Solar Payback:
the devil is in the detail

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Alternative Technology Association
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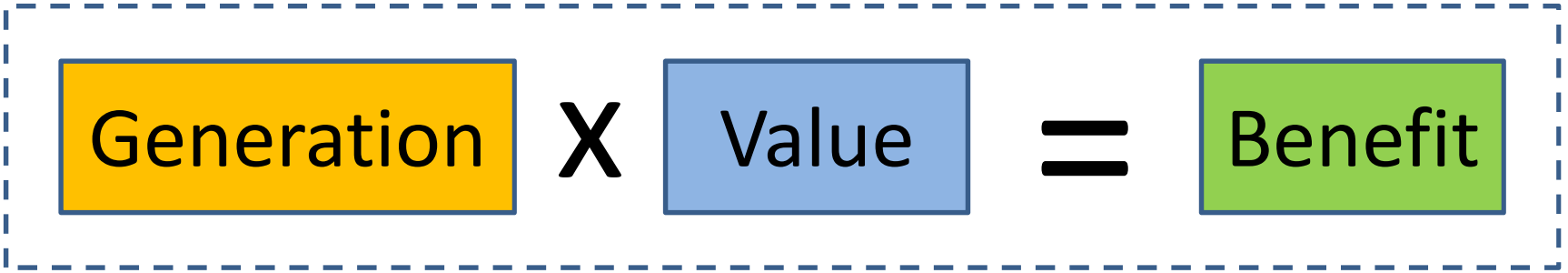
Solar Payback – the simplest view



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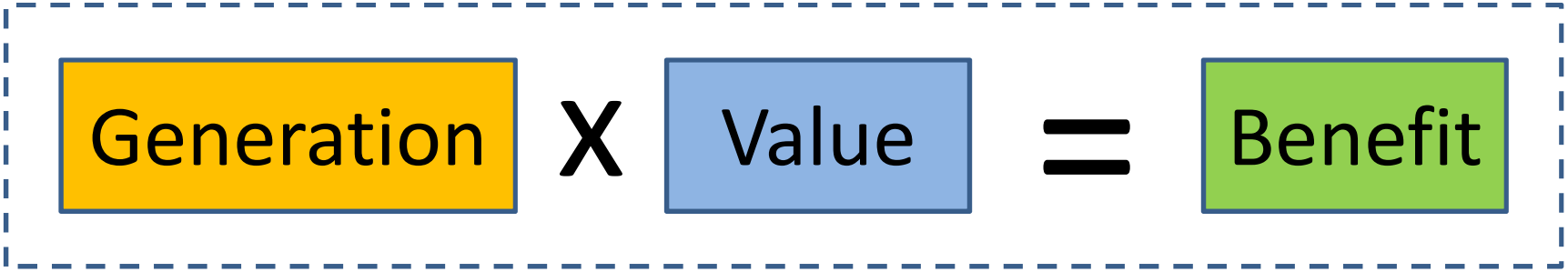

- There are other benefits besides financial
  - Environmental
  - Community
  - Image / reputation
  - Step toward greater independence / resilience
  - Others?

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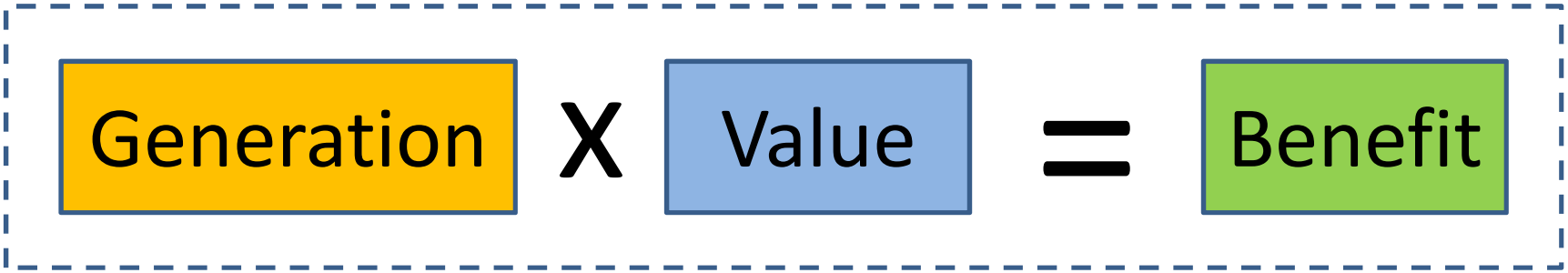
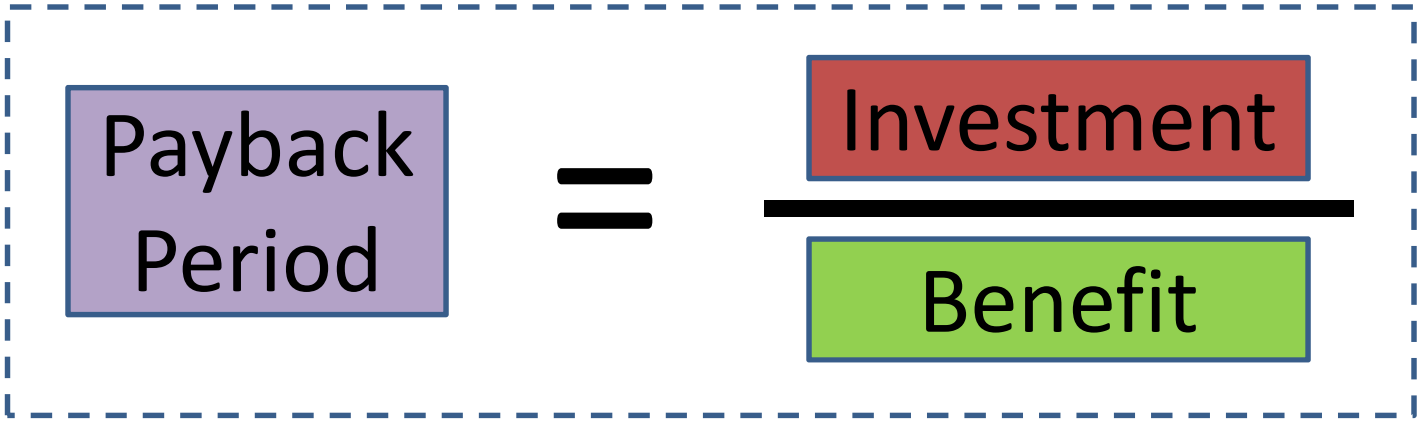
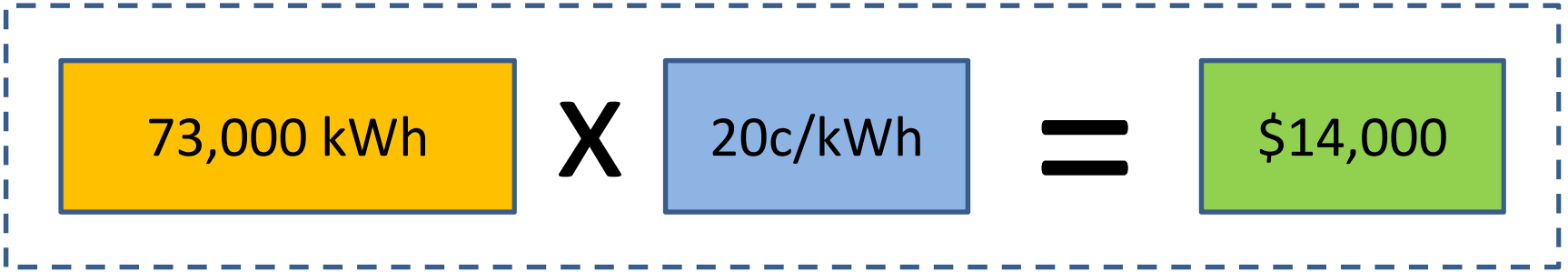
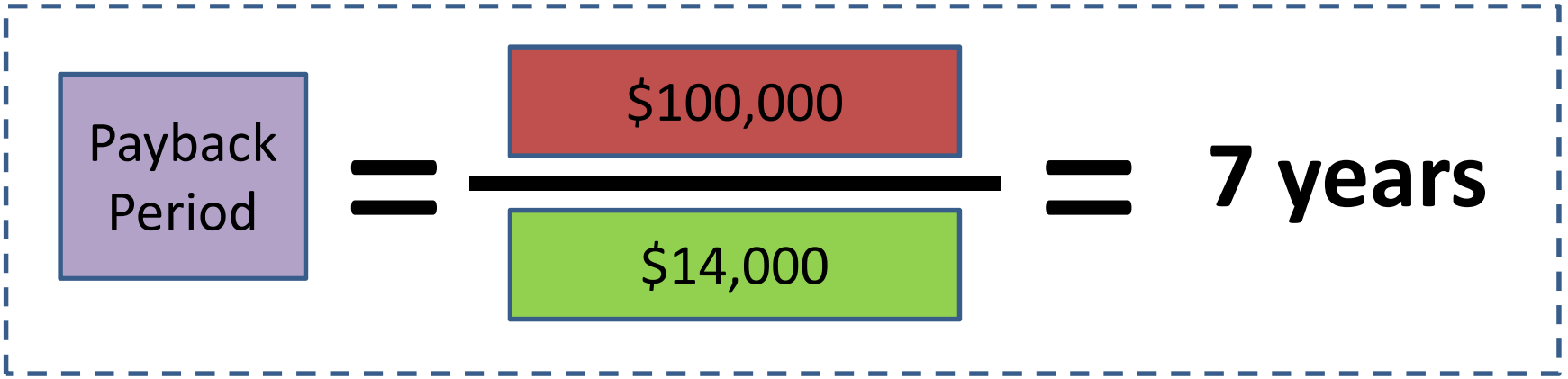




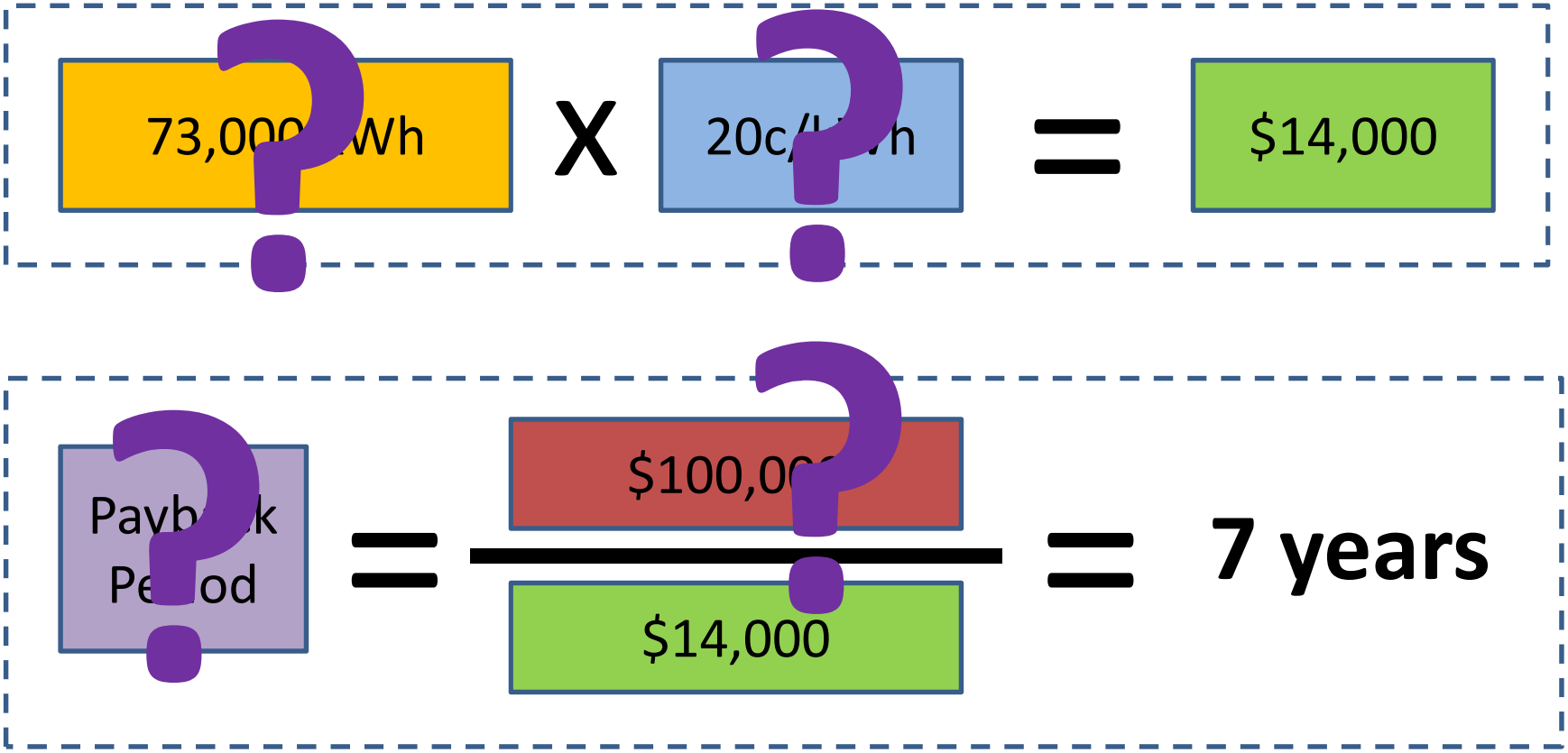
Solar Payback – the simplest view

Eg 50 kilowatt system (200 panels), over one year:





So where is the devil?



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73,000 kWh

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- 4 kWh per day, per kW of panel. Assumes:
  - North-facing
  - Optimum tilt
  - No shading
  - Etc.

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- 4 kWh per day, per kW of panel. Assumes:
  - North-facing, optimum tilt
  - No shading
  - Etc.

➢ **No.** Can be estimated with formulae and good input data.

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- Is it the payback calculation?

Payback Period

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- Method is simplistic. Doesn't consider:
  - Time value of money
  - Size of financial return

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Payback Period

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➢ **No.** Just need understanding and smart formulae.

So where is the devil?

- Is it future changes, eg:
  - Panel degradation
  - Inverter replacement
  - Electricity tariffs
  - etc?

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  - Panel degradation
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  - etc?

➢ **No.** Sure, these can be a problem. But we can assess their impact by using different scenarios.

So where is the devil?

- Is it the up-front investment?

$100,000

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$100,000

➢ **No.** We can start with benchmarks, then get multiple quotes from installers.

So where is the devil?

- Is it the value of generation?

20c/kWh

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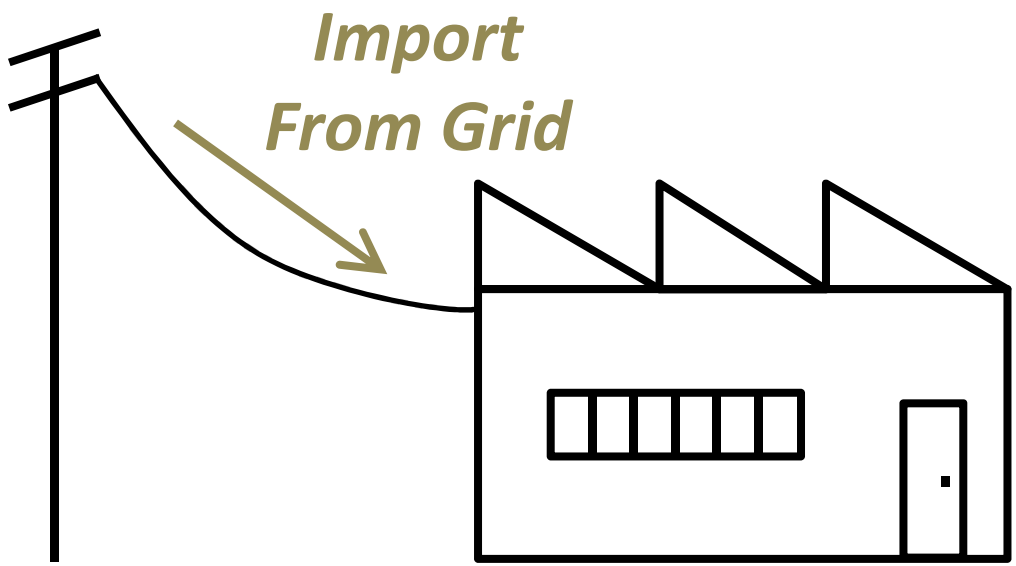
- Is it the value of generation?

20c/kWh

- **Yes!** This is the devilish issue.
- Value of generation depends on
  - How much solar generation is consumed on-site
  - How much is **exported**
  - Electricity tariffs

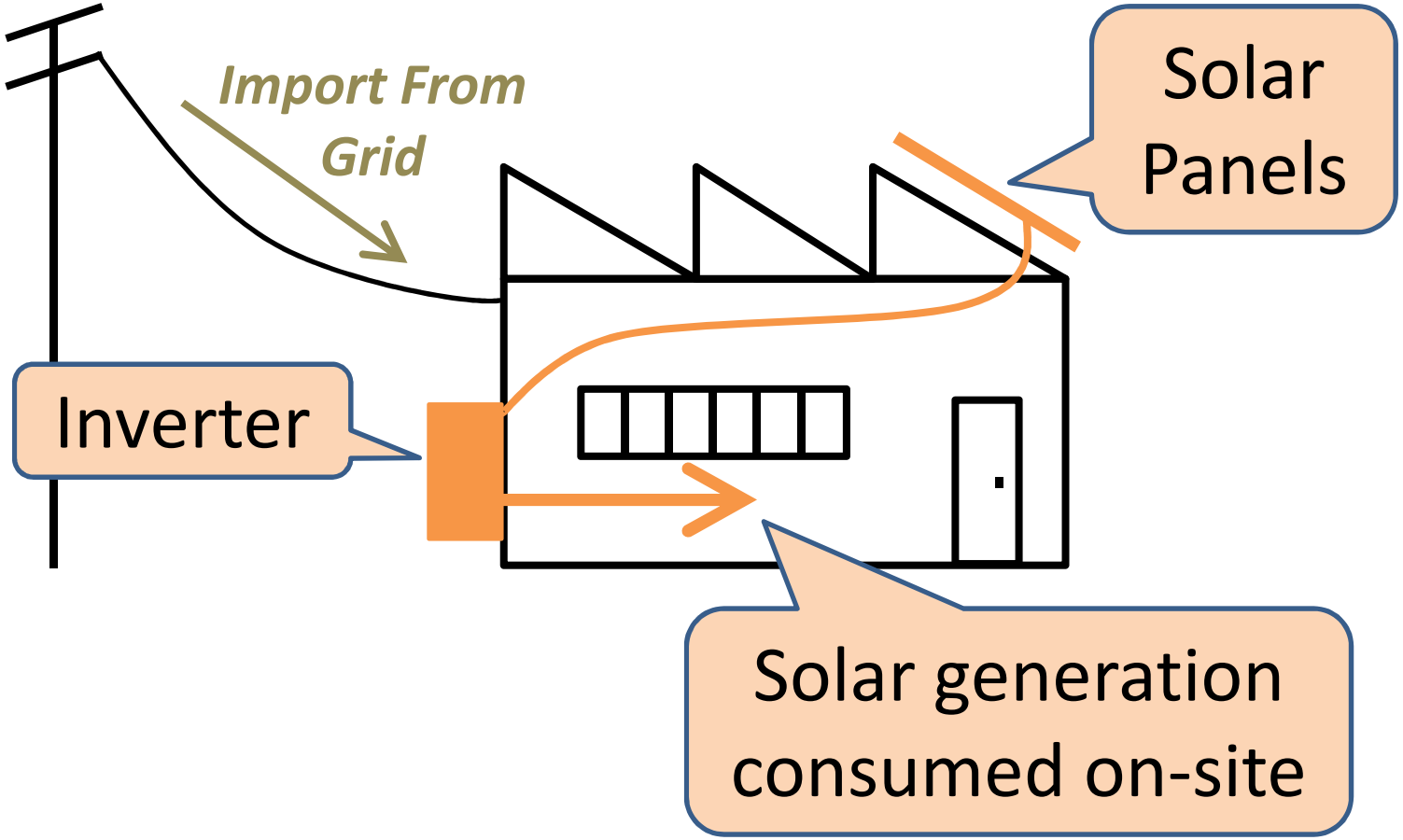
Example: WidgCo

- Fictitious manufacturer in Sydney
- Big, unshaded roof facing north
- Relatively high electricity tariffs
- Works 6 days per week



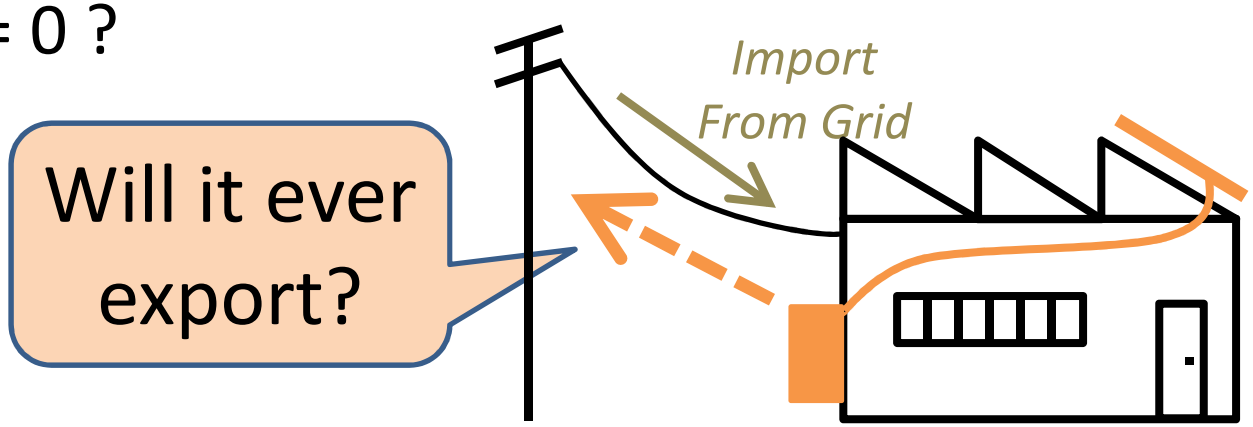
Example: WidgCo

- Solar system installed



Example: WidgCo

- Annual Consumption 200,000 kWh
- Potential solar system: 50 kW
- Annual Solar Generation 73,000 kWh
- Generation < Consumption
  - So export = 0 ?



Impact of export

- Typical retail tariffs
  - Consumed on-site: 10c-40c per kWh. Say **25c**
  - Exported to the grid: **8c** per kWh
- How much is exported?

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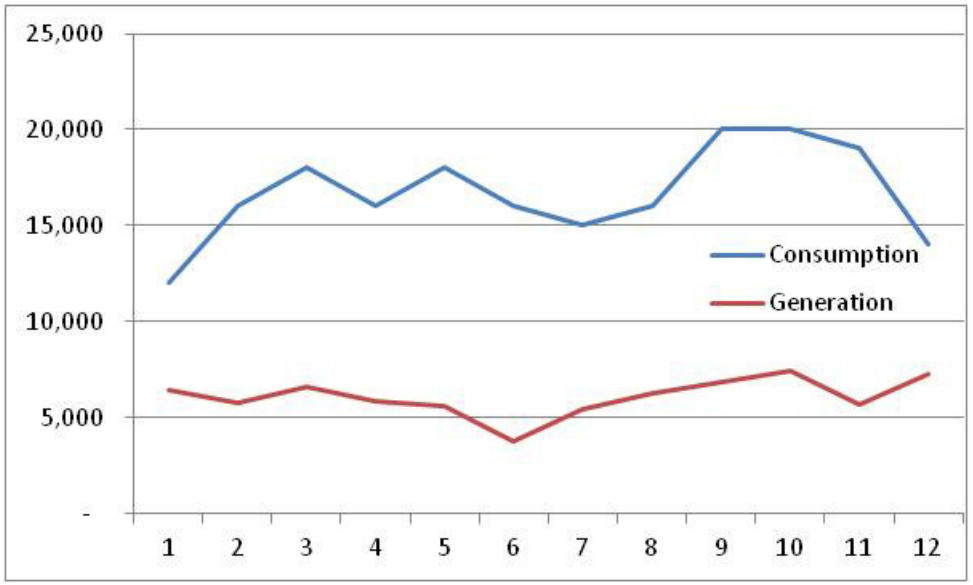
- How much is exported?
- 20% export:
  - Simple payback = **6 years**

- 80% export:
  - Simple payback = **12 years**

Generation vs Consumption

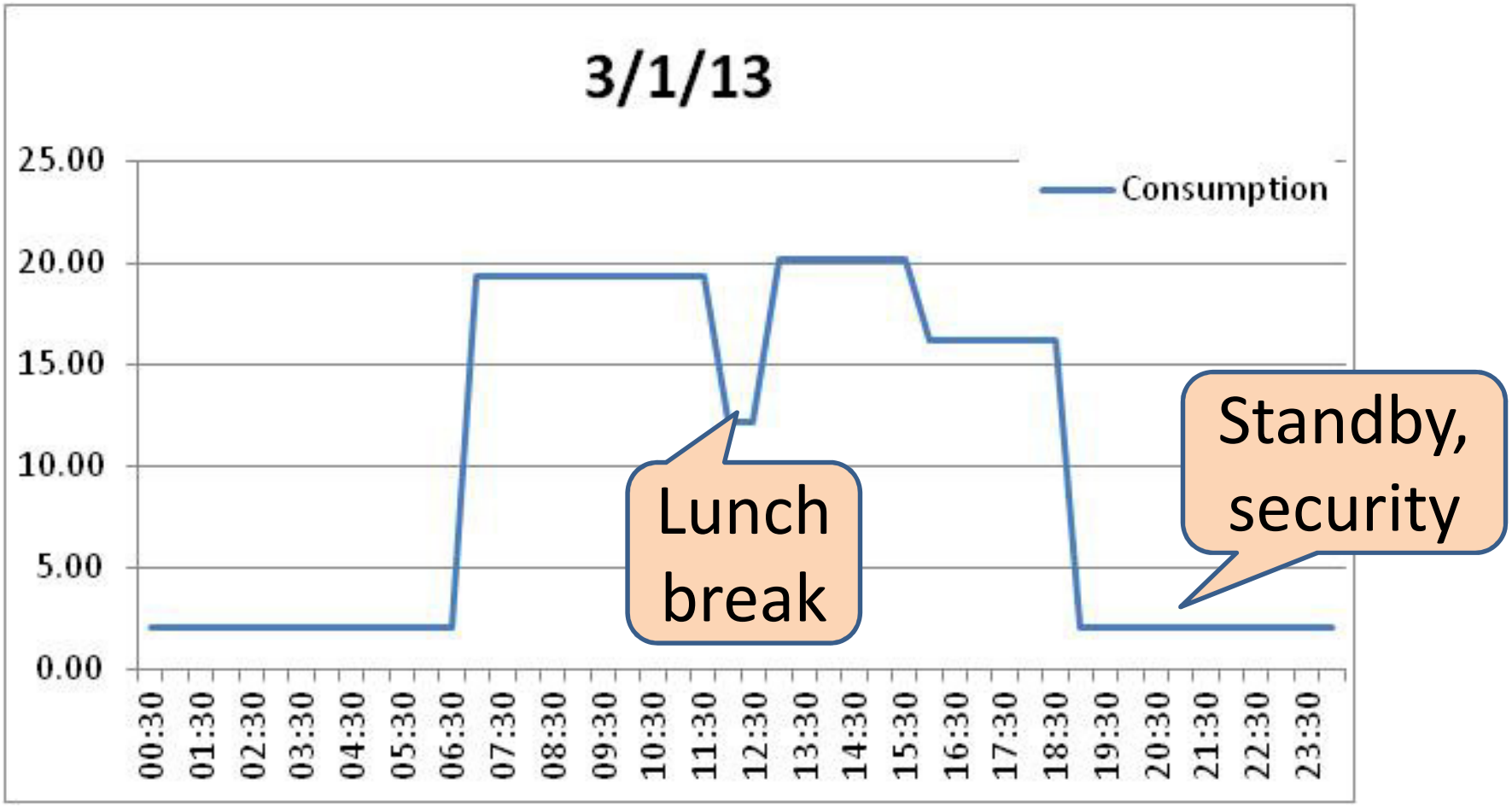
- Monthly picture
  - Generate more in sunny months
  - Electricity consumption varies by month



Still looks like export = zero

By half-hour interval

- Without solar



By half-hour interval

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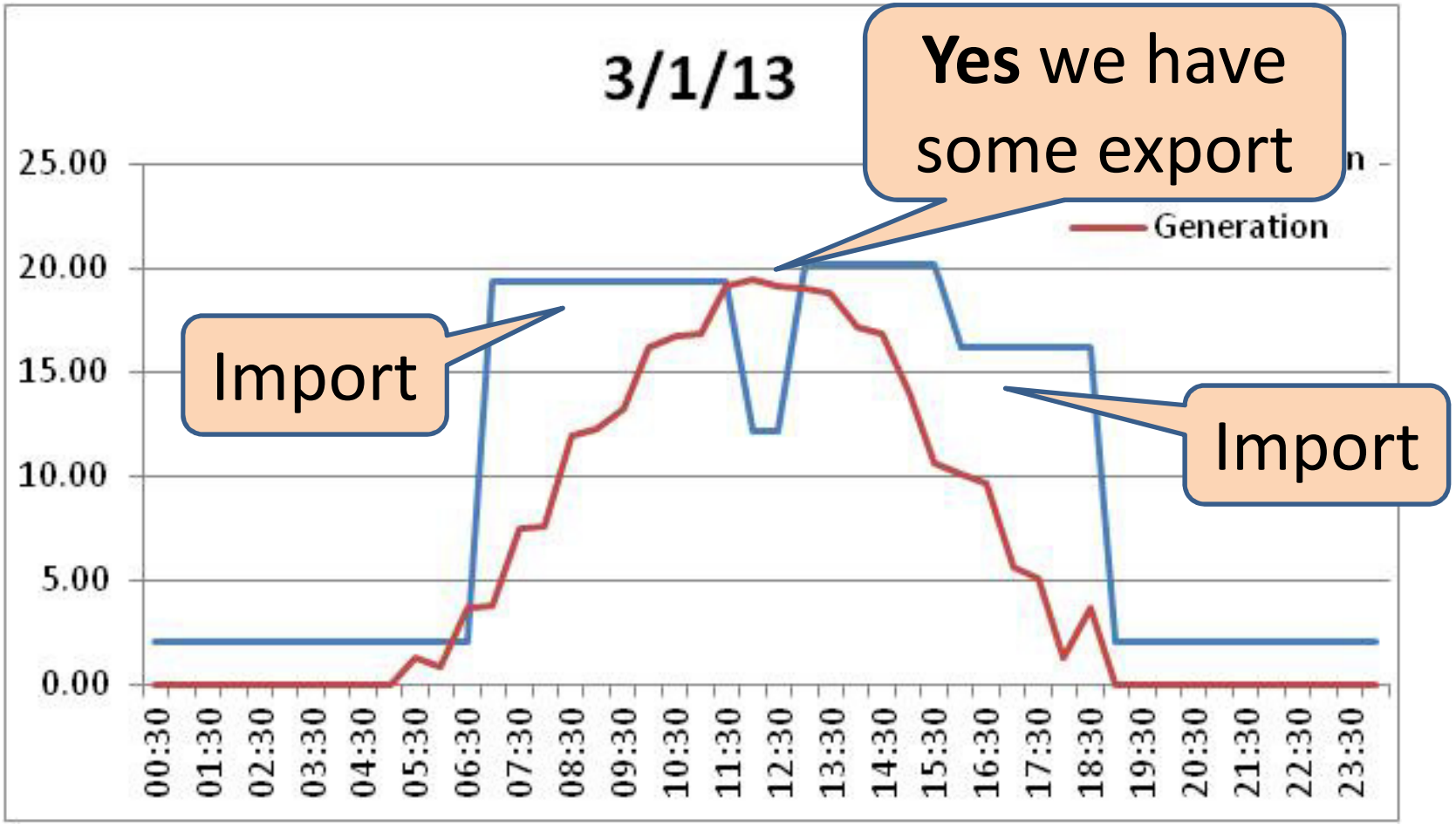
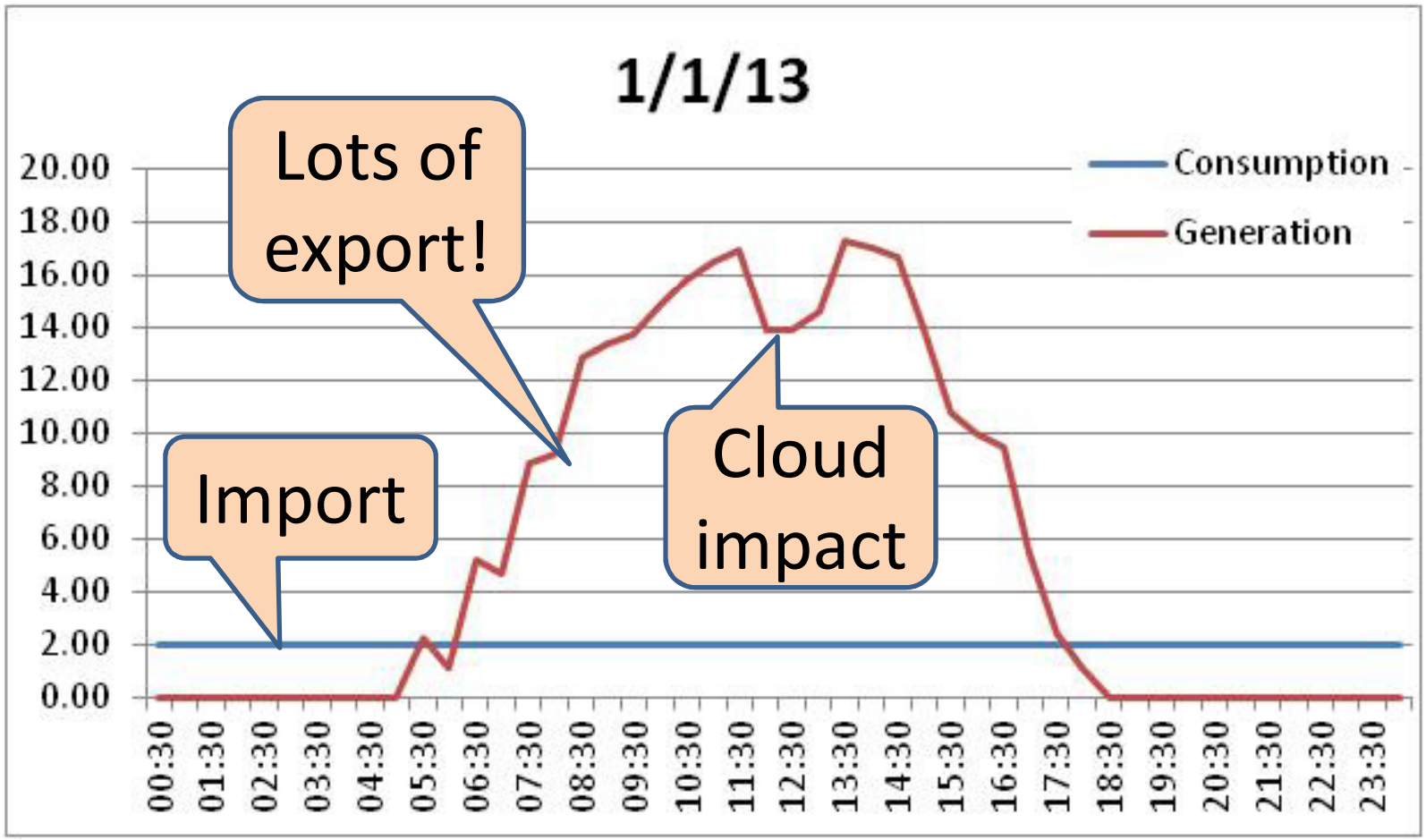


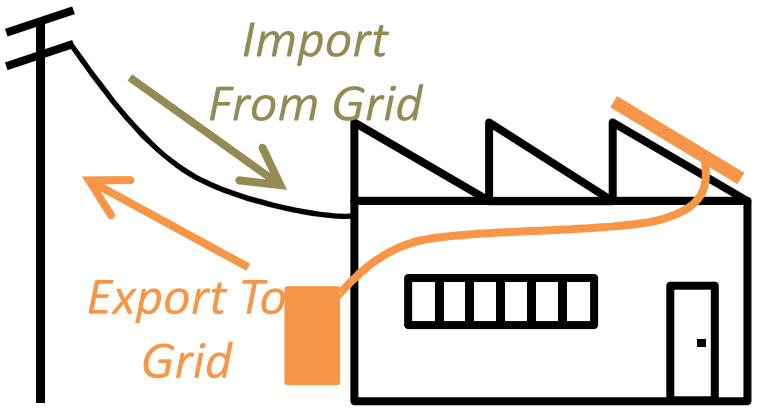
By half-hour interval

- Sundays & public holidays?



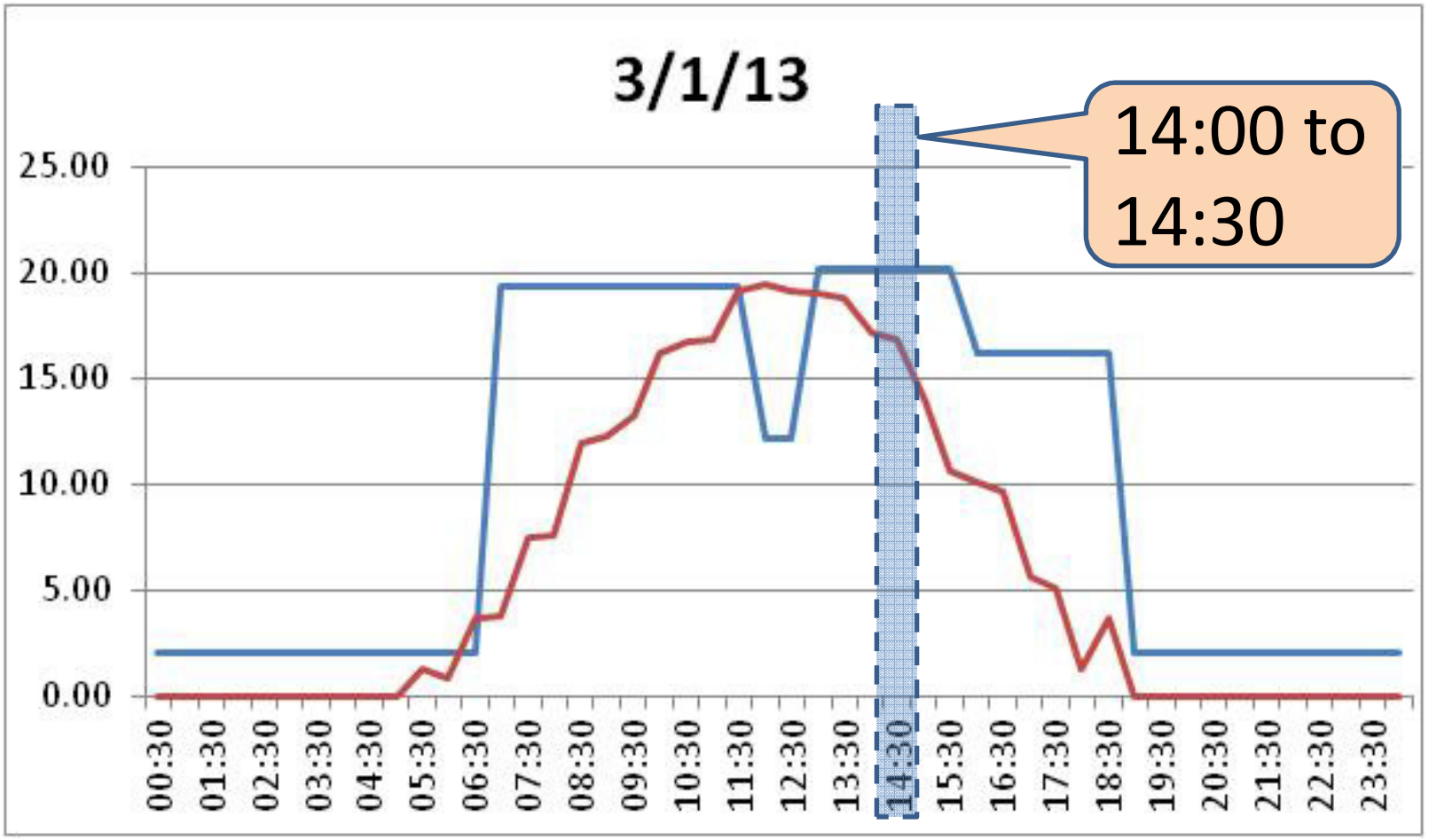
Key point – They don't cancel

- Exports and imports do **not** cancel out on your bill; they accumulate.
  - At any instant, electric current flows in only one direction.
  - Meter operates instantaneously.
  - Meter accumulates exports and imports in separate registers.



Within half-hour intervals

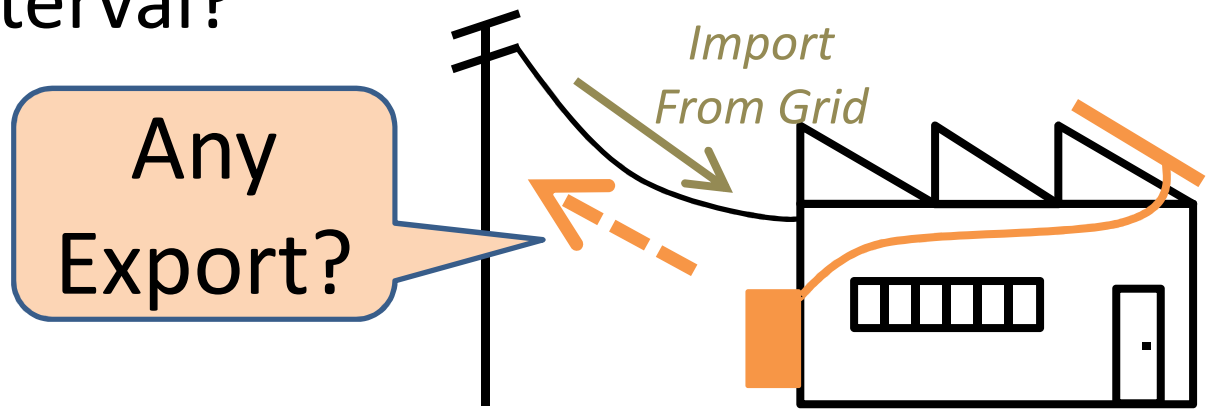
- Let's focus on a specific half-hour interval



Within half-hour intervals

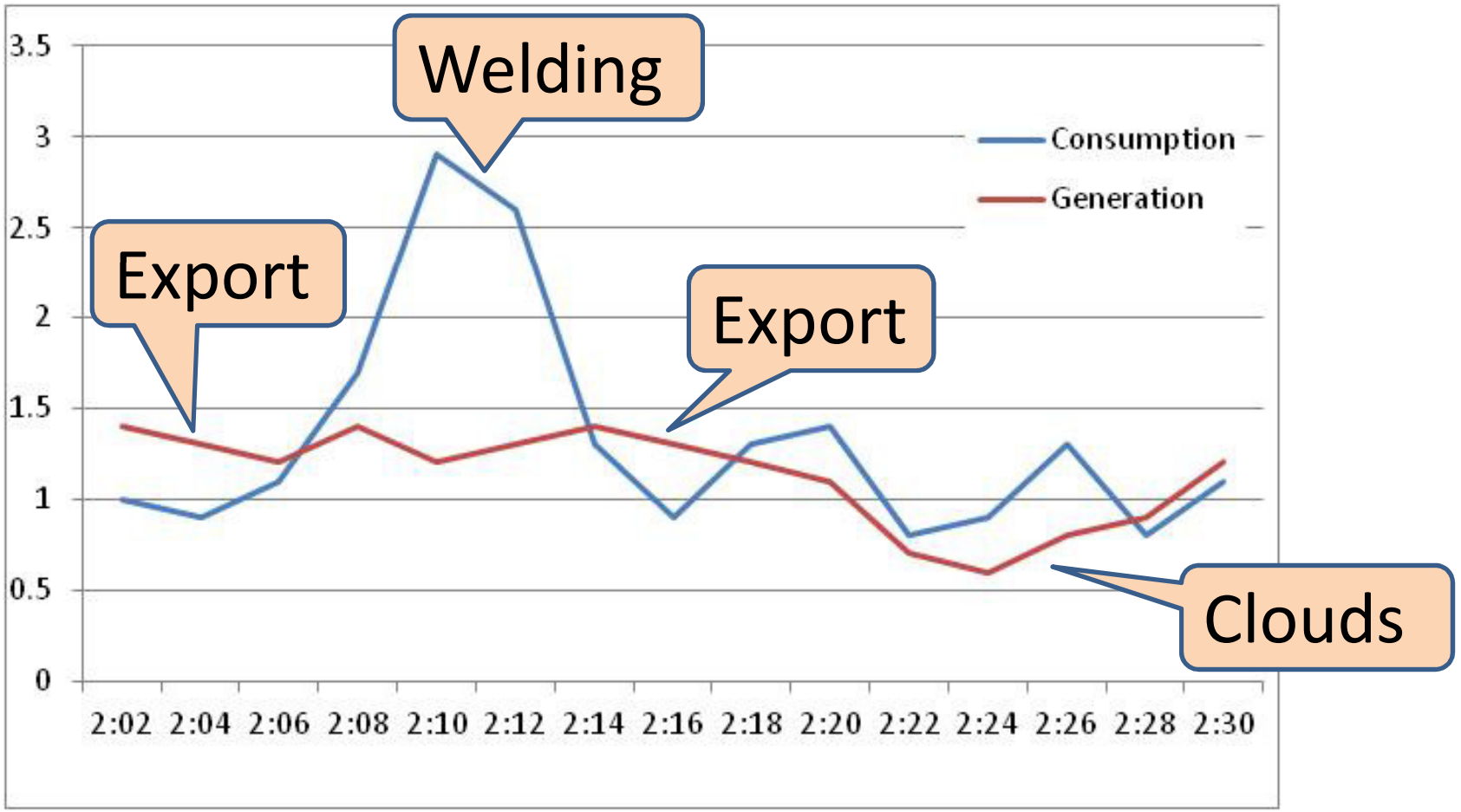
- 3rd January 2013, 14:00 -> 14:30
- Consumption 20 kWh
- Generation 17 kWh

➢ Is there any export during this interval?



Within half-hour intervals

- **Yes**, we are likely to have some export! Eg:



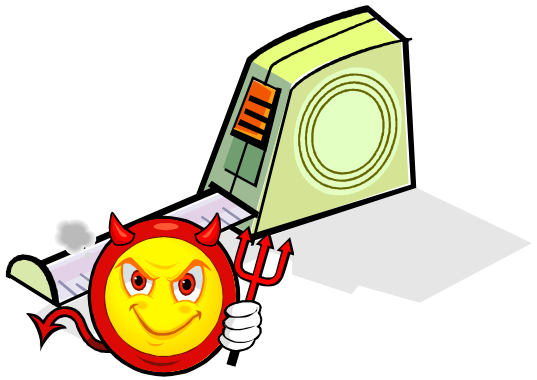
WidgCo - Results

- WidgCo is a good candidate for solar.
- Using ATA's Sunulator tool:
  - 23% of solar generation is exported
  - Simple payback: 7 years*
  - Discounted payback: 9 years*
  - Return on Investment 14%*
  - Net Present Value: $68,000*

* 25 yr horizon, discount rate 6.5%. Inverter after 10 yrs. No changes in tariffs etc. Simple ownership option.

How do we predict exports?

- Analyse consumption vs. generation
- We need:
  - A simulation tool, eg ATA's Sunulator.
  - Consumption data for a whole year.
    - Half-hour intervals if possible
  - Info on tariffs.
  - Time to evaluate scenarios.



How do we get good payback?

- Minimise exports to the grid.
  - Select good sites
    - Consumption during daylight hours
    - Consistent consumption – few holidays
  - Smallish system relative to consumption
  - Orient panels to match consumption?
    - Eg East & West for morning & evening peaks
  - Battery storage?

Key points to take away

1. Minimise exports for good solar payback.
   - Eg **7** years instead of **12**.
2. Imports and exports do not cancel out.
3. Need to analyse consumption versus generation.
4. ATA's Sunulator can do this.

Questions?