

Energy efficiency and Demand side management

Highly valuable energy resources that are consistently overlooked and underutilised

Vince Smart 26 February 2020



Energy Efficiency

It's more important than you think

Energy Efficiency can...

- Keep people alive and healthy
 - Save money and reduce costs
- Reduce greenhouse gas emissions
- Increase business productivity and international competitiveness

but, Energy Efficiency is often:

•	Over]	looked	in	favour	of poorer	options

- Deprioritised relative to genuine costs and benefits
- Resisted by voters, politicians and policymakers

Common mistakes with EE and DSM

- Electricity only
- Residential first/only
- Overly focussed on Behavioural types
- Status quo bias
- Considering a narrow area of effect
- Overlooking non-price barriers
- "Bells and whistles" solutions

Myths and misconceptions



Energy efficiency is dull

The Party of Station

If you say energy efficient car, Most people think of something like this, practical, but not fun

Gamestor



The 24 hours of Le Mans has been consistently won by (comparatively) energy efficient hybrids or diesels over the last decade Indy cars are not energy efficient, but Scott Dixon has made driving one efficiently a key strategy in winning the championship 5 times

Energy efficiency is just tinkering at the edges



Most people assume energy efficiency can deliver a few percentage points of improvement

This chart is from an article lamenting the thermal performance of British buildings, but the average NZ building would probably lose 10 or 15 degrees on the same basis

The difference is energy efficiency, therefore, if NZ building were as good as Norway's, they would be 1000% better

Energy efficiency is optional

Coronavirus is not our most pressing public health problem

Penny Murray • 05:00, Feb 22 2020

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NZ's cold homes kill more people every year than would be expected to die from a major coronavirus outbreak

- estimates that, in the four months from October 1 last year to the end of January, up to 31 million Americans had a flu-like illness and between 12,000 and 30,000 of them died from it. Assuming the worst – that the larger figure is accurate – that's about one person in every 11,000 dying from the flu, out of a population of 331 million. It seems like a lot.

Well yes it does, only the situation here is much, much worse. New Zealand is one of the few countries in the world that sees a significant increase in deaths during the colder months. Over and above the usual heart attacks and car accidents, an additional 1600 people die here every winter, mostly due to respiratory and circulatory diseases and the effects of poorly insulated homes that are hard to heat. That's one in every 3000 of our people, with children and the elderly disproportionately affected.

Four types of energy efficiency



Four types of energy efficiency

Behavioural-

Doing things differently or less Often cheap, but small Hard to keep going, inconvenient The thing people most commonly think of as energy efficiency

Technological-

New or different technologies to do the same thing

Requires investment and some changes Often set and forget, can be 'better' Largest 'obvious' gains

Process-

Using same or different technologies to do things differently Requires investment and large changes Often needs a new mindset Very large gains, but can be hidden behind assumptions Systemic-Efficiency arises from how things interact as a system Requires co-ordination, communication

and data

Actively managed

Gains are often 'indirect'

Behavioural Energy Efficiency

- Switch off lights
- Take shorter showers
- Use a low-flow shower head
- Walk instead of driving
- ~10-20% savings
- Useful for emergencies
- Hard to sustain in the long term
- Cheap, or is it?

Example: – Public conservation campaign

- 2001,2003,2008 Dry periods
- Public asked to reduce electricity consumption by 10%
- Savings of this levels generally achieved, although not necessarily 'easily'
- Certainly not long term sustainable

Renewable energy

New Zealand faces power crisis amid drought

Barbara McMahon in Sydney Mon 9 Jun 2008 11.14 BST

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A Helen Clark: 'it's not an emergency.' Photograph: Adrian Dennis/AFP

New Zealanders are to be urged to wash dishes by hand and turn off lights as the country teeters on the brink of a power crisis caused by drought.

After two years of dry weather, the level of water in lakes that drive New Zealand's hydroelectric power plants is worryingly low.

The energy minister, David Parker, denied claims the country was facing rolling power cuts but said households would be asked to cut electricity consumption by up to 15% during peak early evening periods unless there was "significant" rainfall soon.

Hydroelectric stations usually produce about 75% of New Zealand's electricity but a lack of rain has reduced that output in recent weeks to 50%. Coal, diesel and gas-fired power plants are trying to make up the shortfall, but more strain is expected to be put on the national grid with the arrival of winter in the southern hemisphere.

Backed by the government, the electricity industry is to launch a TV campaign aimed at domestic, commercial and industrial users.

The prime minister, Helen Clark, said: "I think the advice will be that while it's not an emergency, it is time for people to be turning off lights in rooms they are not using, certainly not leaving the computer on all night, the heated towel rail not on for 24 hours a day."

Technological Energy Efficiency

- LED lightbulbs
- Efficient motors and appliances
- Heat pumps for space and water heating
- Insulation and double glazing
- Electric vehicles
- Very large potential savings
- Requires upfront investment
- Often permanent savings
- Can require a mixture of intervention types to achieve uptake

Renewable power stations



FFCA

Generation supply curve

LRMC of new generation projects



Renewable Generation is expensive

Efficiency supply curve

Equivalent LRMC of energy efficient technologies



Energy efficiency is cheaper than generation on the same levelised cost basis

Efficiently using electricity is like building more renewable generation. only cheaper

LRMC of combined energy efficiency and generation projects



Therefore, we could deploy more energy efficiency instead of building more power stations.

See

https://www.eeca.govt.nz/newsand-events/mediareleases/energy-efficiency-keyaction-to-meet-renewableenergy-goals/ for the full report

Process Energy Efficiency

- Microwave/RF heating/drying
- Reverse osmosis
- Telecommuting
- 3D printing on site
- Very large potential savings
- Requires upfront investment and significant change in approach
- Often permanent savings, and co-benefits
- Uptake is often bespoke, largely unknown if it can be done at scale

Example - Industry

- More efficient energy use can sometimes be achieved by changing the underlying process
- In this example, hot water and chemicals are replaced by ozone, for a 90% energy saving

See https://www.eecabusiness.govt.nz/technologies/electrical- <u>heating-technologies/</u> for other examples



Using ozone for tender care

Rotorua laundry leads the way in ozone cleaning to save money and help the environment.

aving your whites laundered using ozone gas sounds like a plausible premise for a scene set in the laundry of the Starship Enterprise, in fact, it's happening in Rotorua

The Tendercare boutique laundrette and commercial laundry in TI Street has boldly gone where few have gone before. With the assistance of the Energy Efficiency and Conservation Authority (EECA) and ELS, an nnovative Auckland laundry technology company, Tendercare Is now laundering commercial quantities of linen, towels and bedding using nothing more than cold water, detergent and ozone gas. It's the first commercial laundry in the country to be using ozone technology. Using ozone for cleaning has been around internationally for some years but its application in laundries is new here. Comprised of three oxygen atoms ozone occurs naturally in the atmosphere whenever there is an electrical storm A laundry ozone generator replicates those conditions then introduces the ozone Into the water under pressure. The gas destroys bacteria and cleans, whitens and brightens - all without the use of hot water before it naturally reverts back to oxygen Tendercare's managing director Philippa Lewis was busy planning the 21-year-old laundry's expansion when she attended

Demonstration programme, a government scheme which provides co-funding support electricity consumption, our labour costs to early adopters of new and under-utilised have gone down because the wash cycles technologies - If they can deliver energy are shorter and our water consumption has and/or carbon emissions savings for the decreased. benefit of New Zealand

Lewis was attracted to the environmentally-friendly nature of the technology: "When considering how to run the business, we've always tried to Incorporate processes that are a wee bit kinder to the environment than traditional ones," she explains.

EECA Technology Demonstration Programme

- Provides co-funding support to early adopters of new and under-utilised technologies delivering energy and/or carbon emissions savings in New Zealand.
- Up to a maximum of 40 per cent of the cost of a project. Up to a maximum of \$100,000 per
- project. The current funding round closes on
- September 20. See the Funding and Support page at

strategic mandate to encourage new and innovative ways of working www.eecabusiness.govt.nz

"Along with energy efficiency, the focus is more and more on emissions reduction and

"We've hugely reduced our gas and

Treagus, managing director of ELS, says

while exact savings data is not yet available

from Tendercare, there's an abundance

generator, the instances where hot water

might be needed are usually minimal, so we're pretty confident in saying that users

will save up to 90 per cent on their water

heating bill and up to 30 per cent on their

The Tendercare laundry is one of about

15 Technology Demonstration co-funded

projects under way with EECA at any one

partnership is to make public the findings

businesses around New Zealand can learn

about the technology, replicate the results

and perhaps avoid some potential pitfalls

"This is an Important part of EECA's

time, across a range of locations and

and results of the project - so similar

Chand says the final part of each

of evidence from installations of the

"After the installation of an ozone

technology around the world

water bill.

Industries

System Energy Efficiency

- Load shifting (hot water, EV charging, space heating) to reduce peaks
- Traffic Congestion management (e.g. congestion charging, start/end time changes
- Significant savings, often indirect (e.g. reduced transmission and distribution losses, infrastructure costs)
- Requires co-ordinated and co-operative investment and ongoing operation
- Can suffer from unclear responsibilities and lack of leadership
- Highly variable history of uptake and approaches

Definitions and examples



✓ Reducing peak loading on infrastructure

✓ Renewable energy integration

✓ Infrastructure investment avoidance, lower costs for consumers

Hot water

0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0 17:00 17:30 18:00 18:30 19:00 19:30 20:00 20:30 21:00 21:30 22:00 22:30 23:00 23:30 0:00 0:30 1:00 1:30 2:00

Hot water load profiles

EV Charging profiles

Different modes of EV charging



Combined impact of DSM for EVs and HW



Benefits and impacts

Energy efficiency can give us a cheaper, cleaner energy system...

System cost per MWh (including generation, transmission and distribution costs)



.. and a faster, easier and cheaper transition to a low emissions economy

Estimated capital cost of each scenario



Energy efficiency has other benefits too



Source: Unless otherwise noted, all material in figures and tables in this chapter derives from IEA data and analysis.

Key point A multiple benefits approach to energy efficiency reveals a broad range of potential positive impacts.

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Load is not growing as fast as people expect



So what?

- Low cost energy
- Avoided infrastructure cost
- Reduced GHG
- Even you aren't interested in the above, EE can affect demand growth, business models etc. so should be taken into account

Energy Efficiency

It's more important than you thought half an hour ago