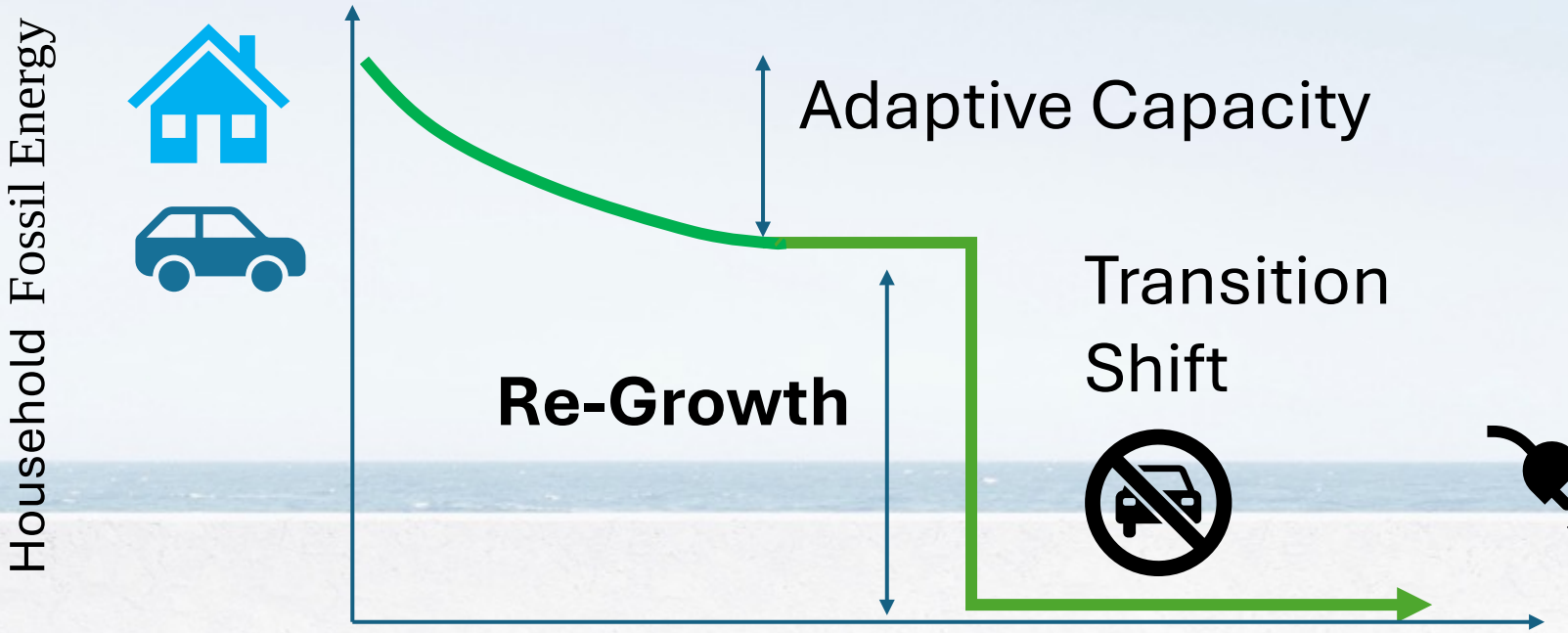
15,000

10,000

8,000

Adaptation and Transition Shift

Ability to meet needs and re-grow while shifting away from fossil fuel energy.



Activity Ecosystem

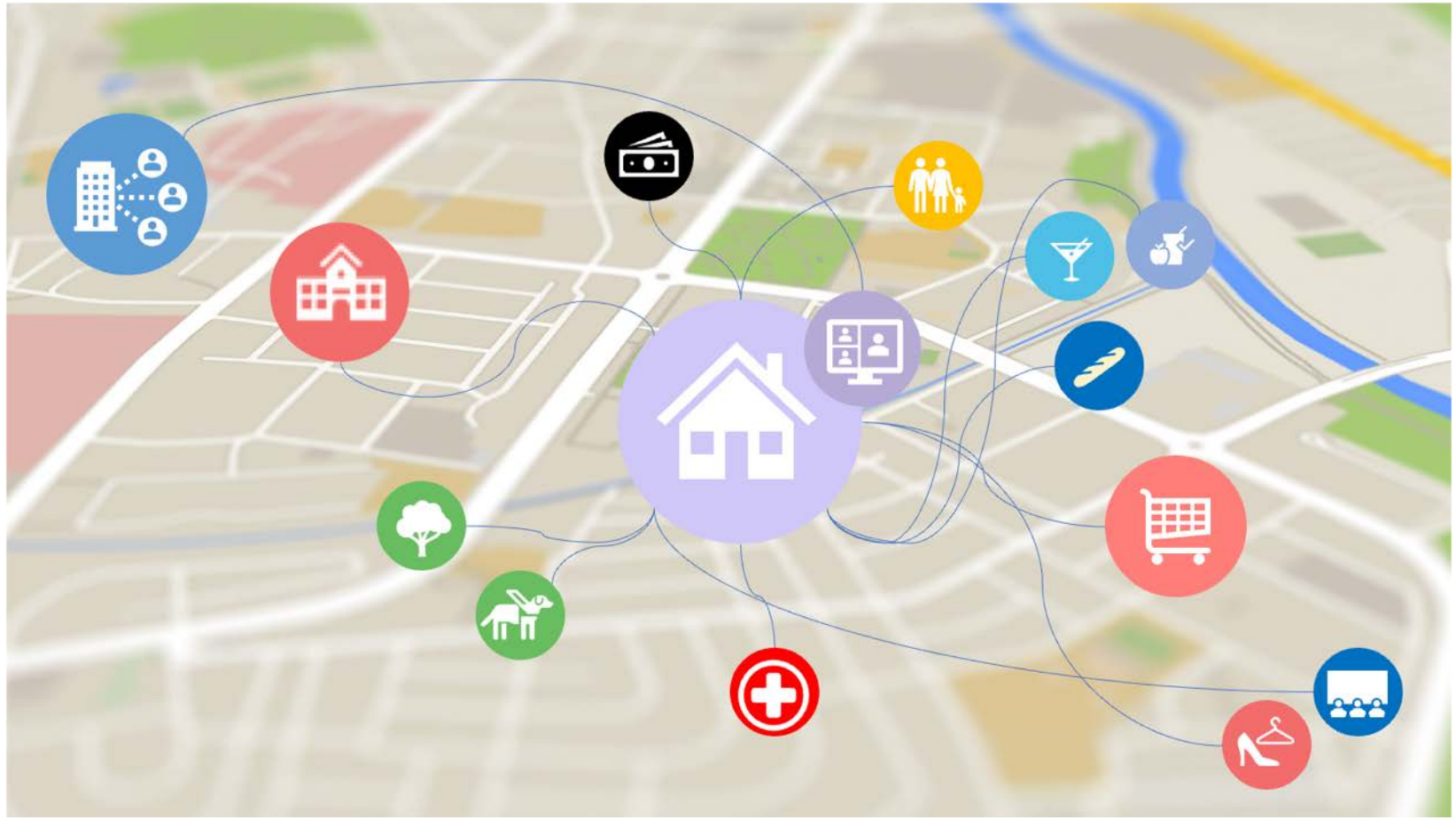
Jochem *et al.*, *Tran Res A* (2020)

Needs-Meeting Modelling

4.0 Household Activity Web

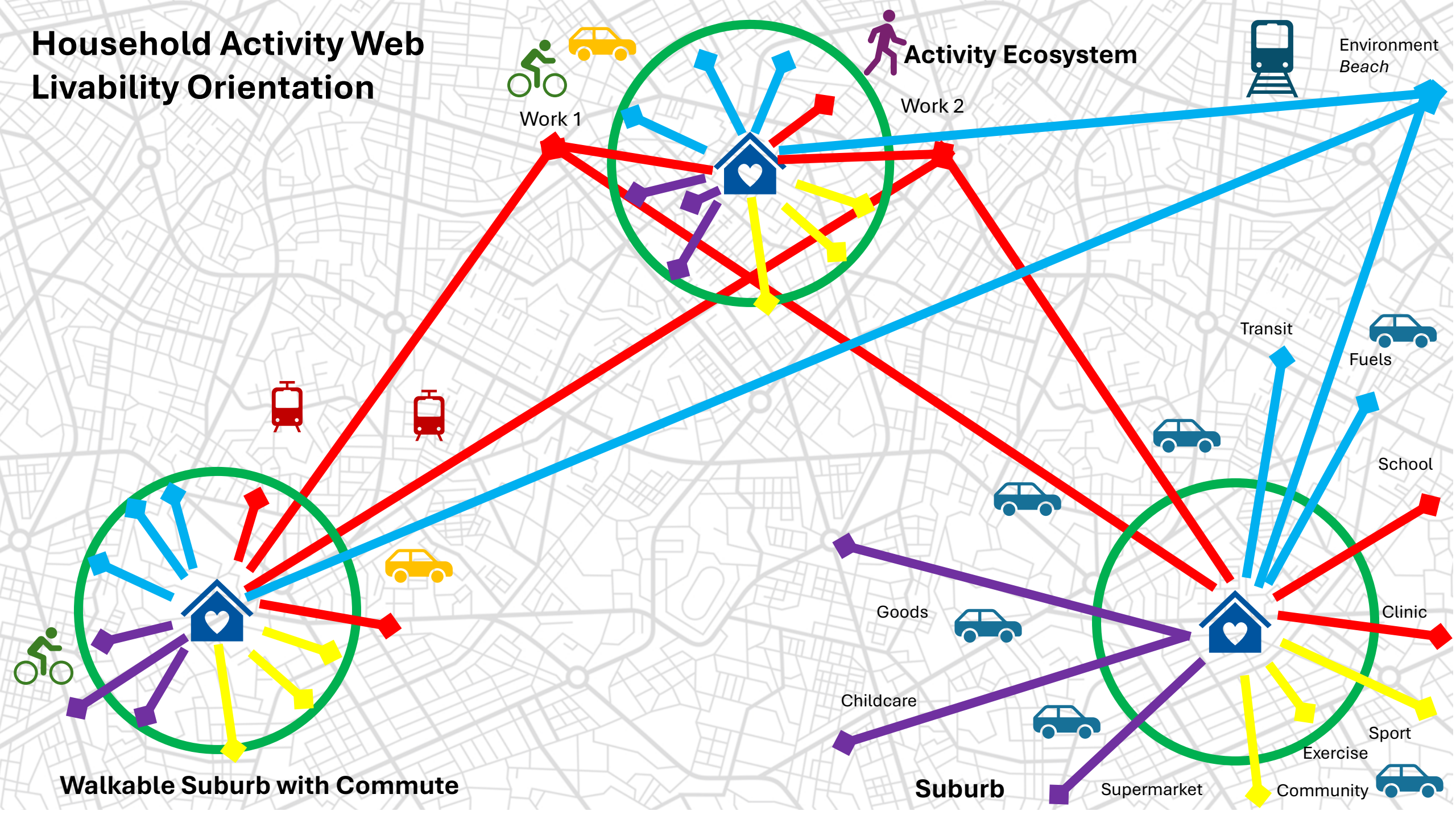
Place Finder Place Maker

Novel Placemaking Utility



TACA Sim approach, enhanced for Employment Connection, Essential Needs, Activity Demand and Housing Demand

Household Activity Web
Livability Orientation



Re-Growth

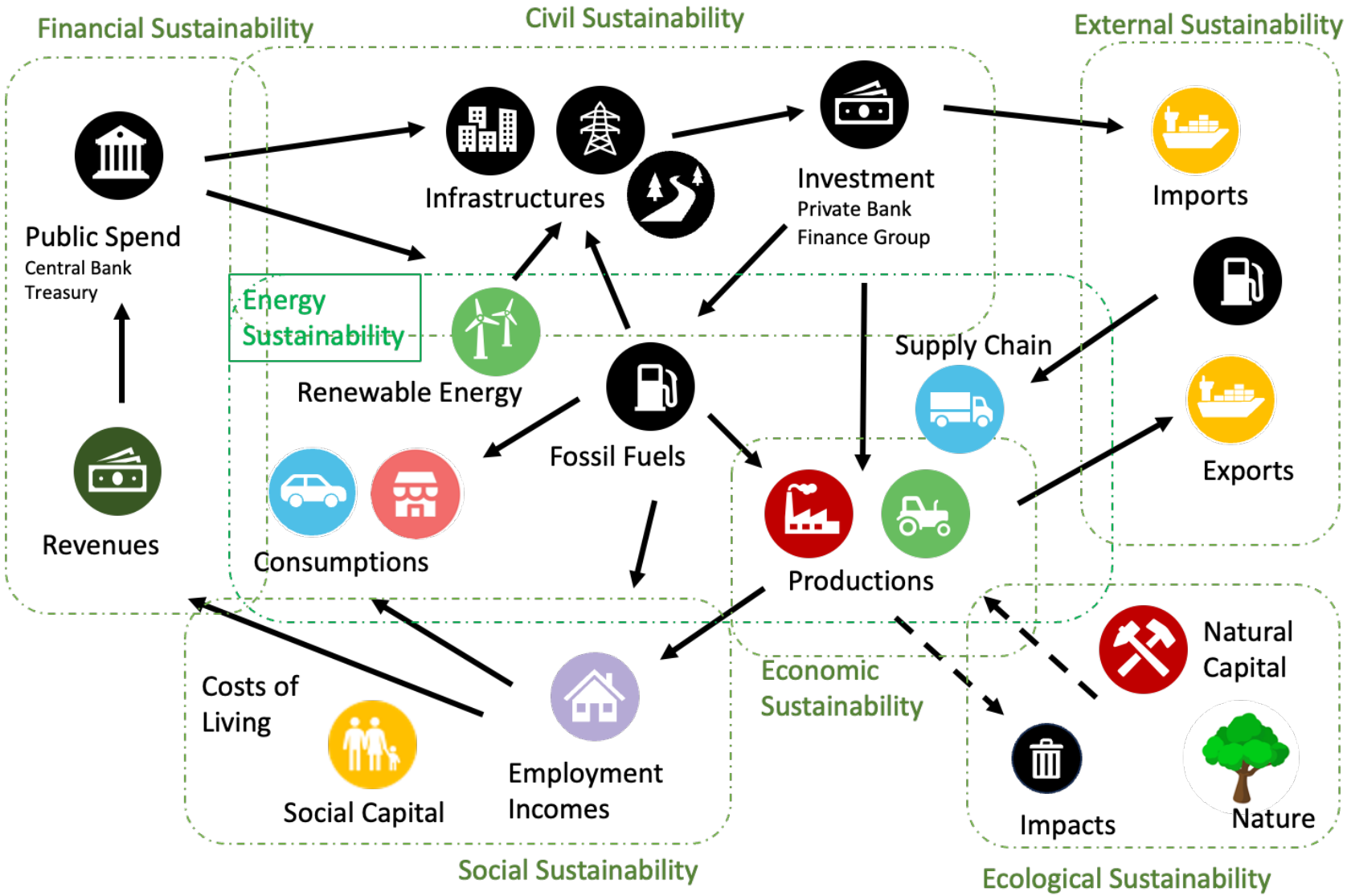
Household Activity Web Creates Activity Demand Data for Business Development and Housing Re-Development

Activity Ecosystem

Bai, Krumdieck *Cities* (2020)

Needs-Meeting Modelling

5.0 City Solvency



System Transition for solvency is an exciting new research area.

Needs-Meeting Modelling

TransitionScaping

Data Exchanges,
Modellizations,
Observatories

Economy &
Regulation

Property &
Rental
Markets

Public
Investment

Property
Development

Climate, Ecology
& Geology

Council Budget
Finance Market

Needs Meeting

Supply Chains

Transport
Infrastructures

Built Environment

Geography of Place

Risk
Activity Web
PlaceFinder

Access to Activities
Adaptive Capacity
Economic & Social
Productivity Sandboxes

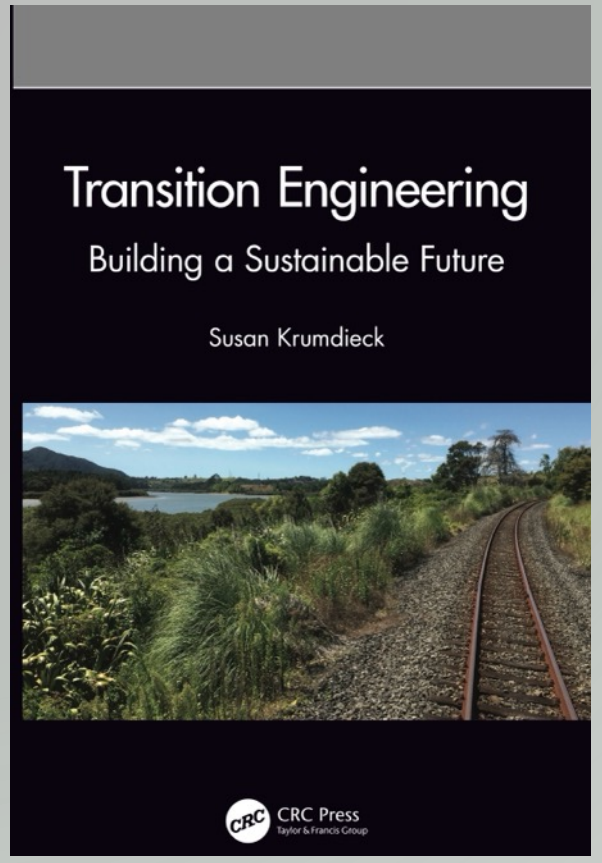
Access to Goods
PlaceMaker
Economic & Social
Productivity

Regeneration
Climate Adaptations

Ways things happen

What is happening

Harmonizing Objectives

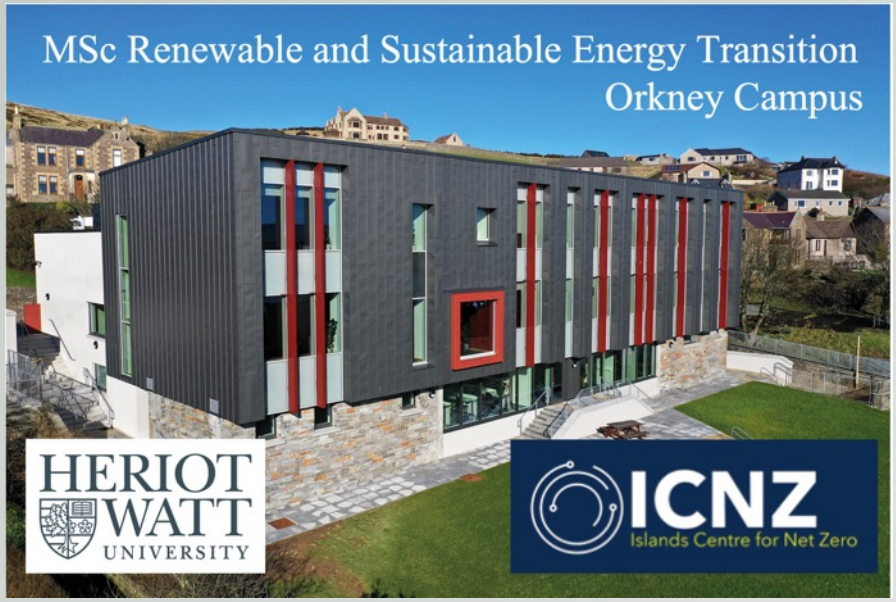


Transition Engineering

Approach, Methods, Tools

Interdisciplinary Professional Organisation
CPD and MSc Courses at HWU
Systems Transition Engineering Processes (STEPs) Programme
Transition Engineering Research Lab
Standards of Practice
Consultancies on Path Break Strategy
Policy and Regulation Recommendations

GLOBAL ASSOCIATION FOR TRANSITION ENGINEERING



What is the biggest Systems Transition Challenge for our Civilization?

Our Cities