



*K O V A R A*

*Energy Consultants*

# Measurement & Verification

## The Principles

Des Murphy

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## Typical Energy Conservation Measure:

- 4 year simple payback
- Will benefit owner for 10 years

**= Internal Rate of Return (IRR) of 20%**

## **So why don't we see more energy conservation projects?**

- Owners don't believe the seller.
- Owners are not confident that they can measure the saving.
- And if the saving does not materialise, will they seller refuse to repay?



# Measurement & Verification of Savings

An independent methodology that has the confidence of the seller and the buyer.

## Measuring Savings

$$\boxed{\text{Saving}} = \boxed{\text{What the consumption would have been}} - \boxed{\text{The actual consumption}}$$

# Measuring Savings

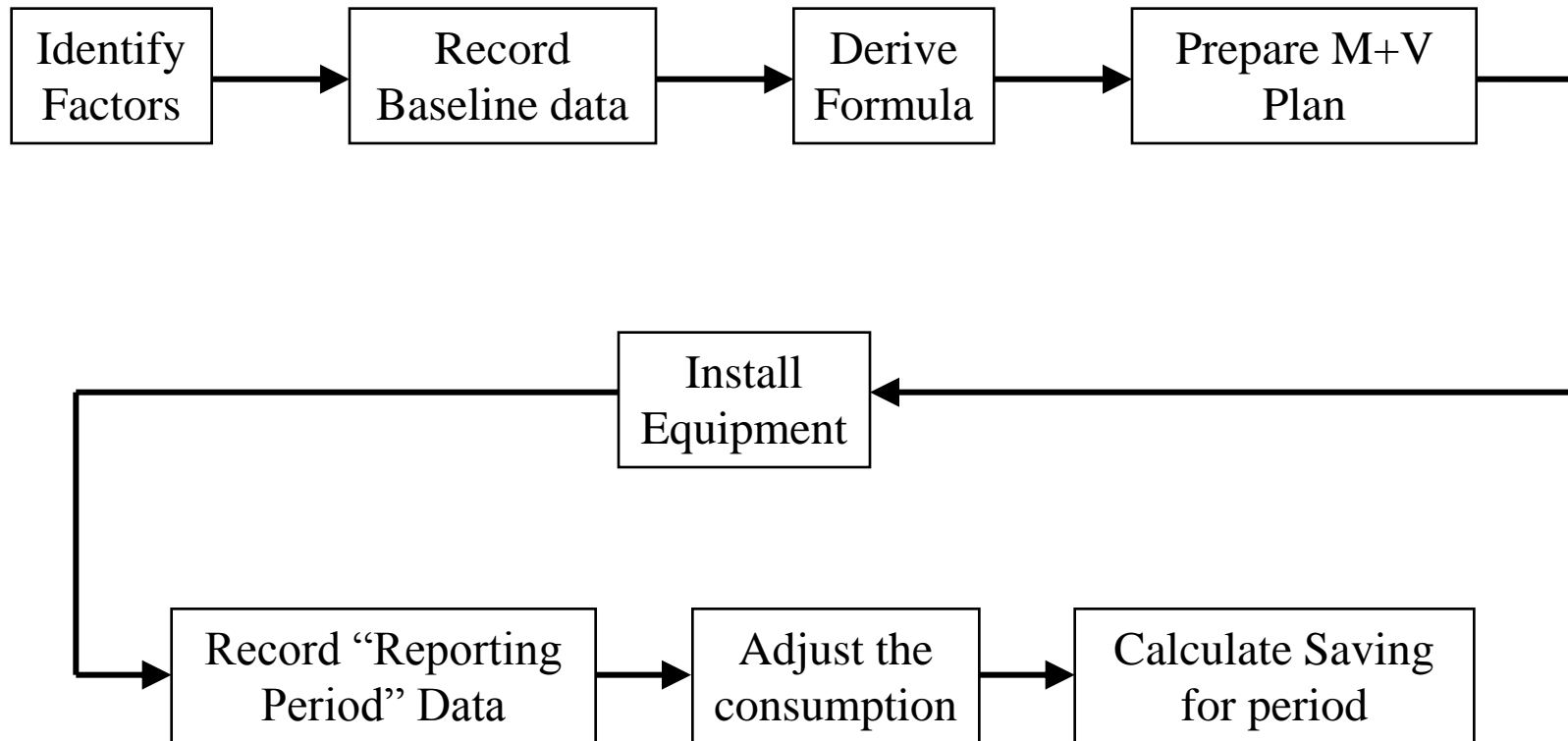
$$\boxed{\text{Saving}} = \boxed{\text{What the consumption would have been}} - \boxed{\text{The actual consumption}}$$

**This is the focus of  
 M+V**

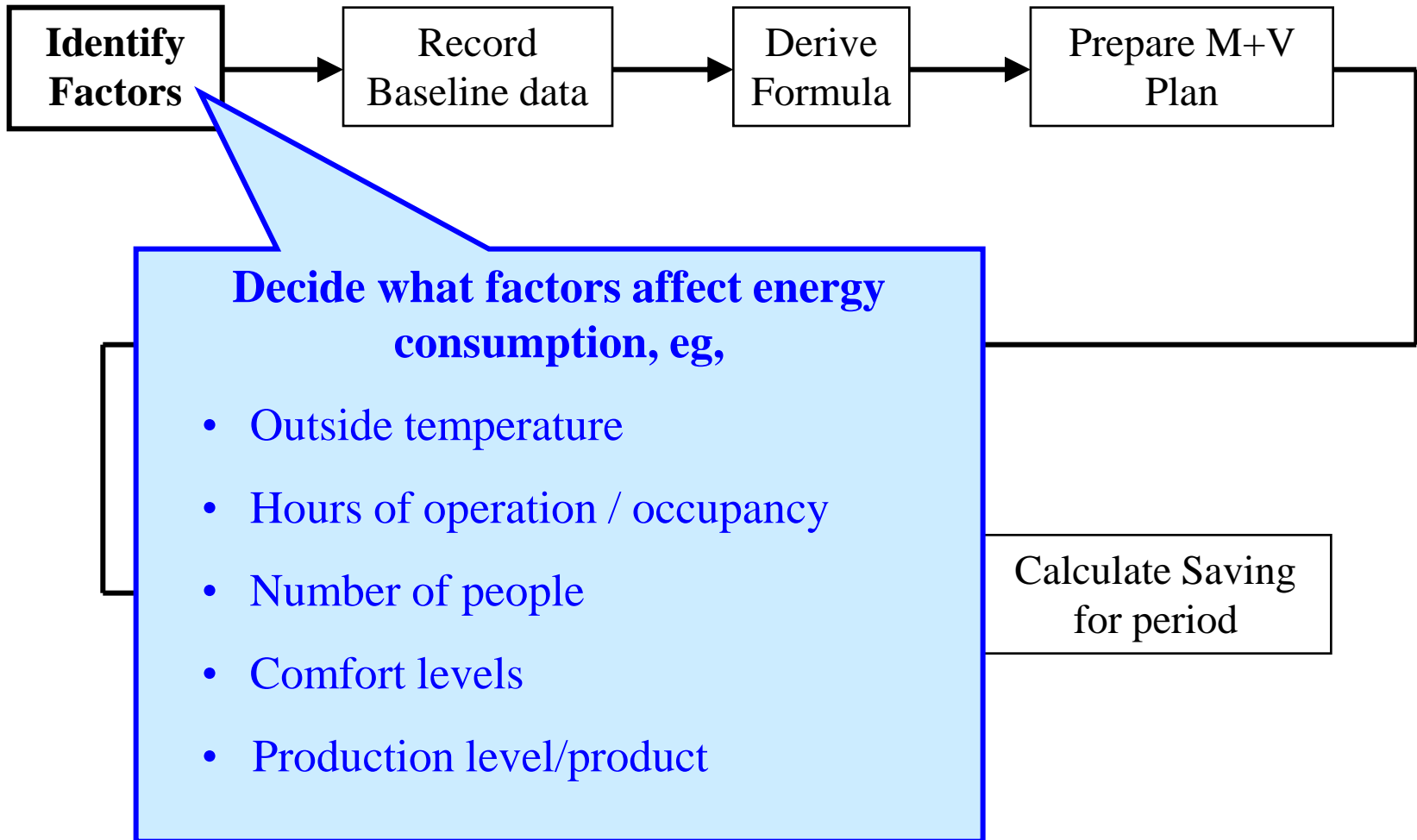
## **Several methodologies have been developed over the past 20 years or so:**

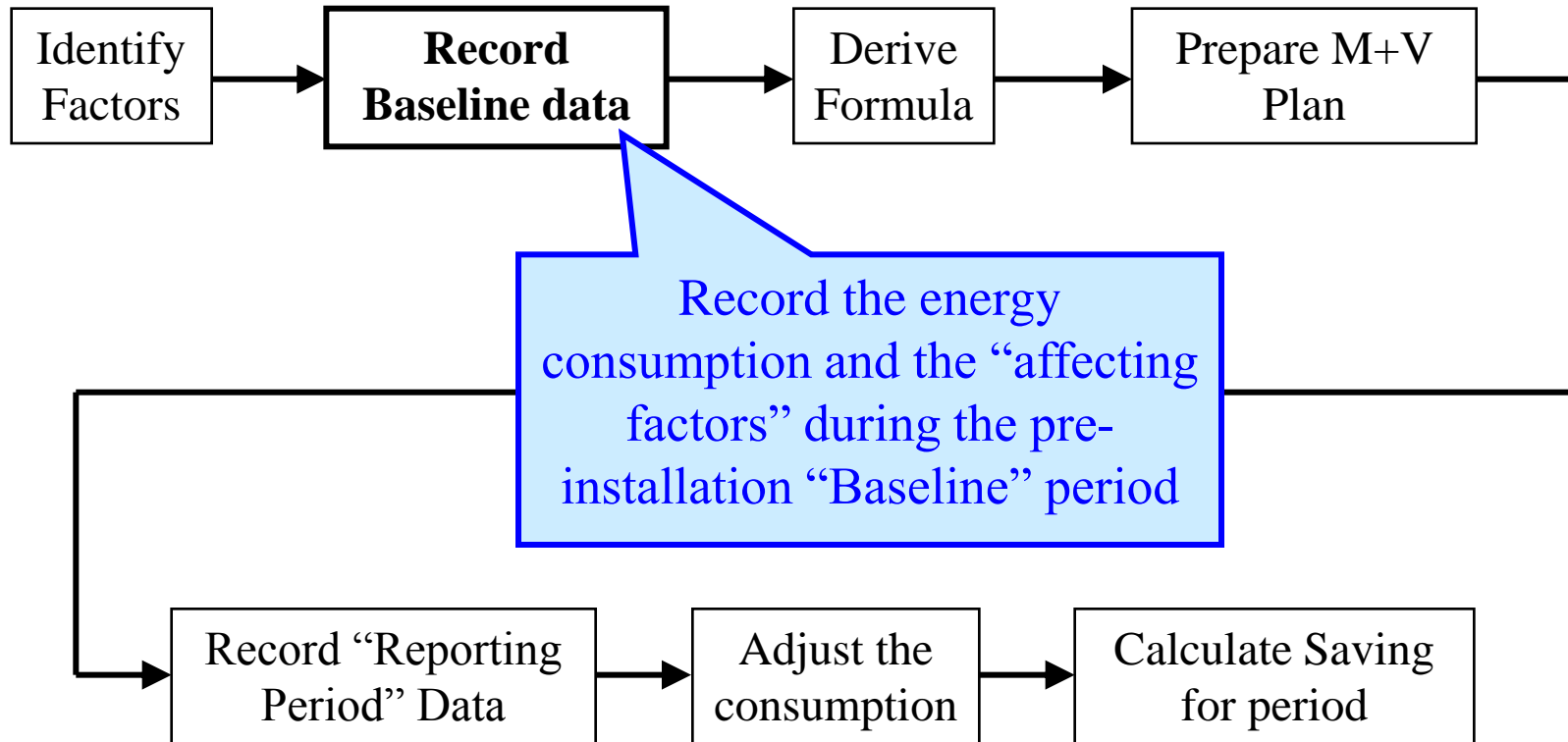
- **IPMVP** (International Performance Measurement & Verification Protocol)
- **ASHRAE**

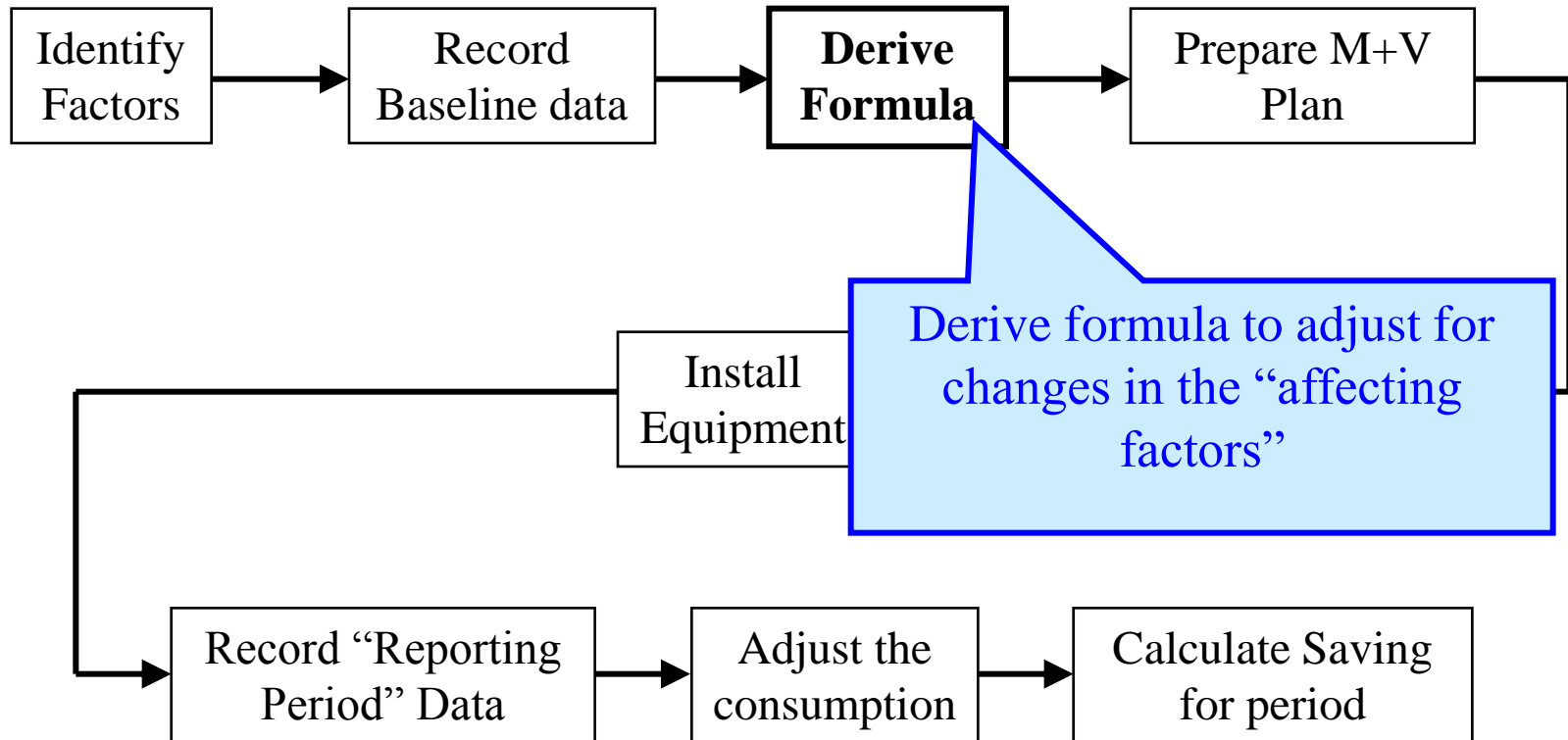
## The M+V Process

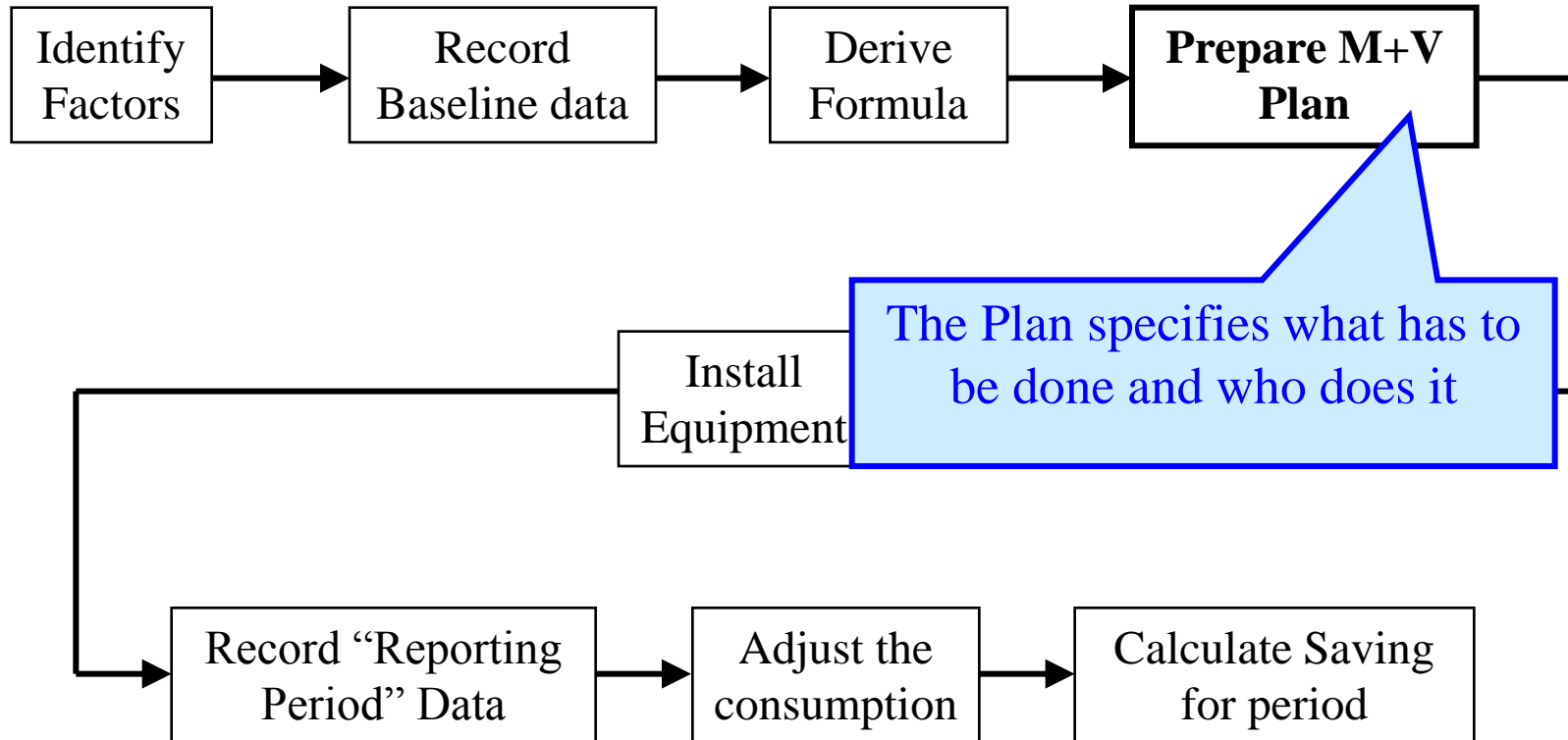


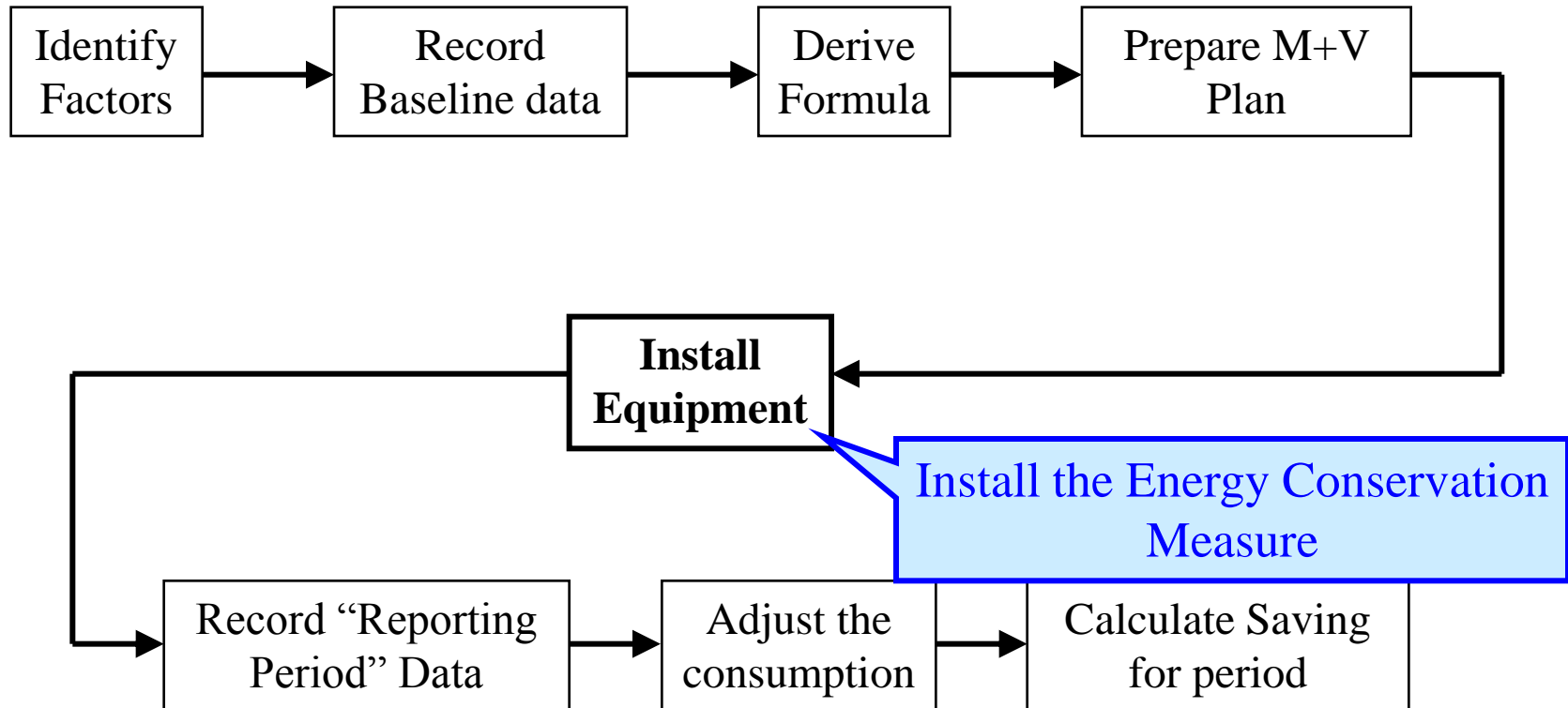


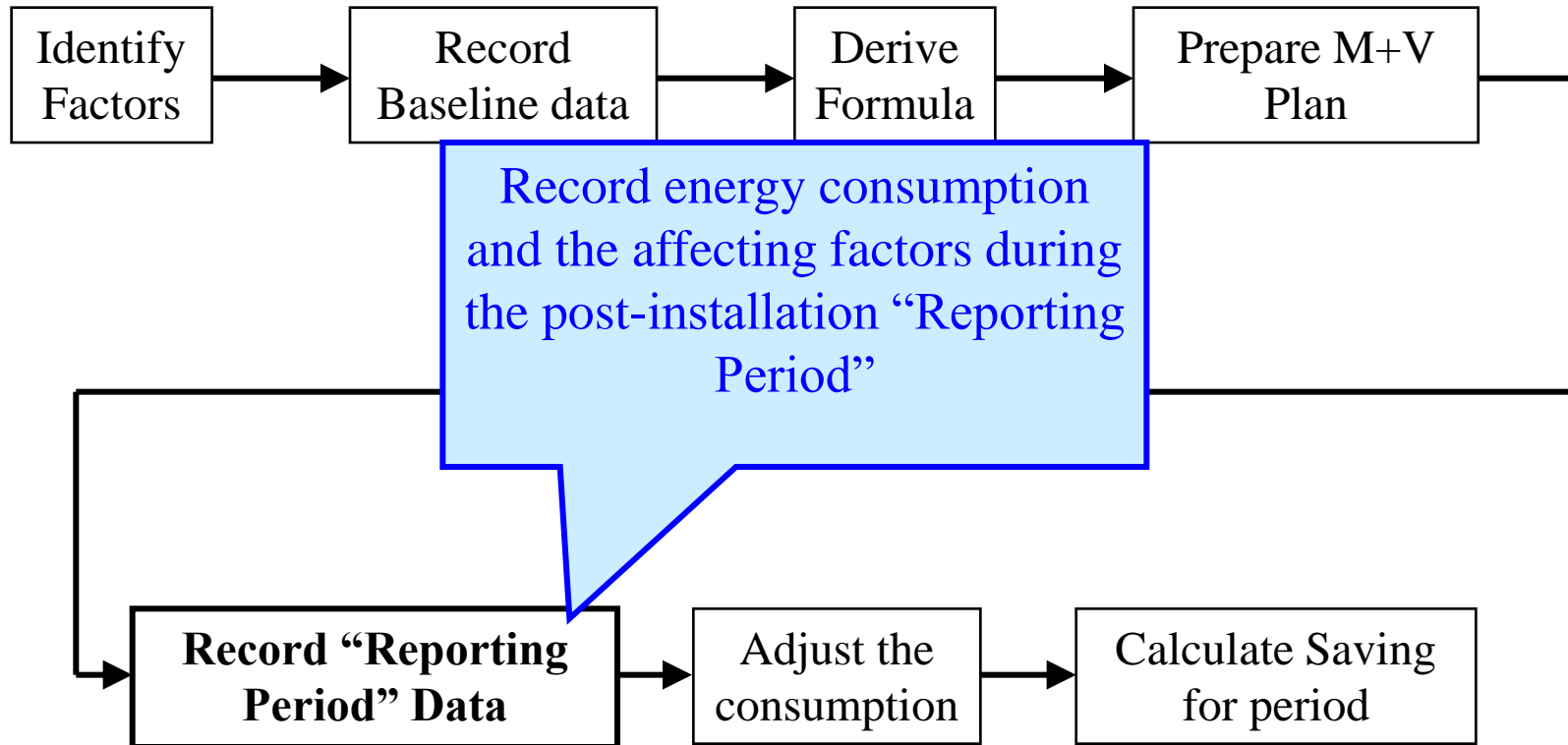


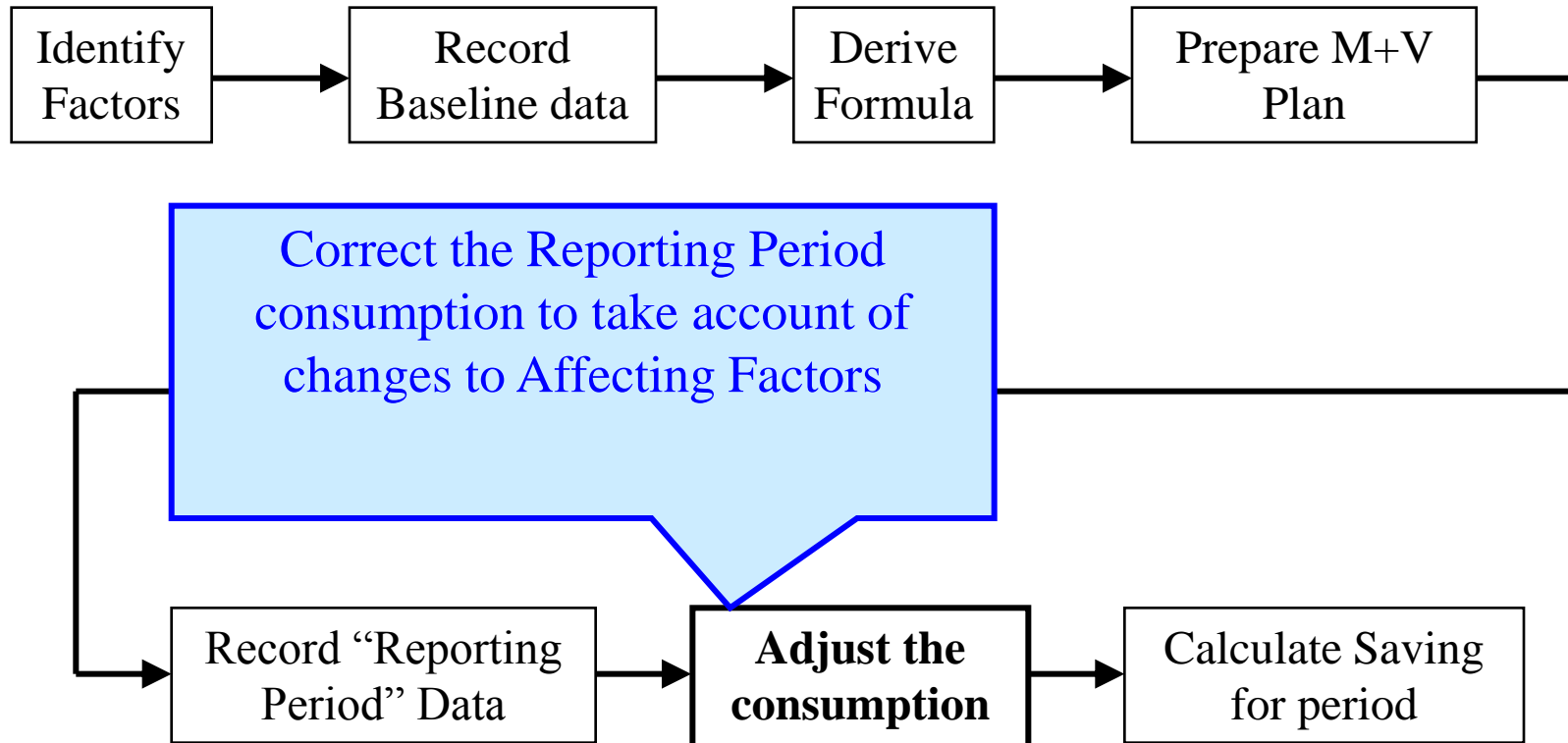


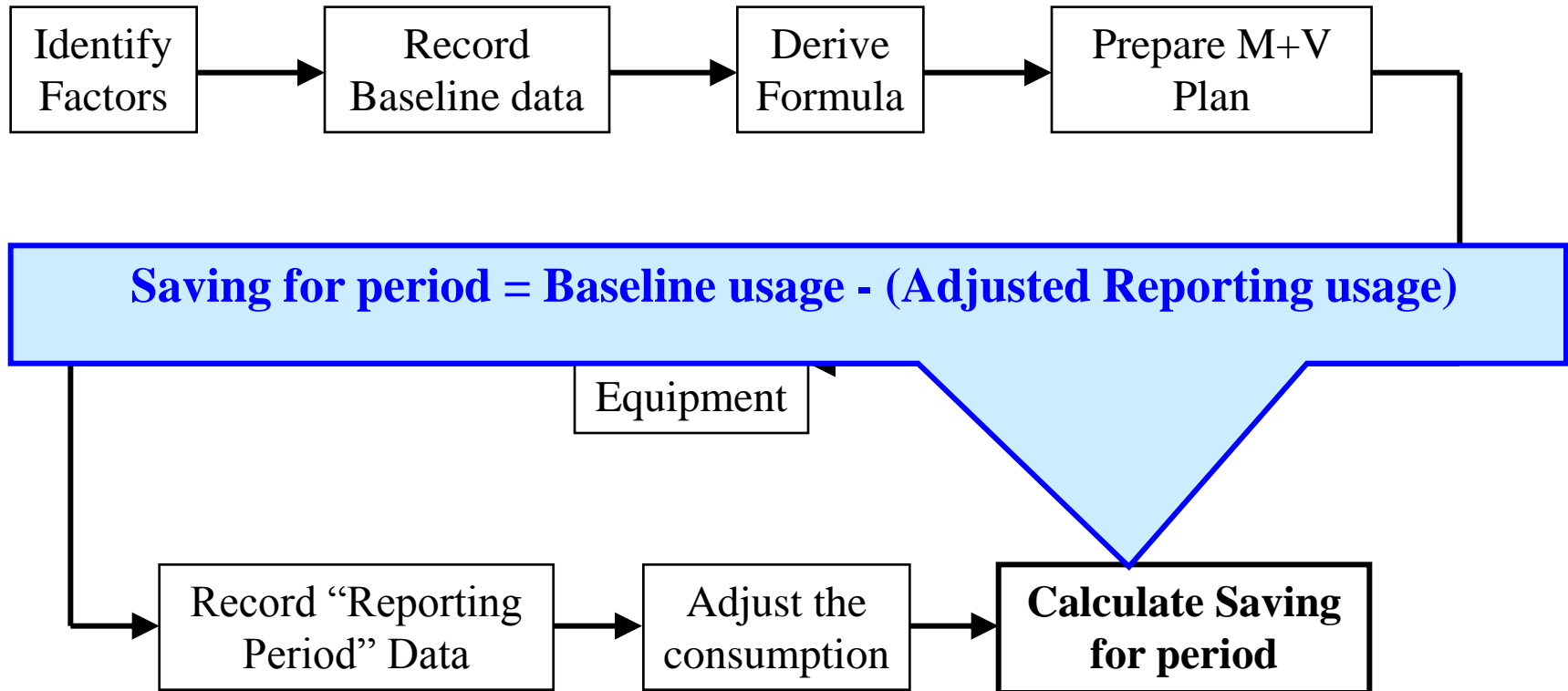




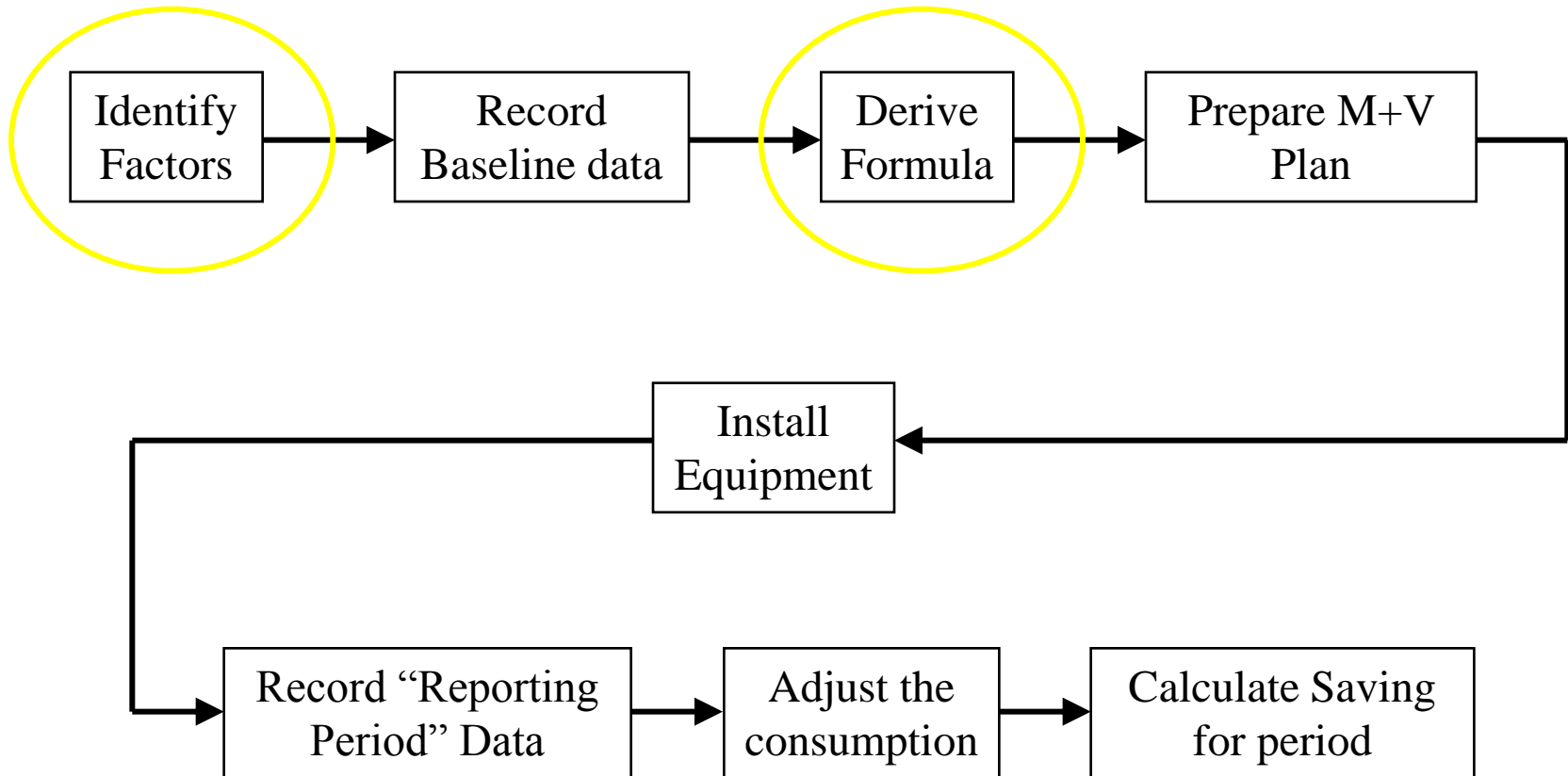












## The Key Challenges

- Deciding on the “affecting factors” that are **significant**.
- Measuring/Recording the energy and affecting factors **at reasonable cost**.
- **Setting up** and **proving** the mathematical relationships.

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## **Option A: Retrofit Isolation – Key Parameter Measurement**

### **Lighting Replacement**

- 1. Pre-installation:** Spot measure the electricity usage of the lights.
- 2. Post-installation:** Spot measure the electricity usage of the new lights..
- Satisfy the owner that the new lights provide a satisfactory lighting level.

**Saving = Reduction in kW x annual operating hours**

## Option A: Retrofit Isolation – Key Parameter Measurement

### Lighting Replacement

1. Pre-installation: Spot measure the electricity usage of the existing lights
2. Post-installation: Spot measure the electricity usage of the new lights.
3. Satisfy the owner that the new lights provide a satisfactory lighting level.

Owner may insist on holding a retention pending carrying out tests 2 & 3 again after 12 months.

**Saving = Reduction in kW x annual operating hours**

## Option A: Retrofit Isolation – Key Parameter Measurement

### Lighting Replacement

1. Pre-installation: Spot measure the existing lights
2. Post-installation: Spot measure the new lights.
3. Satisfy the owner that the new lights provide a satisfactory lighting level.

In order to minimise M+V costs, the owner may accept responsibility for the operating hours.

**Saving = Reduction in kW x annual operating hours**

## **Option B: Retrofit Isolation – Key Parameter Measurement**

### **Lighting Replacement + Controls**

- 1. Pre-installation:** Establish the electricity usage of the lights
- 2. Post-installation:** Record the electricity usage of the new lights.
3. Satisfy the owner that the new lights provide a satisfactory lighting level.

**Saving = Baseline usage – Adjusted Reporting period usage**



## Option B: Retrofit Isolation – Key Parameters

Occupancy sensors  
Outside light sensors

### Lighting Replacement + Controls

1. **Pre-installation:** Establish the electricity usage of the lights
2. **Post-installation:** Record the electricity usage of the new lights.
3. Satisfy the owner that the new lights provide a satisfactory lighting level.

**Saving = Baseline usage – Adjusted Reporting period usage**

**Option B: Retrofit Isolation – Spot readings / Continuous measurement**

**Agree occupancy hours**

**Lighting Replacement + Comparison**

1. **Pre-installation: Establish the electricity usage of the lights**
2. **Post-installation: Record the electricity usage of the new lights.**
3. **Satisfy the owner that the new lights provide a satisfactory lighting level.**

**Saving = Baseline usage – Adjusted Reporting period usage**

## Option B: Retrofit Isolation – Key Parameter Measurement

### Lighting Replacement + Controls

Continuous recording is necessary because of sensors

1. Pre-installation: Establish the electricity usage of the lights
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### **Lighting Replacement + Controls**

1. Pre-installation: Establish the electricity usage of the lights
2. Post-installation: Record the electricity usage of the lights.
3. Satisfy the owner that the new lights provide at least the same light level as before

**Eg, change in occupancy hours**

**Saving = Baseline usage – Adjusted Reporting period usage**

## **Option C: Whole Facility Measurement**

- Energy saving is >10% of total energy used on site.
- A combination of several energy saving measures.
- Great care needed in establishing and recording the factors that affect energy.
- Reporting period generally have to be long to smooth out “noise”.

**Saving = Baseline usage – Adjusted Reporting period usage**

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## **Option D: Calibrated Simulation**

- Suited to situations where little or no historical energy usage data is available (eg, new facility/building)
- Involves building a computer model to represent the facilities energy consumption
- Requires experience and expertise.

**Saving = Baseline usage – Adjusted Reporting period usage**

## **In Conclusion.....**

- M+V opens the door for Energy Performance Contracting. Its here to stay.
- But its not an exact science – trying to predict what energy would have been used had the energy conservation measure not been installed.
- Beware of the risks!
- The more experience and expertise – the less risk.



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*Thank you*

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