# Batteries, microgrids & controls

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# YARRA ENERGY FOUNDATION

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Artist: Hayden Dewar

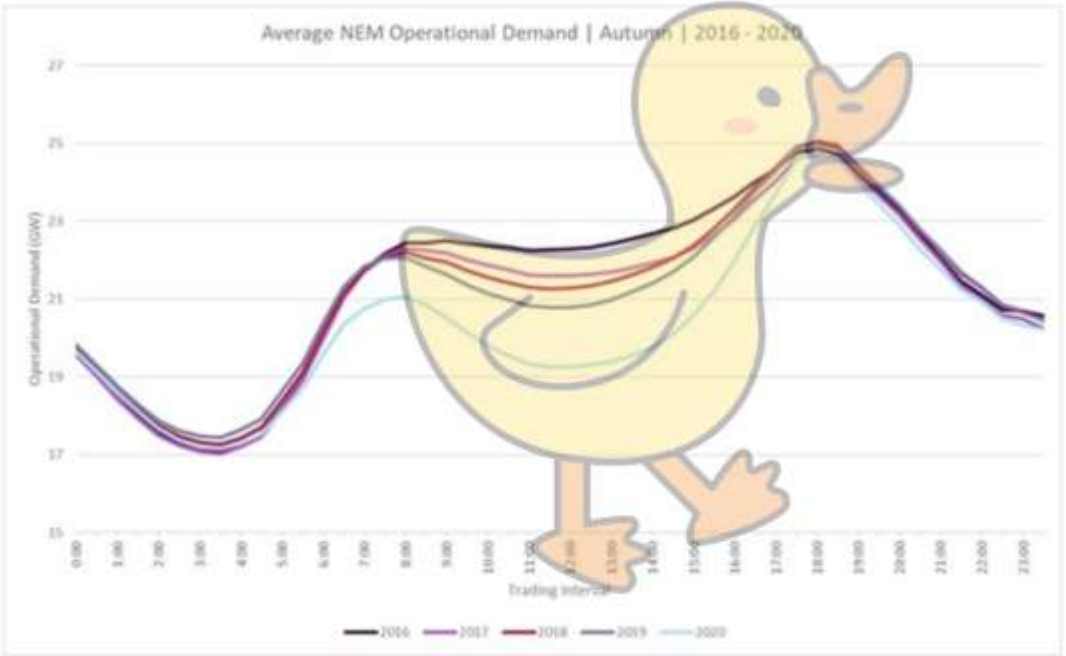
# What is a community battery?

***A mid-scale energy storage unit embedded into the electricity network and allows for energy storage.***

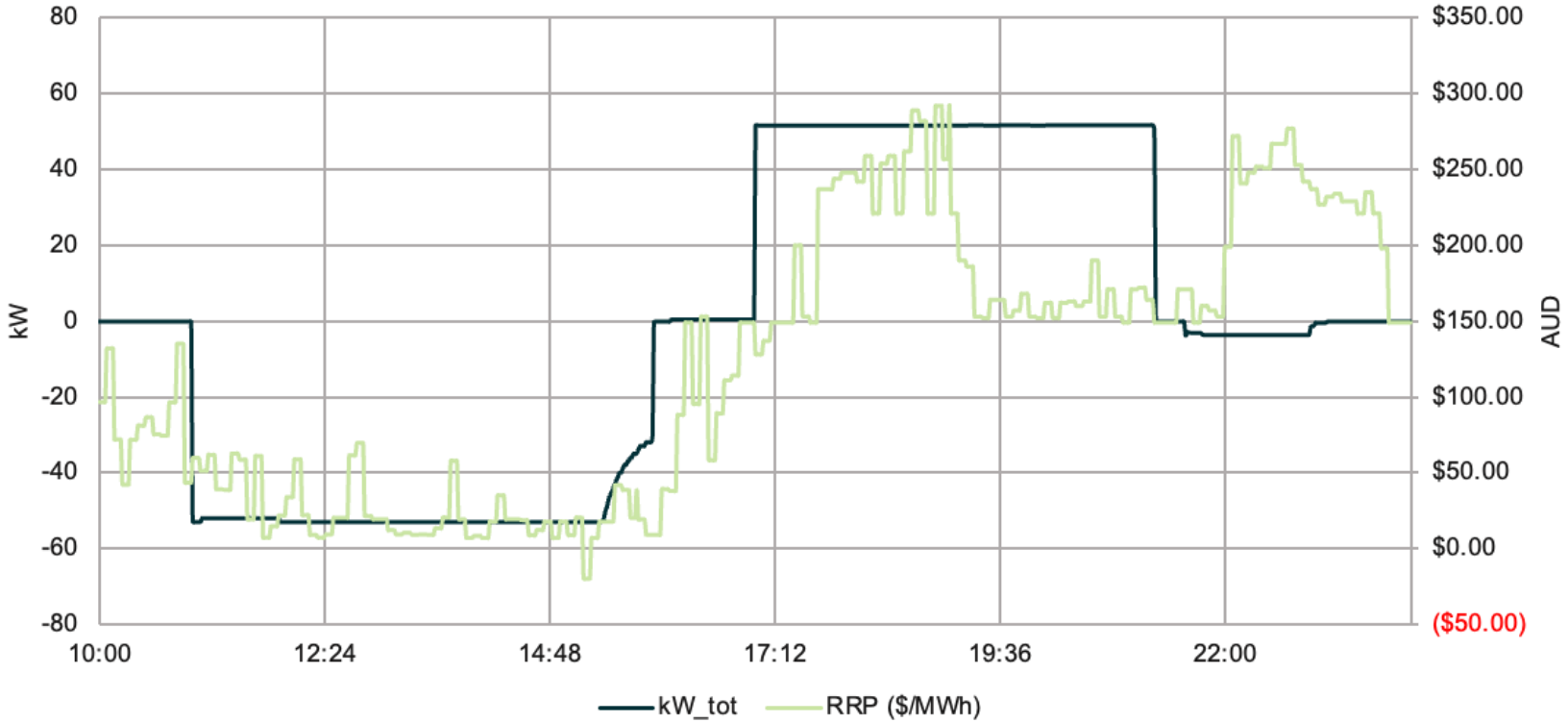
And “community” = ownership / benefit / involvement.

Open: June 2022
Capacity: 110/309kWh
System: Pixii Power Shaper
Size: 4 fridges - 5m2
Connection: FOM
LV: 200 properties


# Wow, it’s the duck curve!



# ‘Solar soaker’ dispatch



# Community battery network tariffs (CitiPower)

| Community battery network tariffs | | | |
|---|---|---|---|
| Time band | Fixed (cents/ day) | Import rate (cents/ kWh) | Export rate (cents/ kWh) |
| 10am – 3pm | 45 | -1.5 | 0 |
| 4pm – 9pm | | 25 | -1.0 |
| All other times | | 0 | 0 |


| | Jun-22 | Jul-22 | Aug-22 | Sep-22 | Oct-22 | Nov-22 | Dec-22 | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metering Charges | -$51.78 | -$59.45 | -$59.45 | -$57.53 | -$59.45 | -$57.53 | -$59.45 | -$59.45 | -$53.70 | -$59.45 | -$57.53 | -$59.45 | -$9.59 |
| Market Charges | -$0.63 | -$1.58 | -$6.12 | -$5.89 | -$6.68 | -$6.71 | -$6.38 | -$6.50 | -$5.60 | -$7.62 | -$7.89 | -$8.43 | -$1.22 |
| Network Revenue | $0.00 | $10.39 | $111.94 | $95.85 | $117.00 | $143.45 | $132.01 | $134.46 | $102.46 | $143.45 | $152.13 | $157.96 | $27.69 |
| Wholesale Arbitrage Revenue | -$25.35 | $150.76 | $829.24 | $743.82 | $822.92 | $777.86 | $697.56 | $555.40 | $654.98 | $772.49 | $921.29 | $872.90 | $89.71 |
| Net Revenue (excl. GST) | -$77.76 | $100.12 | $875.61 | $776.25 | $873.79 | $857.07 | $763.74 | $623.91 | $698.14 | $848.87 | $1,008.00 | $962.98 | $106.59 |

**Figure 9. Summary of year 1 revenue**

Year 1 performance report: https://www.yef.org.au/app/uploads/2023/07/Year-1-Performance-Report_FN1_YEF.pdf

- ✓ NBI $800k
- ✓ YEF/CitiPower $150k (in kind and cash or just)
- ✓ $1000 per kWh
- ✓ Bespoke software

YARRA
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# What’s the future for community batteries?

| SOLUTIONS | Home Battery | EVs | Neighbourhood Battery | Medium Voltage | Grid-Scale |
|---|---|---|---|---|---|
| Low-voltage regulation | ✓ | ✓ *When day-time charging* | ✓ | ✗ | ✗ |
| Low-voltage peak demand reduction | ✓ | ✓ | ✓ | ✗ | ✗ |
| Minimise reverse flow to transmission network | ✓ | ✓ | ✓ | ✓ | ✗ |
| Frequency control | ✓ *In a VPP* | – | ✓ | ✓ | ✓ |
| Firming by time shifting variable renewable energy | ✓ *By exception* | – | ✓ | ✓ | ✓ |
| Firming the output of a renewable energy generator | ✗ | ✗ | ✗ | ✗ | ✓ *If front-ending generator* |

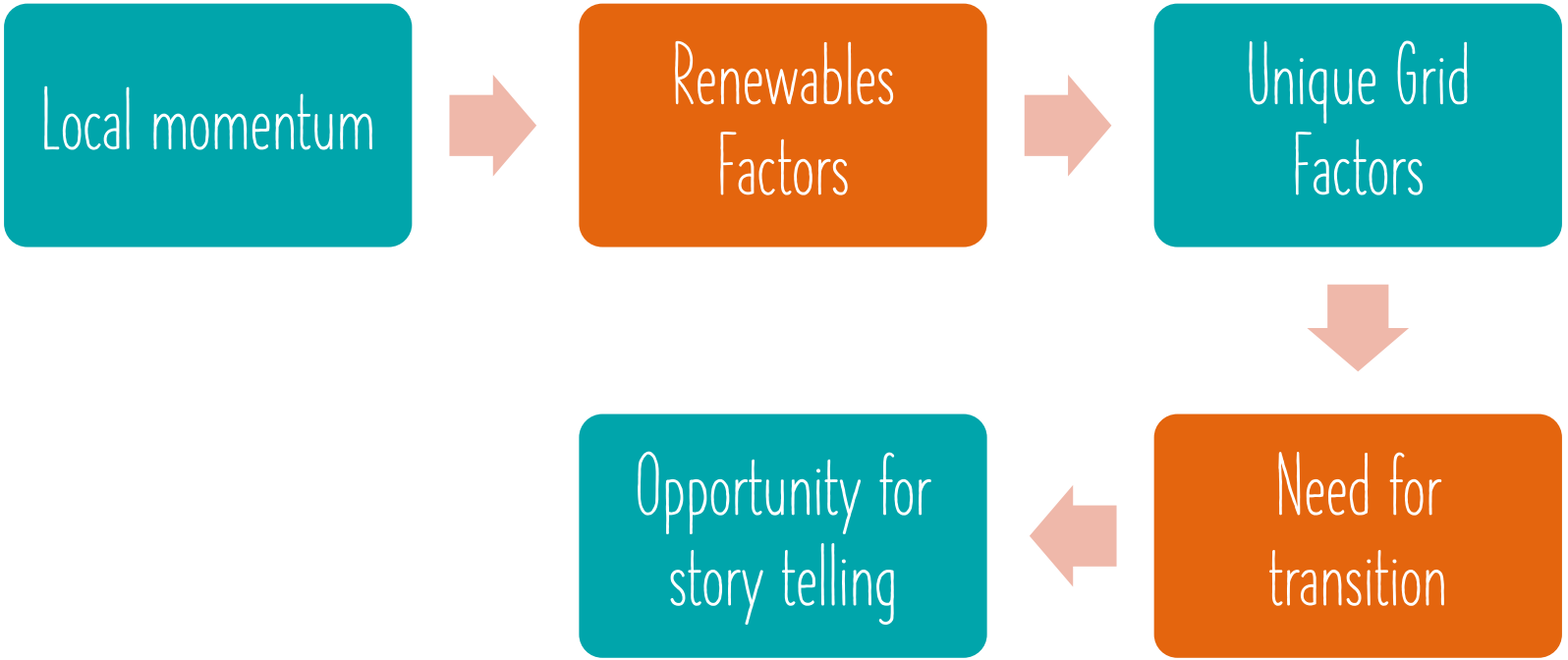
✓ = can do ✗ = can't do – = not currently

August 2023

# WHY NARRABRI COMMUNITY BATTERY?

Geni.Energy

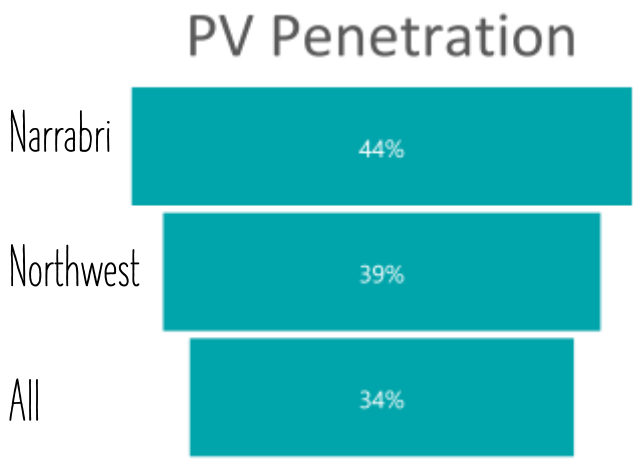
# OUR DRIVERS

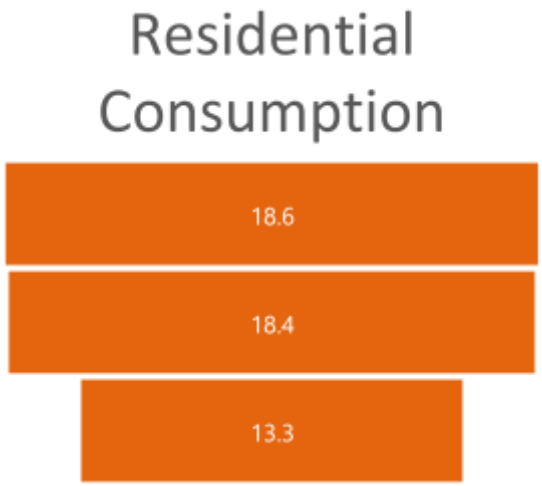

Local momentum
Renewables Factors
Unique Grid Factors
Need for transition
Opportunity for story telling

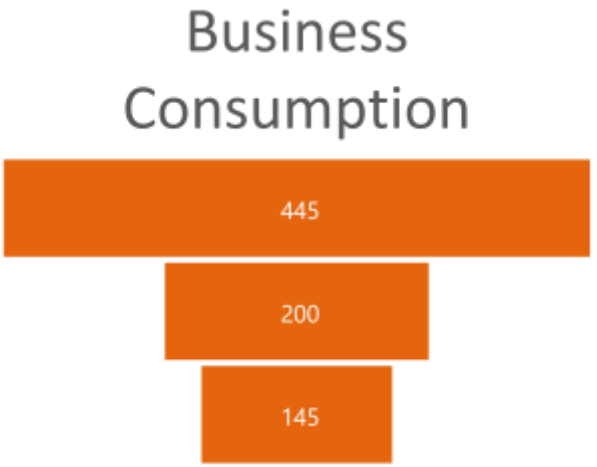
# LOCAL MOMENTUM



# RENEWABLES/ELECTRICITY CHARACTERISTICS

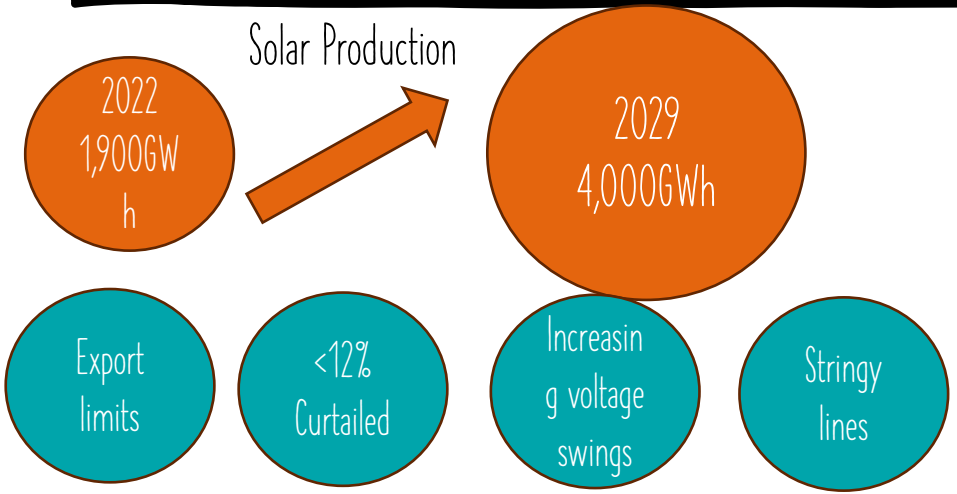



# Essential Energy network data 22/23
# kWh of Daily consumption per customer

# ESSENTIAL ENERGY NETWORK CHARACTERISTICS & PREDICTIONS



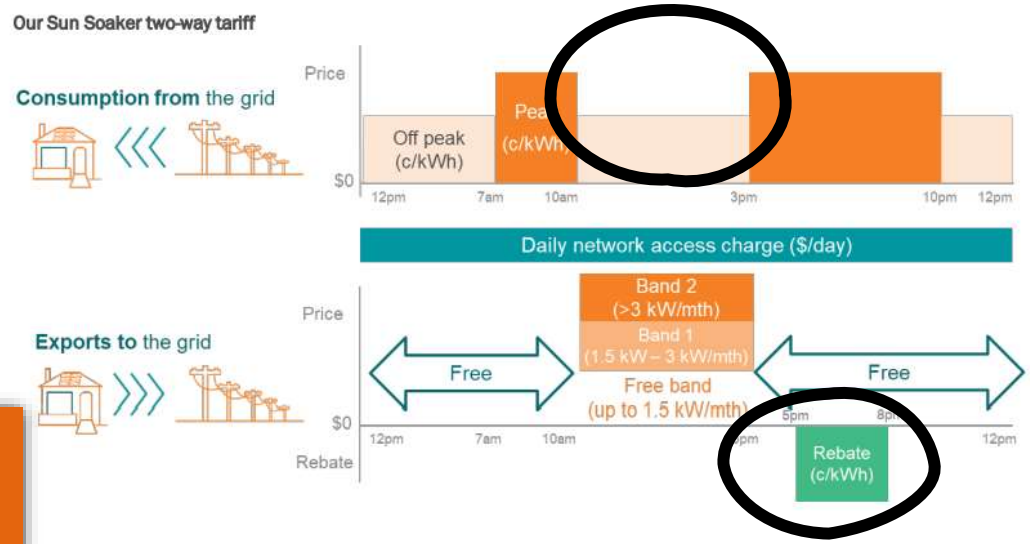

ONLY Community Batteries:

- Operate on LV – Don't need new transmission lines
- Reduce overvoltage risk

# ONE OF THE SOLUTIONS - COMMUNITY BATTERIES

Peak Consumption

Peak Generation




ONLY Community Batteries offer:

- Peak Shaving
- Time shifting of local renewable generation

# NEED FOR TRANSITION

www.narrabricourier.com.au

THE COURIER

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WOOLWORTHS WEEKLY SPECIALS

SIAHTO WOMAN OF THE YEAR

$100,000 FUNDING FOR NARRABRI INDUSTRIAL GROUP

Narrabri wins 'super development' status

# BUILD SOCIAL MOMENTUM

Country Press NSW Newspaper of the Year - 2022 and 2023

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THE COURIER

TUESDAY, JANUARY 23, 2024 • VOL. CXI NO. 6 PROUDLY SERVING THE NARRABRI SHIRE FOR 111 YEARS PHONE: (02) 6792 1011 - $2.20

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MOW A WORTHY RECIPIENT OF DONATION NEWS P3

NEW ST XAVIER'S PRINCIPAL NEWS P8

# Plans for energy hub

Development plans for a renewable energy hub near the Narrabri CBD are

and Doyle Streets.

A battery energy supply system and electric vehicle charging station will be among the site's features.

plans lodged by Narrabri Shire Council, the car park site would be configured and resealed. The site would also be used for markets and

community events.

"The Narrabri Renewable Energy Hub is a key initiative in support of the Narrabri Shire Council Renewable Energy Action Plan (REAP) and Renewable Energy Implementation Plan (REIP), both of which are currently under

development," plans state.

"The proposal includes a no larger than 300kW grid connected solar and BESS installation. The renewable energy precinct will be connected to Essential Energy's network, the distribution line and connectivity pathway, and the ultimate siting of the

Community Battery, will be determined by the connection agreement with Essential Energy.

"It should be noted that a separate application process is being undertaken with Essential Energy for this connection."

Continued on page 3

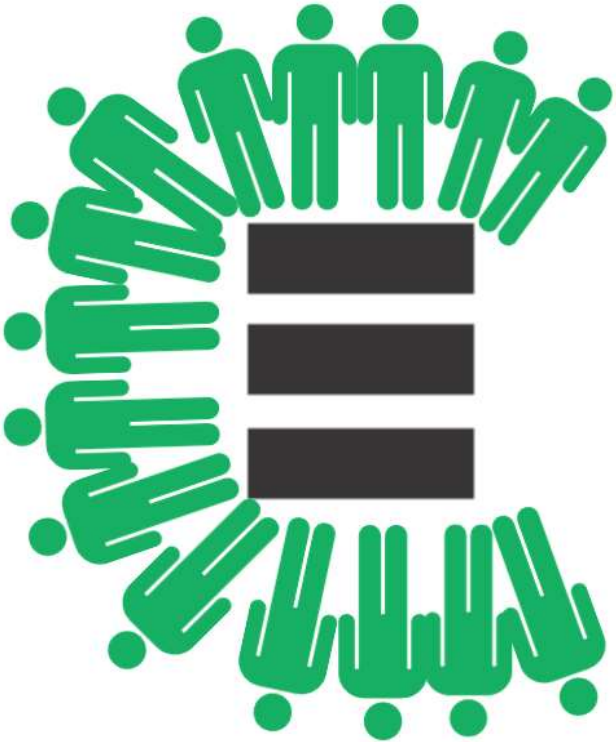
- 73% would opt in to join community energy project
- 91% like the idea of a community managing its own energy
- 75% thought it was a way to have an impact on global warming

# OPPORTUNITY FOR STORY TELLING

# GABRIELLE CHAN

“In rural places, we pride ourselves on self-sufficiency and inventiveness. Great solutions have come from finding yourself a long way from home, with a piece of number eight wire and an assortment of tools. And I don’t just want cheap or free power, I want to be a self-sufficient power producer in my own right”

*Rural Australia believes in self-sufficiency, so let’s set the terms of the renewable energy boom*



Narara ecovillage | power

# Community Power in operation

7 March 2024 Chris Wenban – NEV Power

# Narara Ecovillage (NEV) & NEV Power Pty Ltd

- Intergenerational residential community on the Central Coast
- 150+ homes and is to be phased in 3 stages
- Currently over 55 of the residences are occupied
- All house designs must meet a minimum NatHERS 7 stars rating
- Mandatory to have at least 4kW on solar on each house
- NEV Power Pty Ltd is a full owned subsidiary of the Narara Ecovillage Cooperative

Narara ecovillage | power

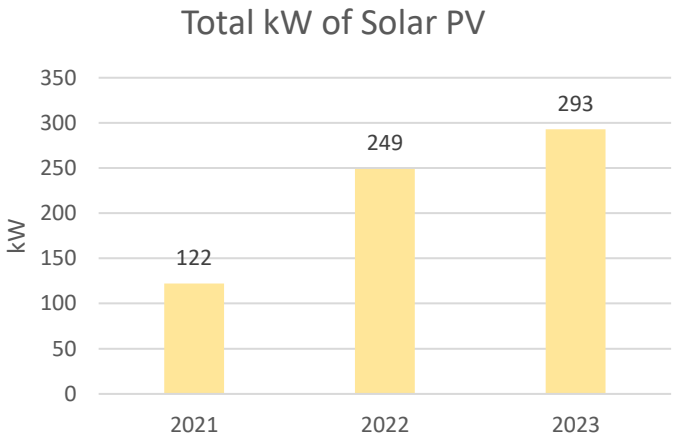
# NEV Power Pty Ltd

- The village has its own behind the meter power network
- NEV Power is an R2 exempt embedded network under AER regulations
- We have a high voltage connection to the Ausgrid network with our own tap change transformer
- Installed grid controllers to to ensure that the NEV Power Smart Grid can coordinate with the Ausgrid network in the case of power outages, surges or equipment failure.
- All houses in the village are required to have at least 4kW solar power. Many have much more. Overall the village now has more than 350 kW of installed solar power.
- Commissioned a Hitachi ABB 437kWh community battery
- Installed a back up generator to provide the ultimate safety net

# Amount of PV in the village

## PV is of course increasing over time and will continue with Stage 2

| As of | Solar Panels in the Village (approx.) | Total |
|---|---|---|
| January 2021 | 92 kW plus 30kW admin | 122kW |
| January 2022 | 133 kW plus clusters 86 kW plus admin 30 kW | 249kW |
| January 2023 | 177 kW plus clusters 86 kW plus admin 30 kW | 293kW |

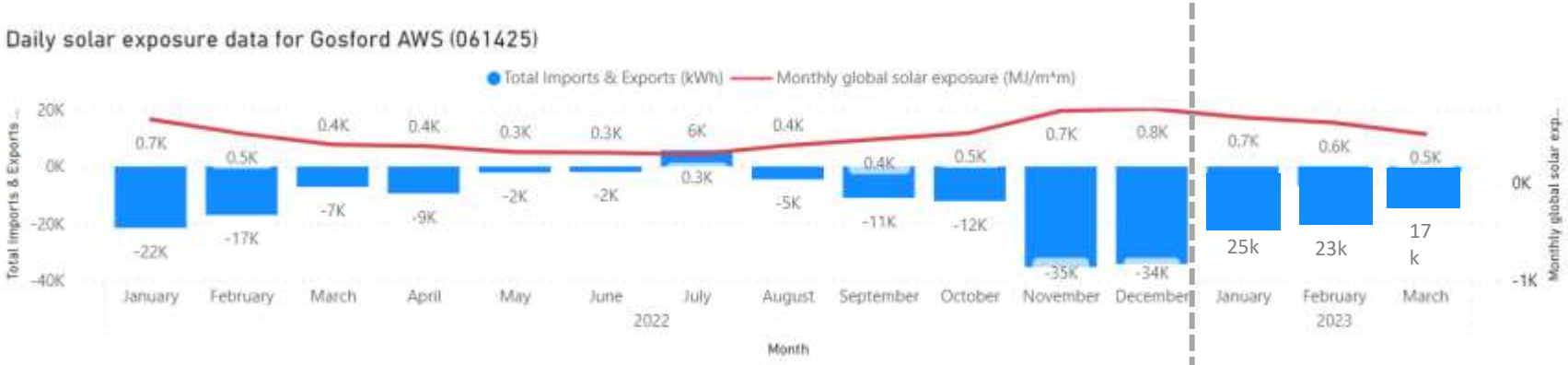



Narara ecovillage | power

# Solar Generation on a Perfect Summer's Day


Narara ecovillage | power

# 2022-23 Import and Export with Sunshine Hours




- Export to the grid (bar below the line)
- Import from the grid (bar above the line)
- Hours of sunshine
- We will be able to compare over time as we get more data

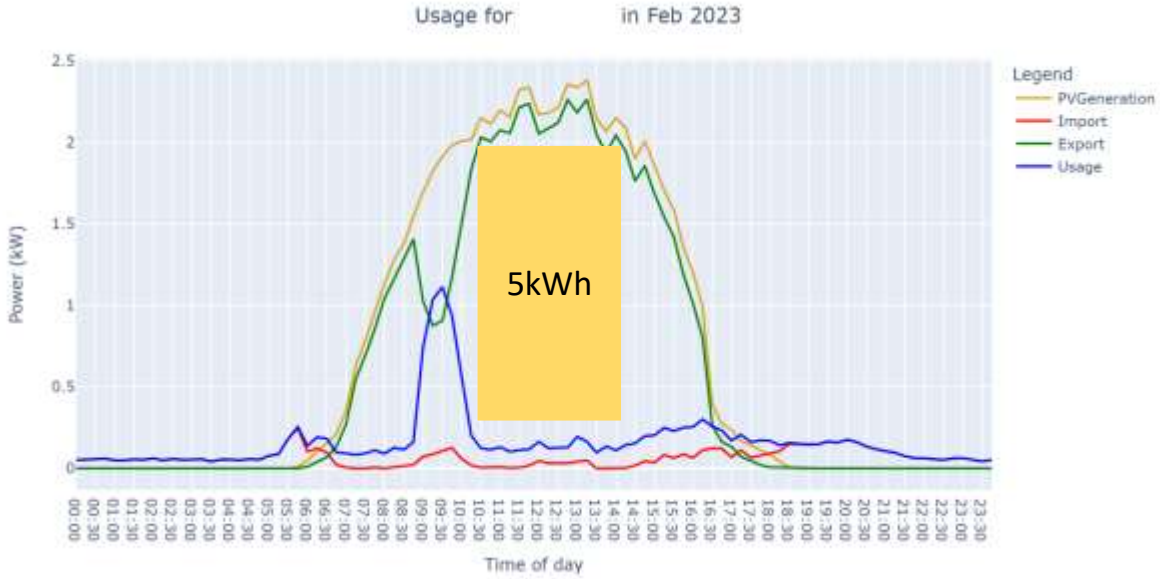
New Year

Narara ecovillage | power

# Individual NEV Households

## Each household needs to contribute to the battery storage each day, in addition to their own use.

- In general, solar generation is far higher than usage
- Some of this spare 'capacity' is required to fill the battery each day
- Around 5kWh each day from each house is needed with 50 houses to fill the community battery

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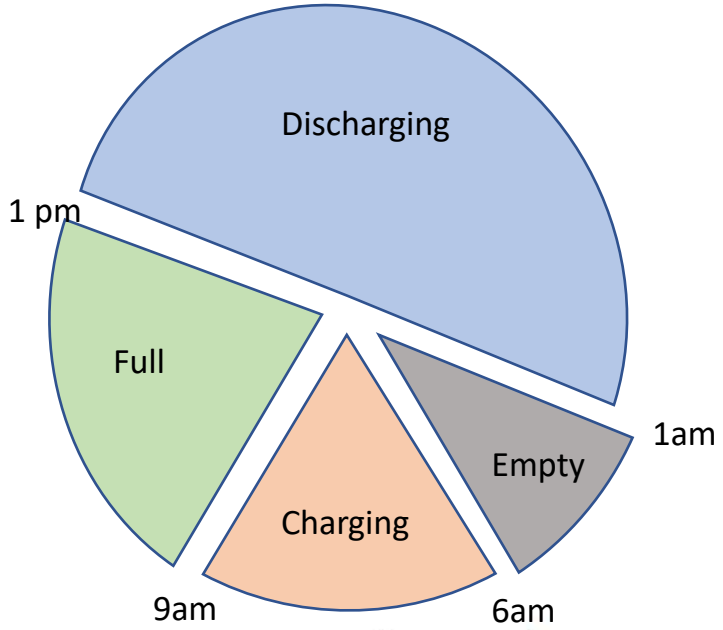
# Community battery – the first 12 months

- The battery was full 22% of the time.
- The battery was charging 17% of the time. On a typical day the battery recharged in 2-3 hours
- The battery was discharging 49% of the time
- So overall the battery helped our network be energy self sufficient 88% of the time.
- The remaining 12% of the time NEV power was partly reliant on power from the grid
- There were only 90 days during the year where the battery was not fully recharged by the end of the day



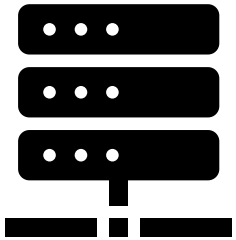

Narara ecovillage | power

# Smartgrid

- Capturing data every 5 minutes from each meter
- Using the data
  - Released an API interface
  - Producing reporting for individual houses
- Having reliable data to move to Time of Use billing
- Modelling various options but the preferred option seems to be a daytime and night time split
  - Low cost daytime because we normally have too much power
  - High cost night time because that's when we use the limited battery storage
- Set-up customer billing using a 3rd party billing platform
- Provide customers with usage reporting

Ceta meter

RAK & LoraWAN



NEV Power server

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# Managing Demand for Power

There are many ways we can manage the demand for power and we can also use our Slack channel to alert village residents to urgent issues

- Village Households
  - Dishwashers, Washing Machines & Dryers
  - EV Charging

- Community Facilities
  - Pump water during the day
  - Recharge batteries for grass cutters

Narara ecovillage | power

# Managing Energy Use

We have a ‘Bot’ that tells us what is happening with our power


Narara ecovillage | power

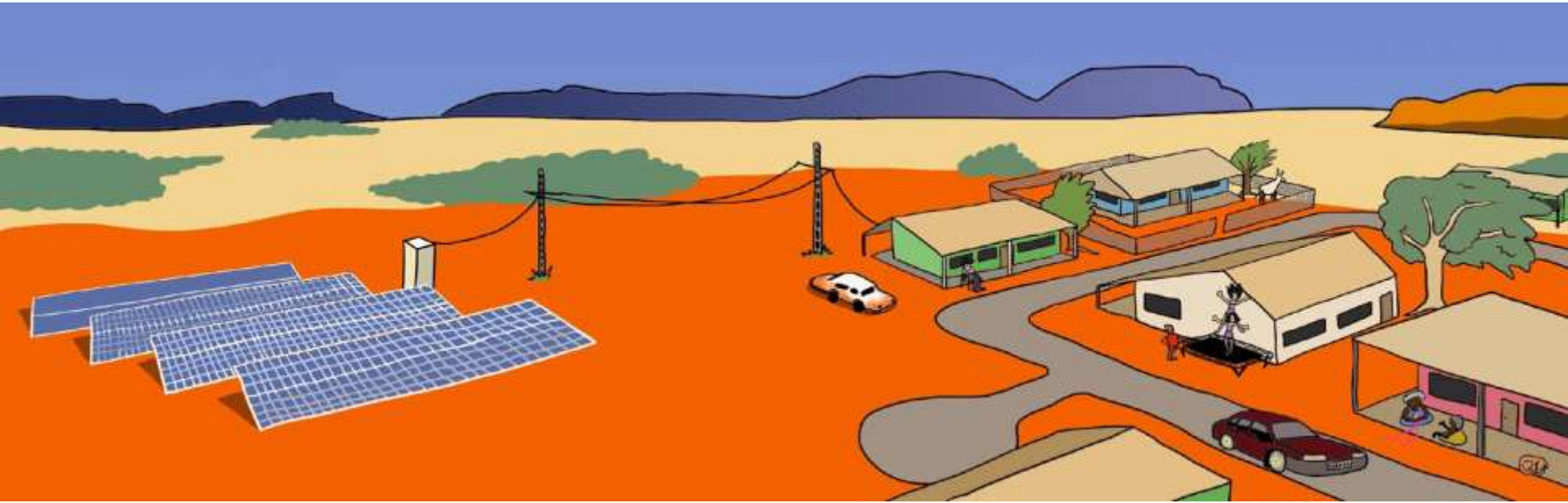
# Narara Ecovillage in Action

## How to visit Narara Ecovillage

Coalition for Community Energy – Narara Ecovillage - Friday 8 March 2024

- Monthly Village Open Days (see Facebook page & Website)
  - Saturday 30 March 2024
  - Sunday 28 April 2024
  - Saturday 25 May 2024
  - Sunday 30 June 2024

Narara ecovillage | power



# Marlinja Microgrid –
# a case study in community energy

# Community Energy Planning

When a community invites Original power to work with them on finding an energy solution to local challenges, we use a community energy planning process to decide everything from the design of the system to how it can meet community needs.

- Access to reliable, affordable power underpins all other community wellbeing outcomes
- The planning and delivery of services and infrastructure in First Nations and remote communities can be a complex and costly exercise. Better outcomes are achieved wheh service delivery is carefully tailored to meet the needs of residents.
- Original Power's Community Energy Planning Model (CEP) is a process of working with community residents, other service agencies and electrical contractors to improve a community's energy services, typically resulting in the installation of a renewable energy system.

Original Power used the CEP in partnership with Marlinja community in the Northern Territory to plan and prepare for the transition away from diesel generation, to solar and batteries.

# Are you ready to start your own community energy project?

## There are some other important things to consider in your community energy plan..

- **Who will make the decisions?** Has your project got the right stakeholders involved to make a decision to proceed?
- **What resources will be needed?** Funding for system design, contractors, equipment, land access and legal support will be needed, as well as capacity to negotiate and plan.
- **What technical and project management support will be needed?** Will the community need to fund a project manager?
- **Who will manage the project?** A community reference group or company, existing organisation, or a private company?
- **How will the project be funded?** Apply for a loan? Apply for private investment or government funding? Apply for a grant? Other?
- **What benefits does the community want from the project?** Reduce power prices? Create jobs? Provide a community income stream? Other?
- **Will connection be assured?** Unless your project is a standalone system, connection agreements are a fundamental prerequisite for accessing or building clean energy. Eg. grid connection and Power Purchase Agreement conditions.
- **Have you checked ownership of power assets?** This includes things like poles and wires in the community, or existing power generators to understand the rules for connecting your energy project to these assets.

# It took four years from idea and energy planning to build stage.
# So what will the end result be at Marlinja?

- In April 2024 the Marlinja Microgrid will become the first 100% Indigenous community-owned, grid connected community solar microgrid anywhere in the NT – or Australia!
- For the first time, households will receive direct financial credit on their pre-paid meters proportional to what they produce at the microgrid each day. This innovative benefit sharing model could provide a blueprint for many other Indigenous communities on pre-paid meters to access renewable energy benefits in future
- We have helped build regulatory processes to make project assessment easier with the regulatory and retailer through ongoing working groups.

•Marlinja residents participated in solar training on the Community Centre solar installation and on a large solar farm in Wagga Wagga in anticipation of installation of their own community microgrid.

ORIGINAL POWER

# Join the First Nations Clean Energy network!

FIRST NATIONS CLEAN ENERGY NETWORK

# *Mallacoota's Area Grid Storage (MAGS) Energy Story*


***Dr Tricia Hiley***

*Coordinator,*

*Mallacoota Sustainable Energy Group (MSEG)*

*becoming **TRiM** (Totally Renewable in Mallacoota)*

# AusNet Services Transmission Network

## Some Statistics:

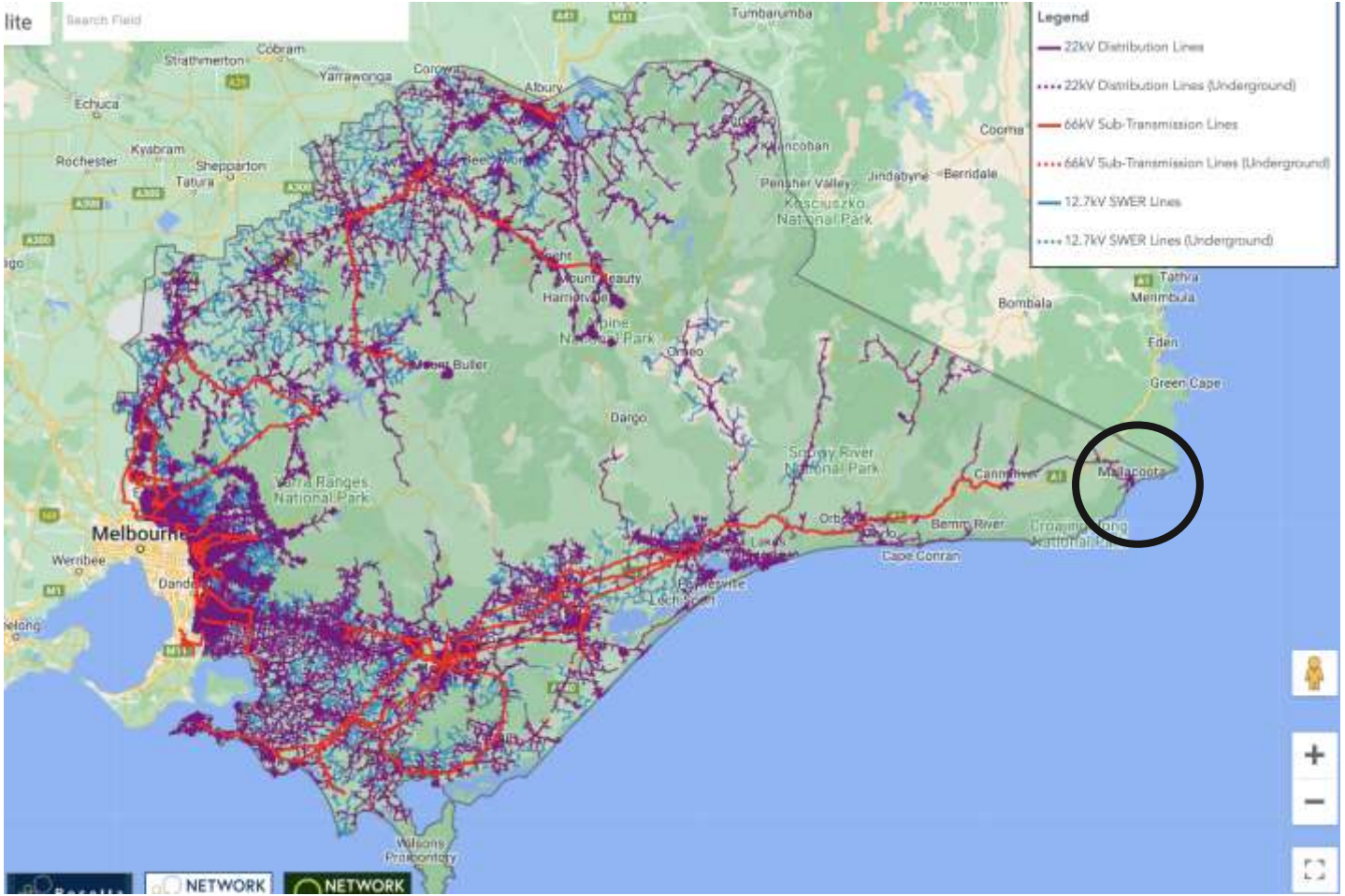
Area **80,000km2**

Regional/Rural Areas **93%**

Customers **802,000**

Mallacoota to Melb **520kms**

CNR2 is **least reliable** feeder




https://www.ausnetservices.com.au/about/what-we-do#

# The Big Battery

commissioned 28 May 2021

# Launch of Mallacoota's 1st Community-owned Solar System

June 4 2022

# … and finally …

## Major community benefits?

- Most significantly, our town is totally ‘islandable’ during grid outages, thus
  - ^ installed solar works during outages
  - ^ solar provides supports the battery
  - ^ smart meters log feed-in
- “Group of 7” is a game changing initiative

## THE Key Message for ALL OF US?

Urgent cultural ‘reframe’ is needed within DNSPs
to regard CE projects as part of our energy SOLUTION
not part of the PROBLEM

## Major community challenges?

- No precedents so ‘bleeding edge’ issues abound
- Lack of ‘good news’ data sharing with community
- Messaging not in synch with community interest and capability

Indigo Power

# *Community Power Plants*

*or :*

*How I Learned to Stop Worrying and Love 'Behind-the-Meter'*


Nick Mason-Smith, 7 March 2024, C4CE Congress

This work is supported by the Australian Commonwealth *Regional and Remote Communities Reliability Fund - Microgrids*

# What can neighbourhood batteries do that grid-scale batteries can't do?

| The potential | Our take |
| --- | --- |
| Alleviate network import constraints | |
| Alleviate network export constraints | |
| Provide 'virtual storage' or 'storage as a service' | |
| Provide resilience | |

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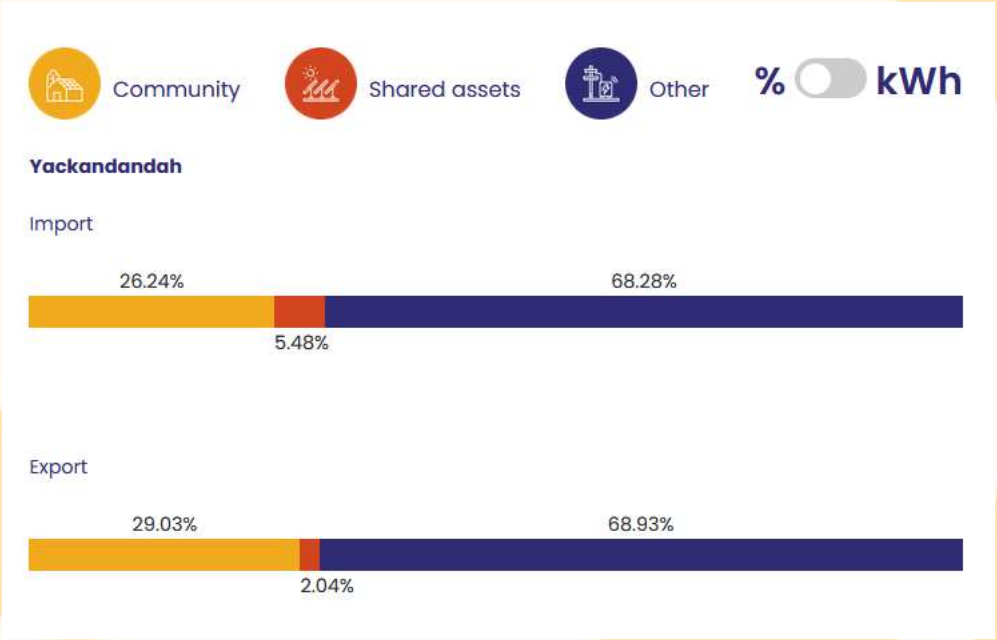
| Provide 'virtual storage' or 'storage as a service' | This is a financial instrument that could be provided without building anything – just with smart meter data |
| Provide resilience | If it's your network (or connection point), *go for it!* |

# Indigo Power is:

- Community Owned: 1000 shareholders
- For-purpose certified social enterprise
- Projects
- Energy sharing




Indigo Power

# Yack01

- 274 kWh battery
- 65 kW rooftop solar
- Small load relative to system
- Standalone transformer

*Behind-the-meter? Front-of-meter?*

→ *Solar-battery system sized for the connection point – not the load*

# Where to build community power plants

Project priorities:

1 & 2. Emissions reduction and resilience

3. Market participation

4. Network support

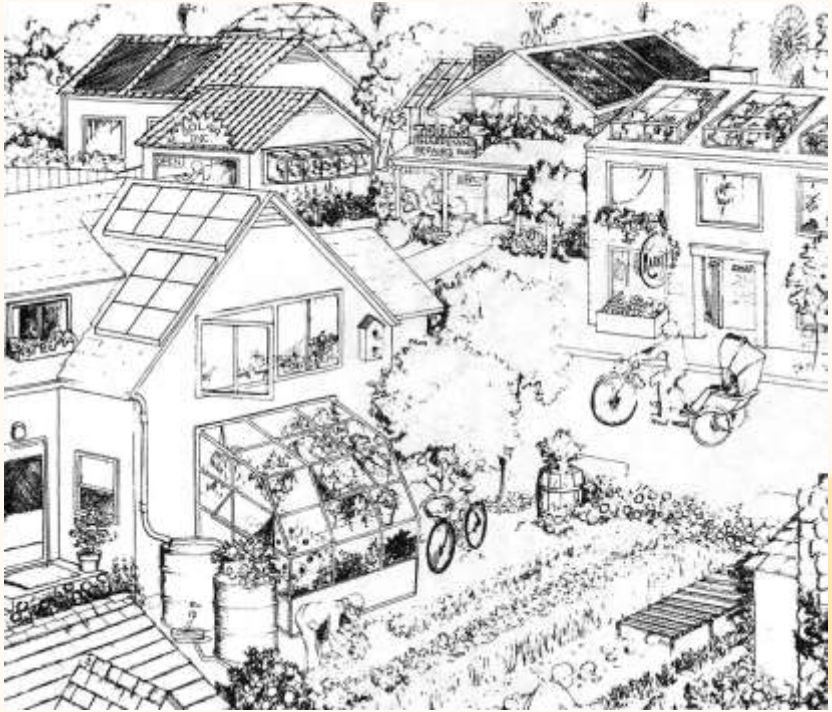
Sports stadiums & halls:

- Relief centres
- Low daytime usage
- Large roofs
- Large electrical connections
- Standalone transformer

# Community power plant feasibility

| Feasibility | Notes |
| --- | --- |
| Regulatory | Planning |
| Technical | No major barriers |
| Commercial | New nonstandard models required<br><br>(We're not in Kansas anymore!) |
| Financial | Sensitive to network charges<br><br>Major trends are expected to improve feasibility |

# Combining vision…



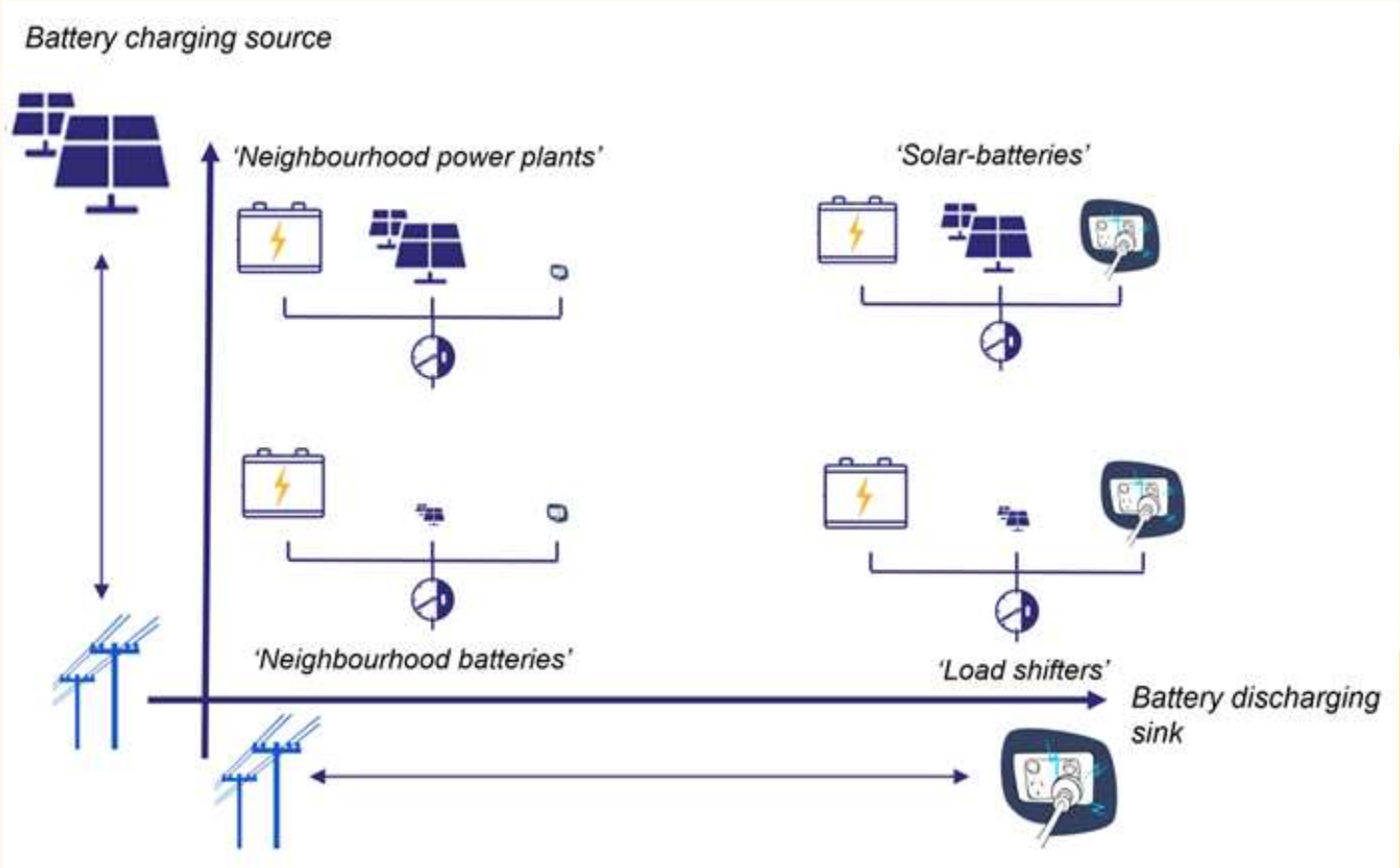
Diane and Joel Schatz, *Visions of Ecotopia*

# … and practice

Charlie Chaplin, *Modern Times*

Indigo Power

# Different types of community batteries



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