"Solar drying of brine – better understanding leading to improved decision making"

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- Municipal
- Mining
- CSG

Reverse Osmosis

- Large quantities (up to several gigalitres) of brine

- What should be done with the brine?

Brine Management Options

Options:

1. pipeline transfer to the coast for ocean discharge
2. aquifer injection
3. generation of saleable salt
4. permanent storage (e.g. in a mine void).
5. drying followed by encapsulation (e.g. in a regulated waste facility)

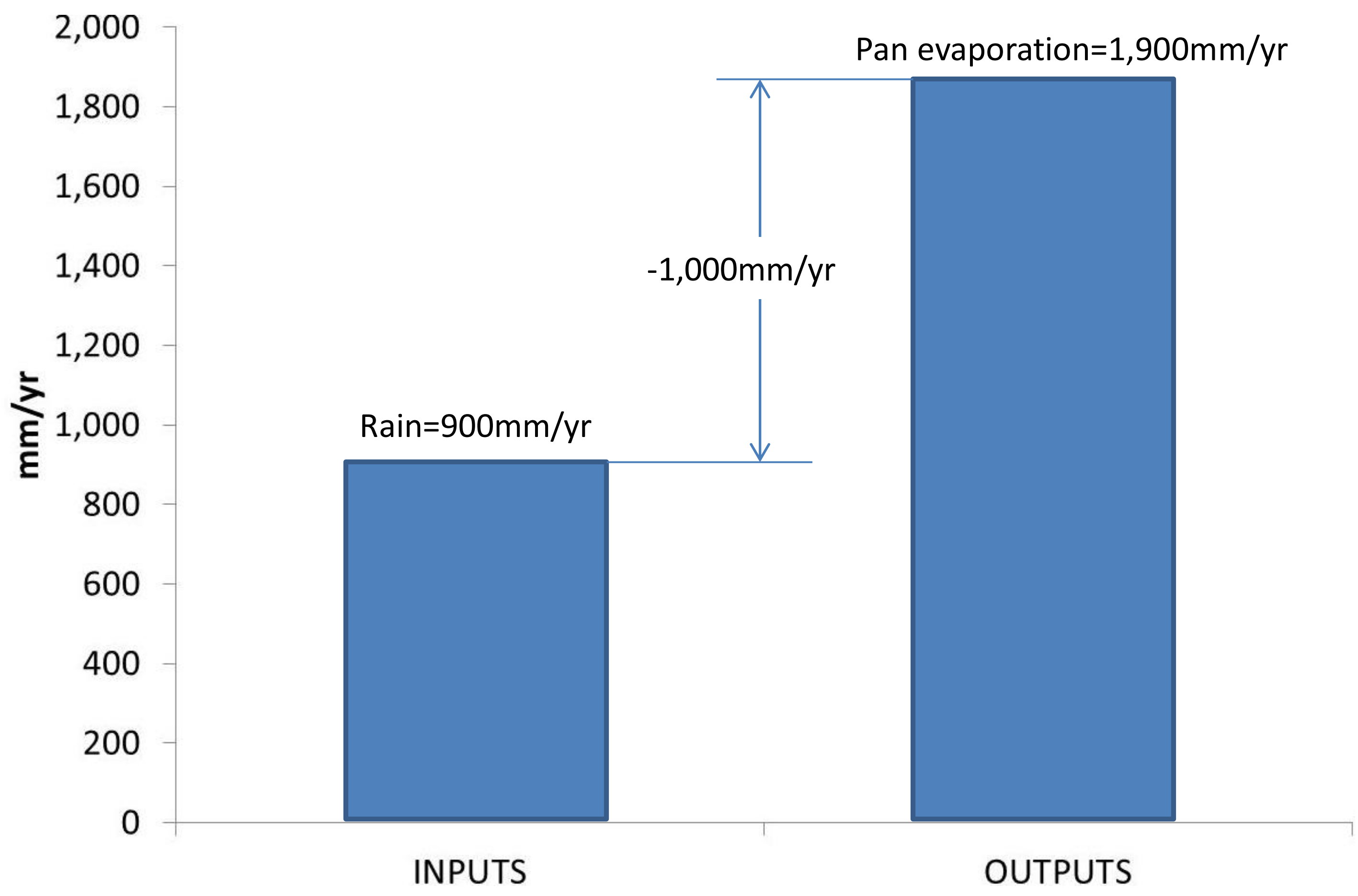
Solar drying

Common misconceptions:

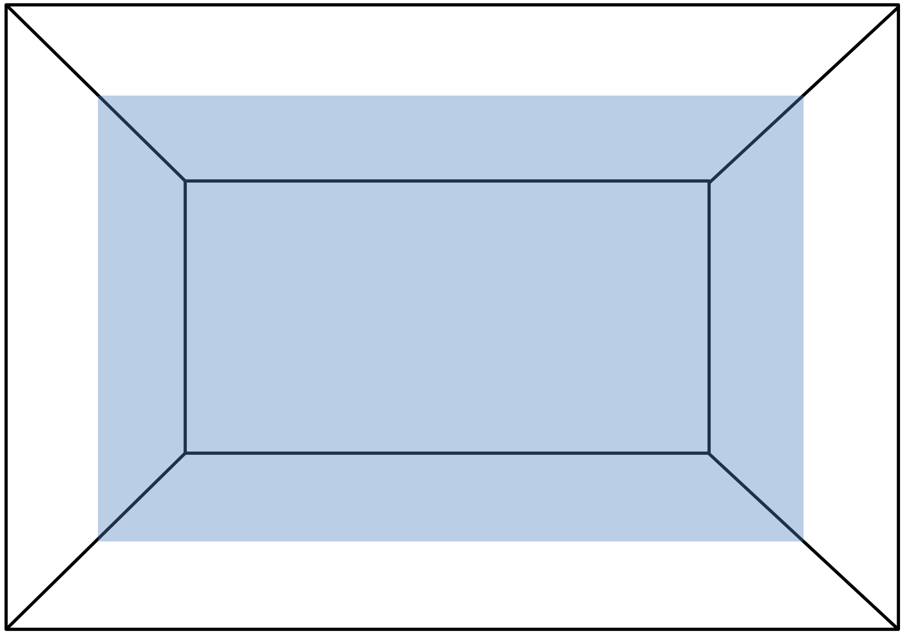
- **Evaporation>Rainfall** : Leave in a pond and it will evaporate
- **Evaporation<Rainfall** : Solar drying cannot work

Perceptions

Engineering & Construction



Perceptions



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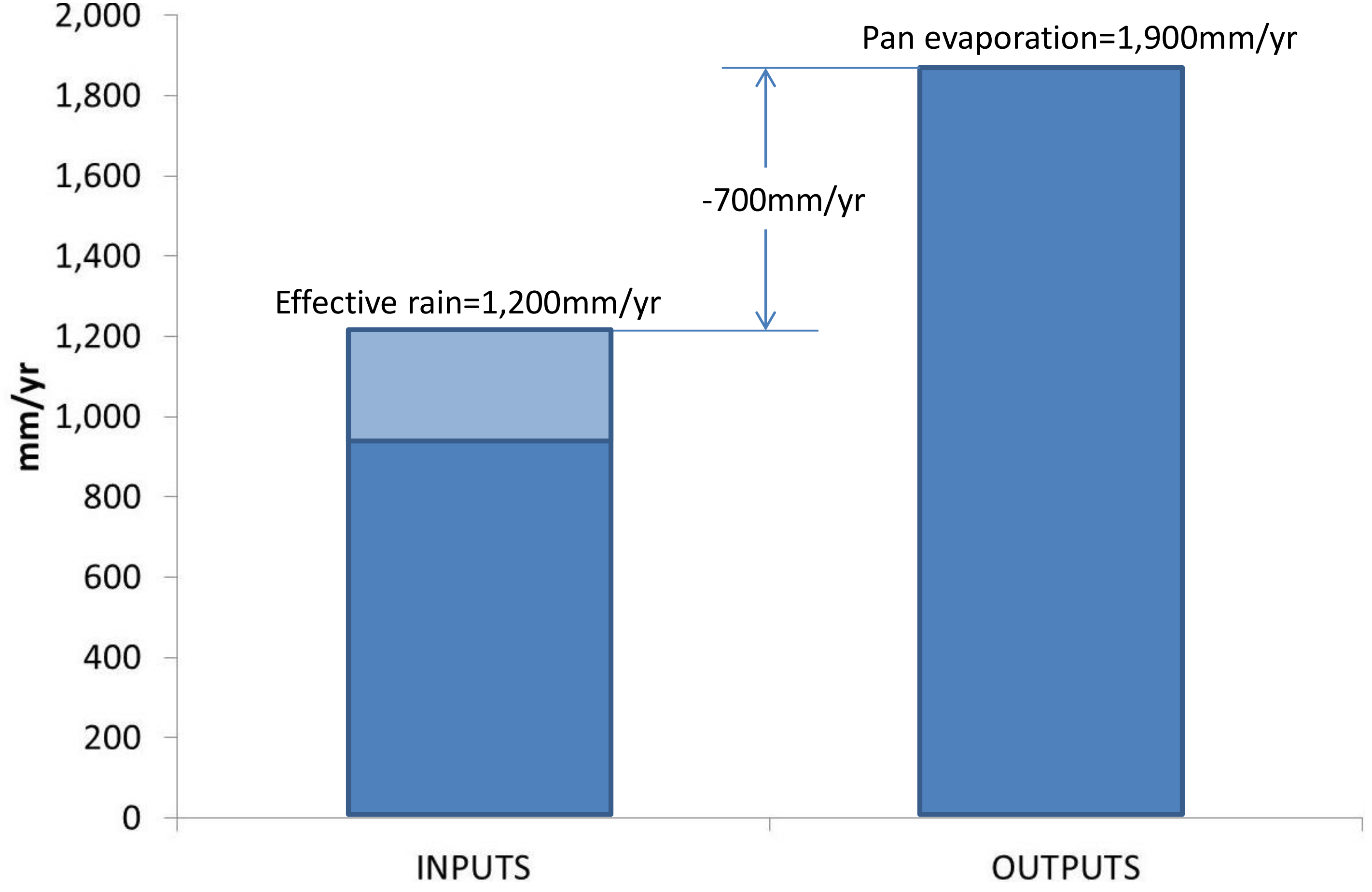

Perceptions

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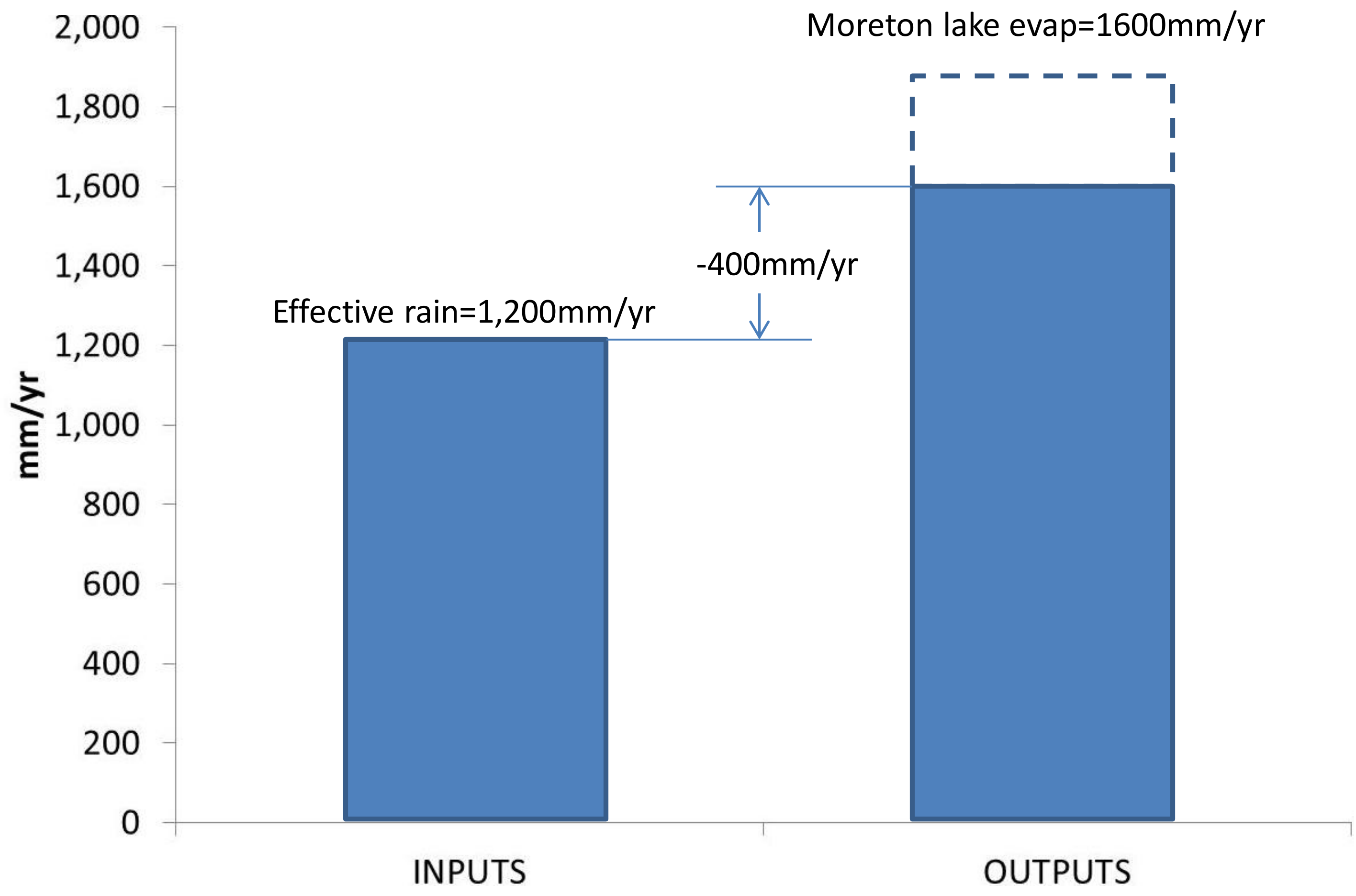

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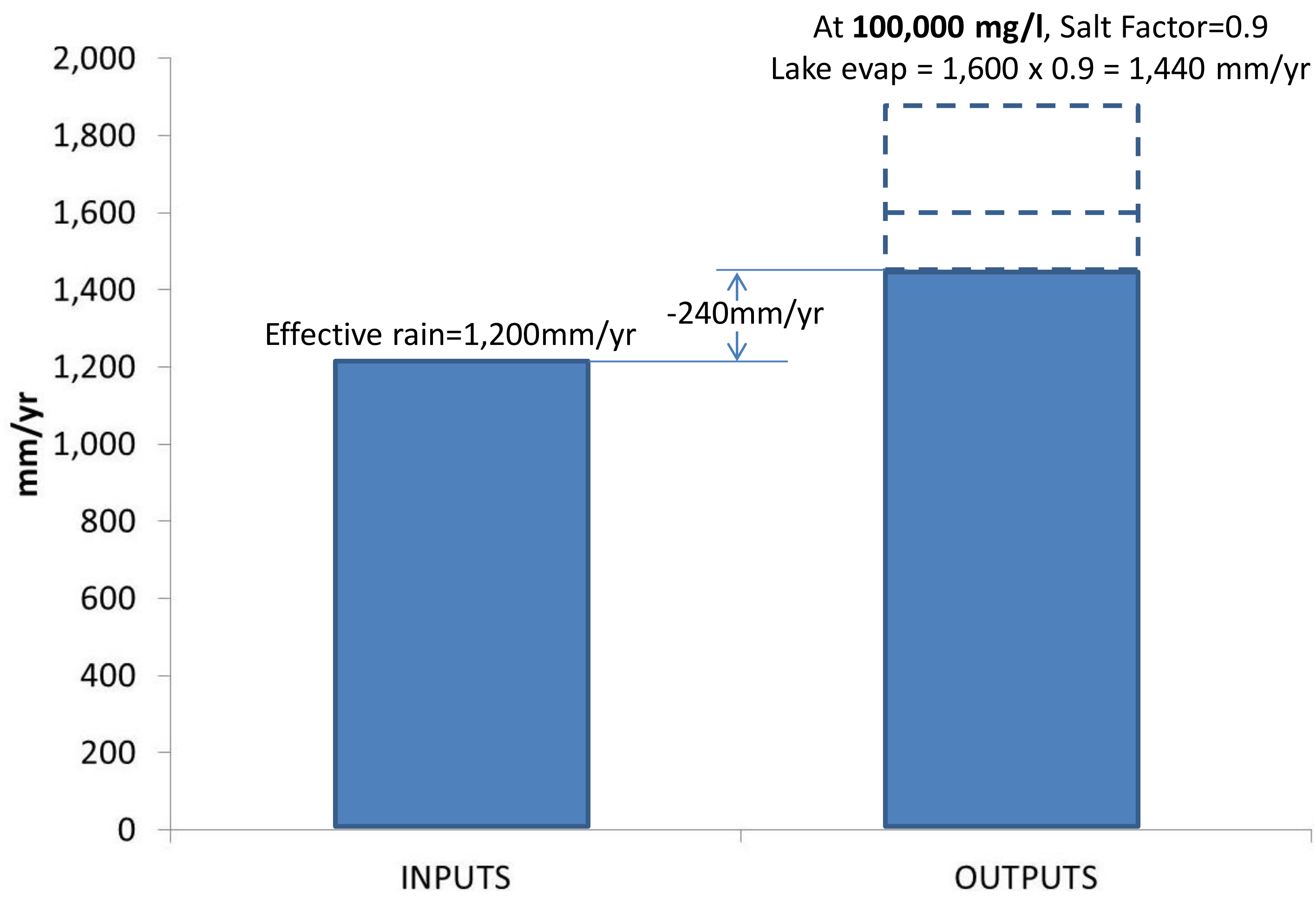
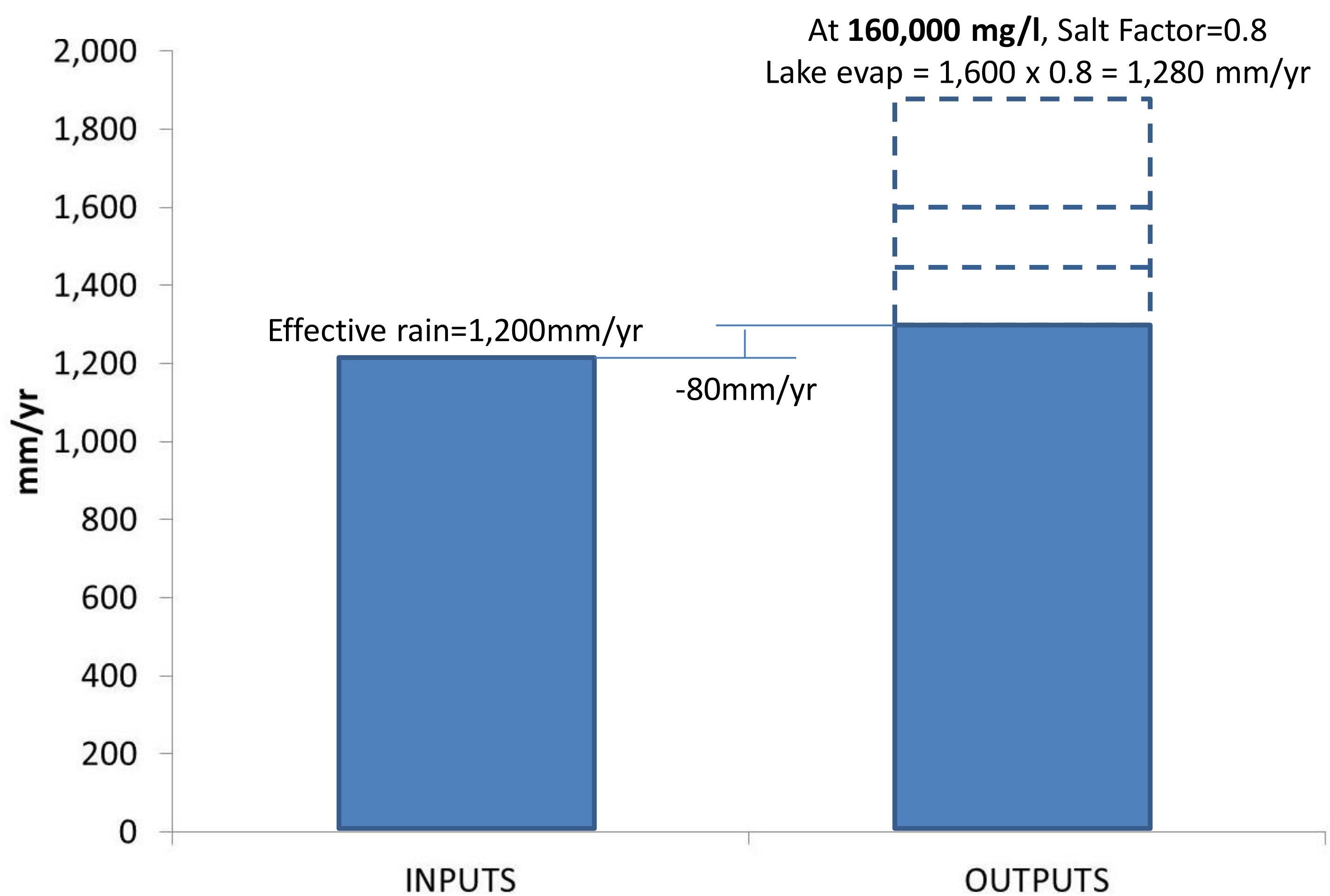
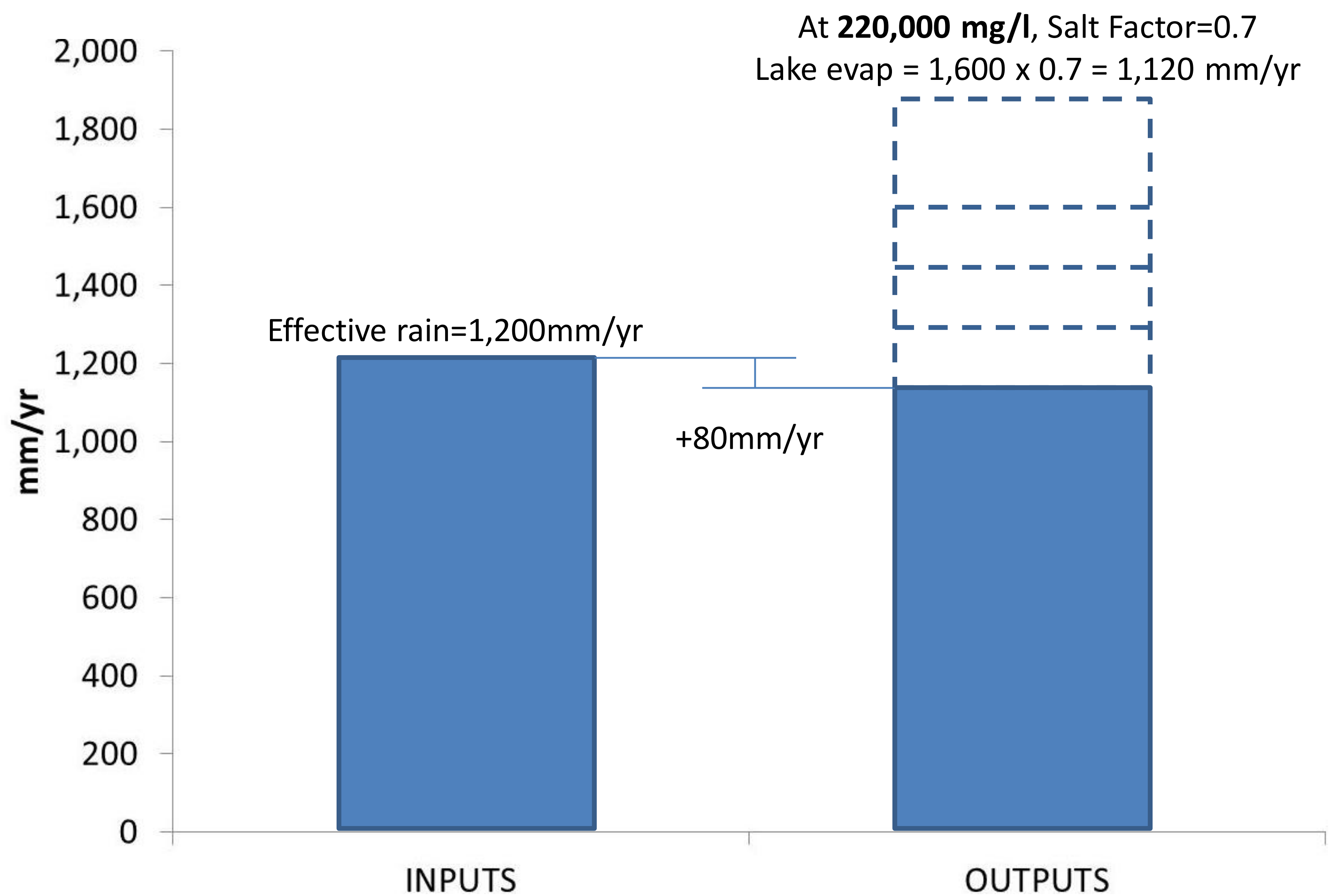


Perceptions



Perceptions



Appreciation – Solar drying facilties

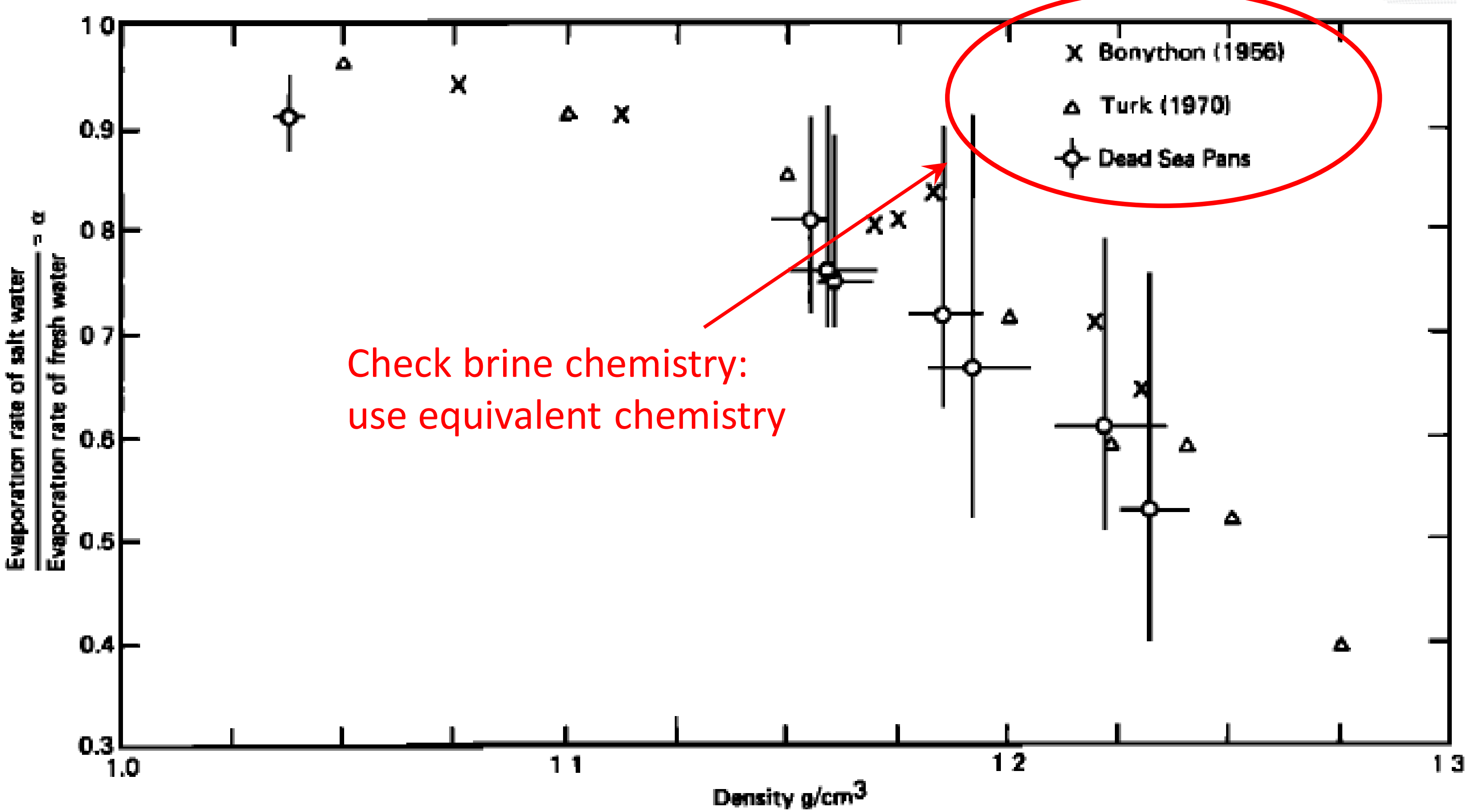
- Storage ponds: 5-8 m deep
- Solar concentrators: 1.5-3m deep
- Solar crystallisers: <1m deep

Appreciation – Solar drying facilties

- Liners important for inland settings
- Liners need to deal with heat and aggressive chemistry

Appreciation – Evaporation rate

Evaporation rate diminishes with increasing salinity



Appreciation – Evaporation rate

Salt factor should be estimated based on:

- Geochemical modelling based on brine chemistry
- Bench scale testing
- Field trails

Appreciation – Salt formation

Different water compositions will behave very differently when drying

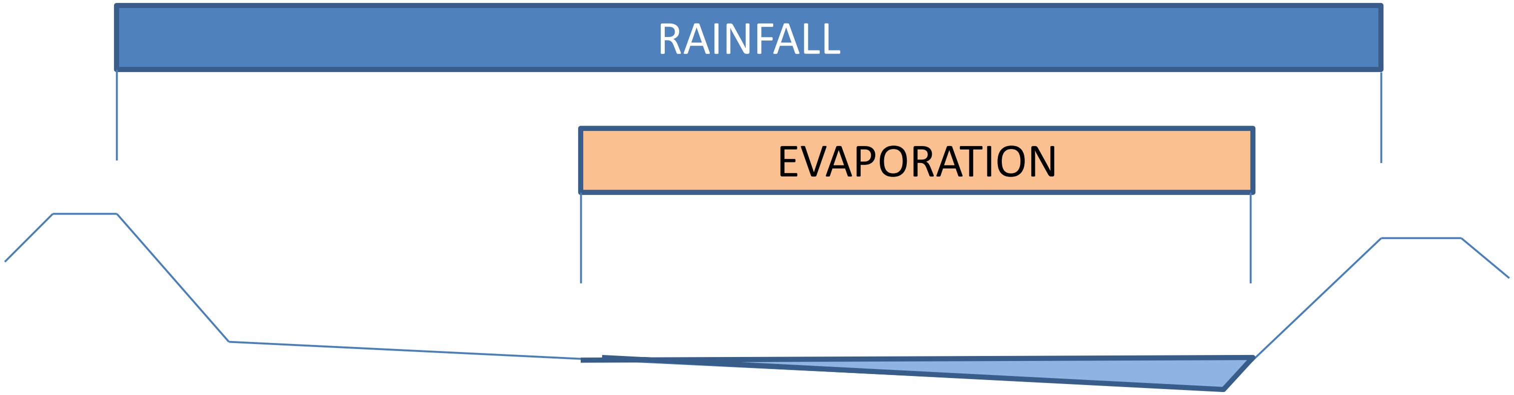
- Review water chemistry
- Geochemical modelling (drying models)
- Trails

Appreciation – Salt crusting

Salt crusts can form that inhibit evaporation

Mineral density > precipitate density (bouyant)

Appreciation – Geometry important



INPUTS = OUTPUTS
(rain) (evaporation)

Appreciation – Bitterns

– A residual liquid (highly concentrated) will usually remain indefinitely

Appreciation – Biological activity

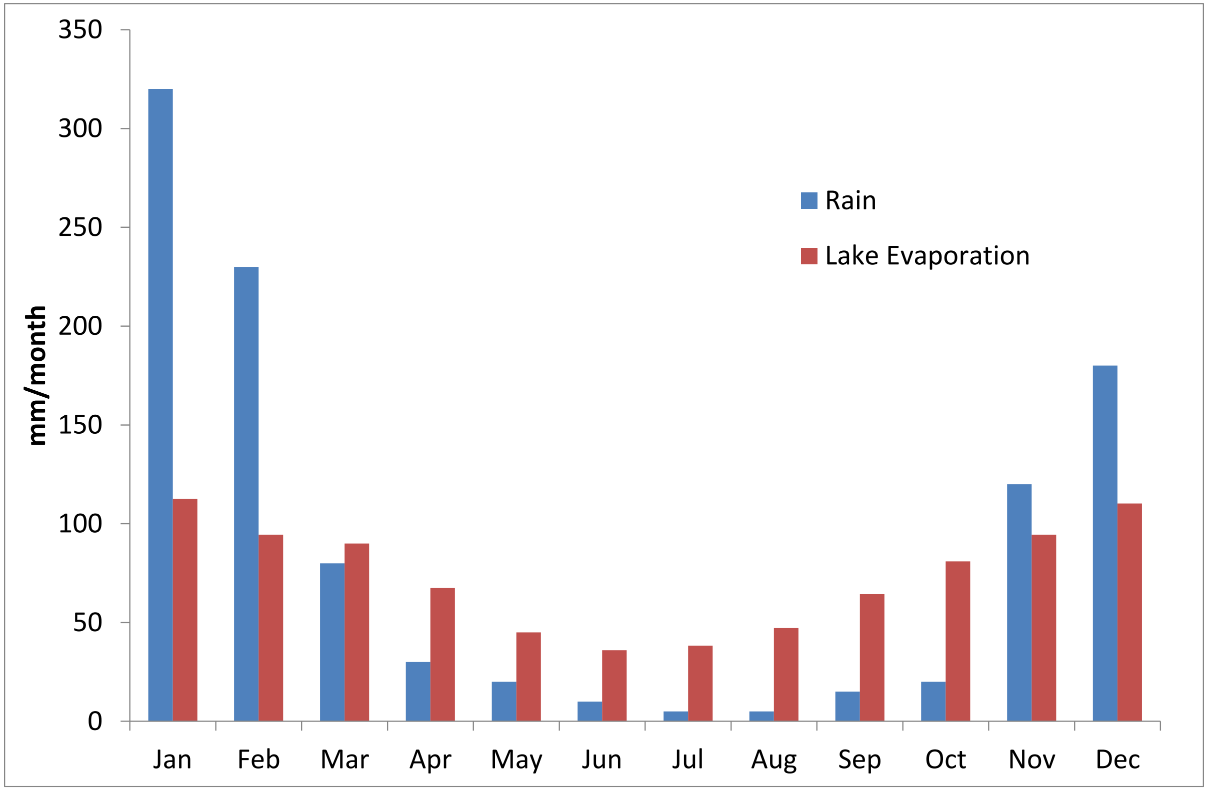
Biological activity can diminish evaporation

Appreciation – Management

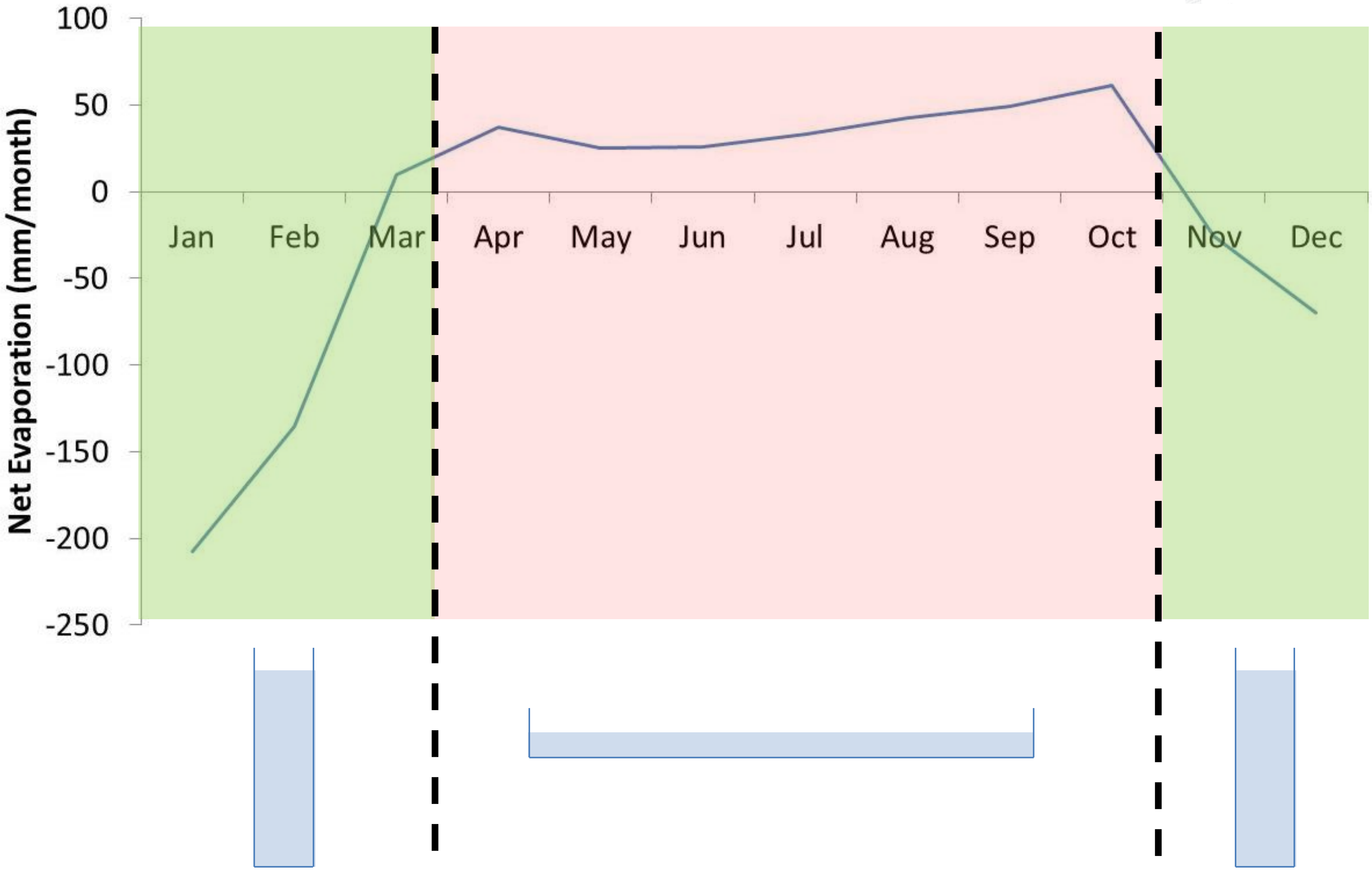
Solar drying can still work where rain>evaporation, with careful management

e.g. Annual average rainfall = 1035 mm

Annual average lake evaporation = 880 mm



Appreciation – Management



Framework

Objectives / Constraints	Define scope and outcomes of the assessment
↓ **Climate review**	Is the climate conducive to solar evaporation?
↓ **Water chemistry assessment**	What minerals will precipitate during drying, when and in what quantity?
↓ **Conceptualisation**	What are the key processes affecting evaporation?
↓ **Salt factor determination**	How does water chemistry affect evaporation?
↓ **Mass balance**	Assess the water balance (inputs, outputs, storage)
↓ **Configuration**	How should a solar drying facility best be arranged?
↓ **Benchmarking**	How does the concept reflect natural and anthropogenic analogues?
↓ **Trials**	Does the desktop accurately reflect actual behaviour?

Conclusion

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