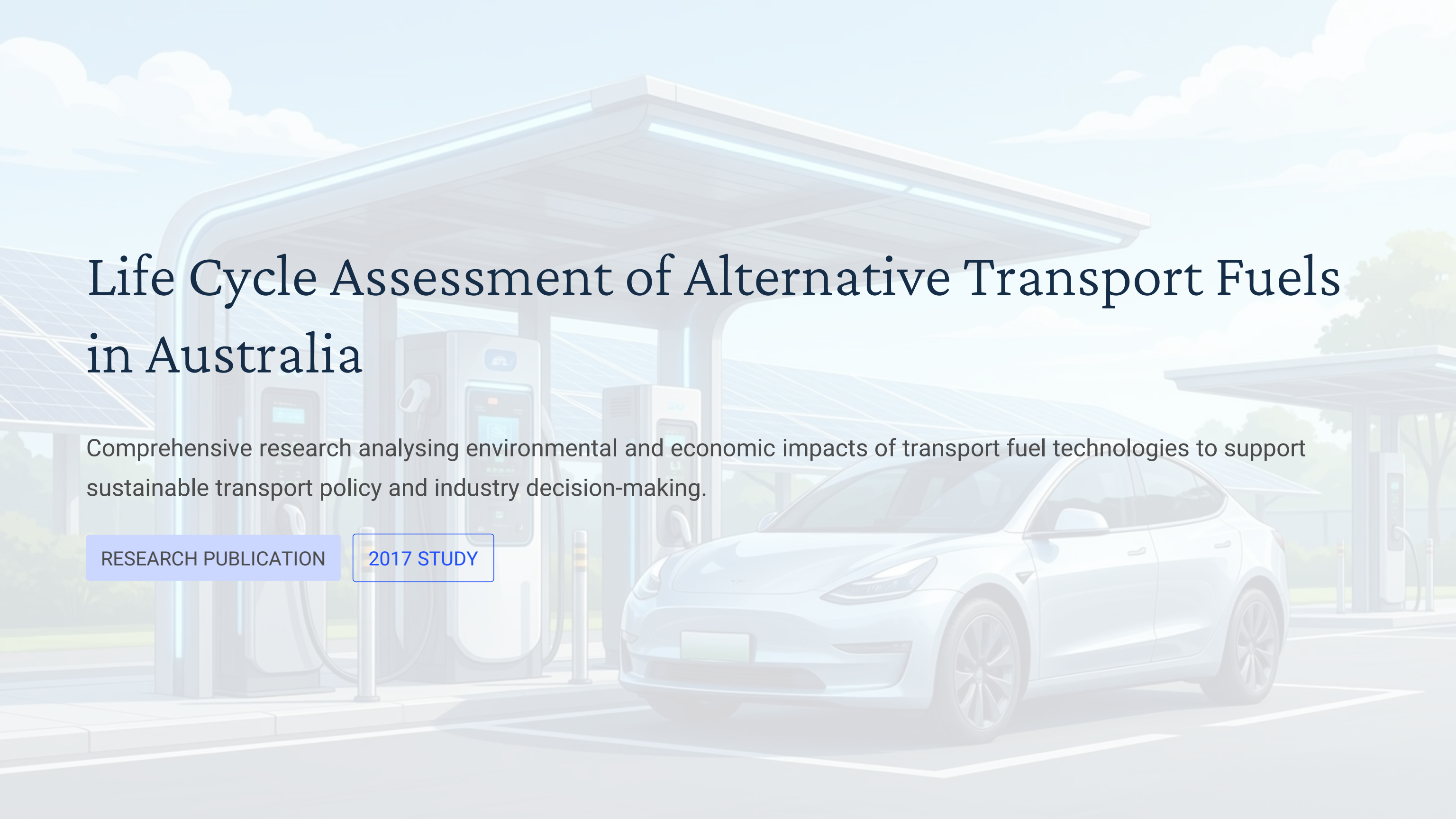




Life Cycle Assessment of Alternative Transport Fuels in Australia

Comprehensive research analysing environmental and economic impacts of transport fuel technologies to support sustainable transport policy and industry decision-making.

RESEARCH PUBLICATION

2017 STUDY

Research Overview

Authors & Affiliation

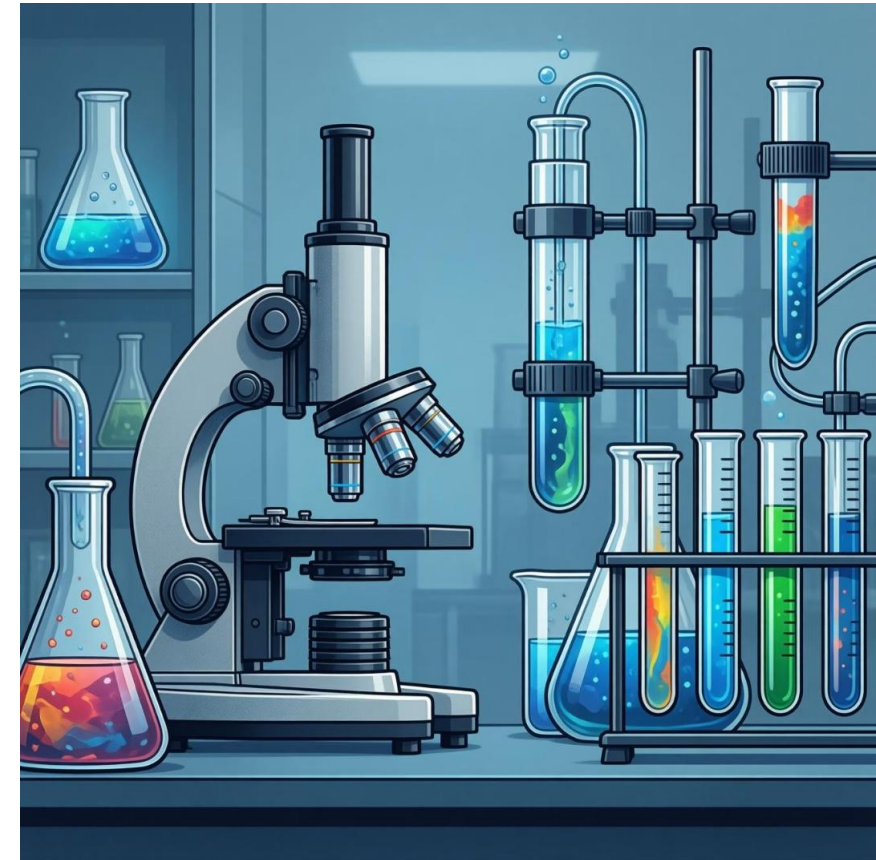
Ashish Sharma and **Vladimir Strezov** conducted this groundbreaking study published in the prestigious *Energy* journal. The research provides critical insights into the life cycle impacts of alternative transport fuels specifically within the Australian context.

This comprehensive life cycle assessment (LCA) examined multiple fuel pathways using SimaPro 8.05 software and the Recipe methodology, establishing a robust framework for comparing environmental and economic performance across diverse transport technologies.

Publication Reference

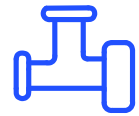
Sharma, A., & Strezov, V. (2017). Life cycle assessment of alternative transport fuels in Australia. *Energy*, 145, 1-12.

DOI: [10.1016/j.energy.2017.04.160](https://doi.org/10.1016/j.energy.2017.04.160)



📄 **Methodology:** SimaPro 8.05 with Recipe assessment framework

Fuel Technologies Analysed



Conventional Fuels

Diesel and petrol (gasoline) technologies representing current dominant market solutions



LPG Technology

Liquefied petroleum gas as an alternative fossil fuel option



Biofuels

Biodiesel and ethanol flexi-fuel technologies from renewable sources



Hydrogen Fuel Cells

Advanced hydrogen fuel cell technology for zero-emission transport



Electric Vehicles

Battery electric vehicle technology powered by grid electricity

Key Research Findings

1

Highest Environmental Impact

Ethanol flexi-fuel technology demonstrated the highest environmental burden across multiple impact categories, challenging common perceptions about biofuel sustainability.

2

Highest Economic Cost

Battery electric vehicles exhibited the highest economic costs when considering total life cycle expenses, infrastructure requirements, and current technology limitations.

3

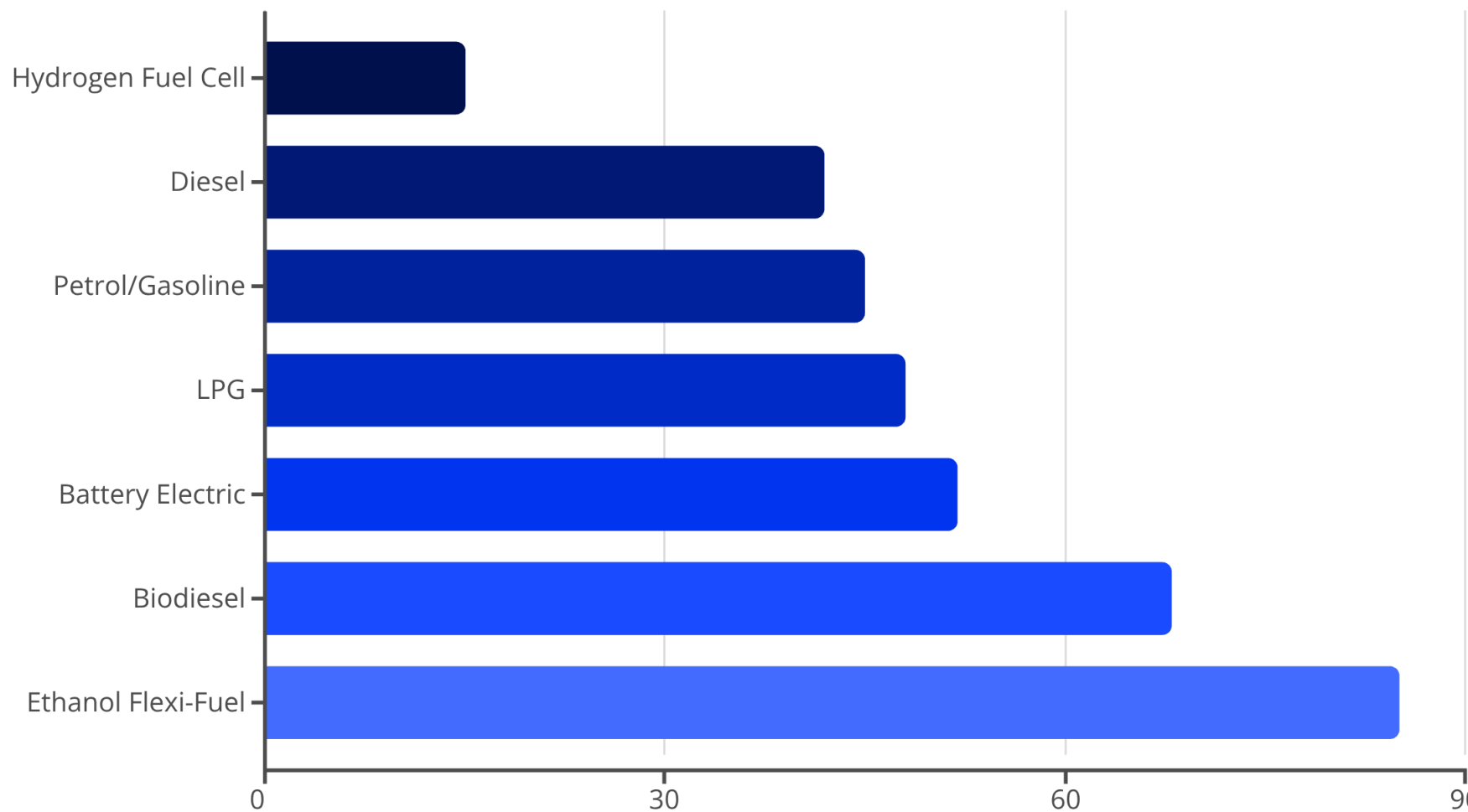
Best Overall Performance

Hydrogen fuel cell technology emerged as the most favourable option, achieving the lowest combined environmental and economic impacts across the assessment.

Environmental Impact Analysis

Comparative Assessment of Transport Fuel Technologies

The life cycle assessment evaluated environmental impacts across multiple categories including climate change, human toxicity, ecosystem quality, and resource depletion. Results reveal significant variations between fuel pathways, with implications for policy development.



Hydrogen fuel cell technology demonstrates superior environmental performance, whilst ethanol flexi-fuel systems show unexpectedly high impacts due to agricultural inputs and processing requirements.

Economic Impact Assessment

Total Life Cycle Costs

Economic analysis incorporated vehicle acquisition costs, fuel production and distribution expenses, infrastructure requirements, maintenance, and end-of-life considerations across a typical vehicle lifetime.

Battery electric vehicles, whilst offering low operational costs, face significant economic challenges from expensive battery systems, limited infrastructure, and current technology maturity levels in the Australian market context.

 **Key Insight:** Lowest economic impact achieved by hydrogen fuel cell technology when considering total life cycle perspective



Hydrogen Fuel Cell Advantage



Environmental Excellence

Lowest greenhouse gas emissions and minimal ecosystem impacts across entire life cycle



Economic Viability

Competitive total cost of ownership when infrastructure and scale economies develop



Technical Maturity

Advancing technology readiness with growing commercial deployment worldwide



Renewable Integration

Excellent compatibility with renewable energy sources for green hydrogen production

The research identifies hydrogen fuel cell technology as the optimal pathway for sustainable transport in Australia, balancing environmental performance with economic feasibility.

Policy & Industry Implications



Policy Development

Evidence-based framework for transport policy decisions and emissions reduction strategies



Industry Planning

Strategic guidance for automotive manufacturers and fuel infrastructure investors



Sustainability Targets

Quantified pathways to achieve national climate commitments and air quality goals

Strategic Recommendations

- Prioritise hydrogen infrastructure development
- Reconsider biofuel incentive programmes
- Support electric vehicle adoption with renewable grid integration
- Implement technology-neutral carbon pricing mechanisms



Research Methodology Excellence

1 System Boundary Definition

Comprehensive cradle-to-grave scope including fuel extraction, processing, distribution, vehicle operation, and end-of-life stages

2 Software & Framework

SimaPro 8.05 life cycle assessment software with Recipe impact assessment methodology for robust, internationally recognised analysis

3 Data Collection

Australian-specific data for fuel production, energy systems, and transport conditions ensuring local relevance and accuracy

4 Impact Categories

Multiple environmental indicators including climate change, acidification, eutrophication, human toxicity, and resource depletion

5 Economic Assessment

Total cost of ownership analysis incorporating capital, operational, maintenance, and infrastructure expenses

The rigorous methodology employed ensures credible, defensible results suitable for high-stakes policy and investment decisions in Australia's transport sector.

Knowledge Product Application

Sustainability Consulting Value

This research exemplifies the type of rigorous, evidence-based analysis that Sustainability Alternatives delivers to clients seeking to navigate complex environmental and economic trade-offs in transport and energy systems.

Our knowledge products combine academic rigour with practical applicability, providing actionable insights that support strategic decision-making for government agencies, corporations, and industry associations.

7

Fuel Technologies

Comprehensively assessed

15+

Impact Categories

Evaluated across life cycle

1

Clear Winner

Hydrogen fuel cell technology



Access Full Research

Read the complete peer-reviewed article to explore detailed methodology, comprehensive results, and extensive discussion of findings.

Read Full Research Article