ICID2015
26th ERC & 66th IEC

HYDRAULIC IRRIGATION INSTALLATION DIAGNOSIS: KNOWING OF THE SYSTEM TO IMPROVE IT

GENDRE Sophie
s.gendre@arvalisinstitutduvegetal.fr

ICID2015
26th ERC & 66th IEC

Presentation outlines

1. **Study context**

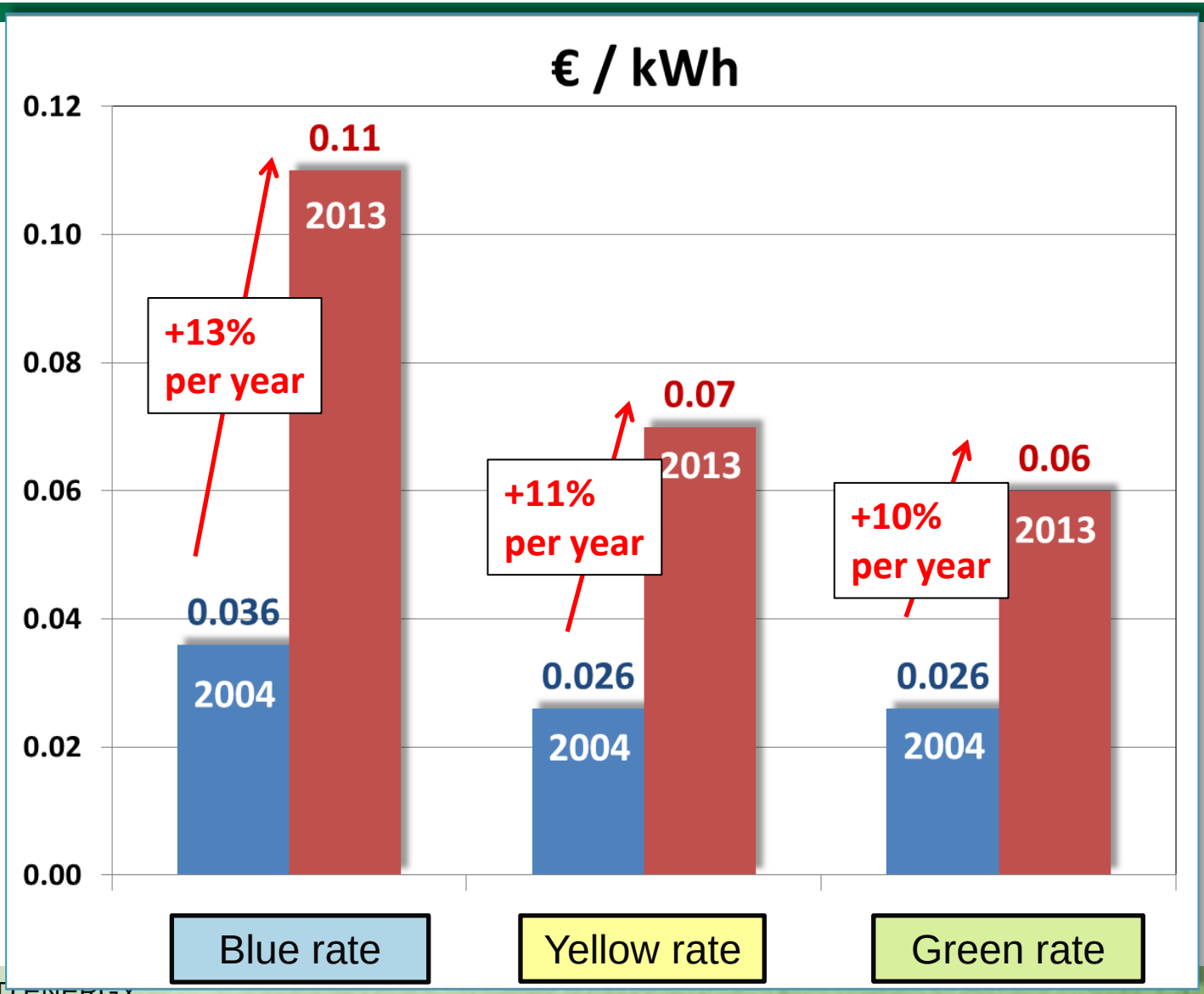
2. Methodology

3. Results

Electricity cost increasing between 2004 and 2013 in France (without taxes and subscription)

New law about electricity market :

Yellow and Green rates will disappear at the end of 2015



EDEN Project

From sensor to indicator : spatial data warehouse to evaluate farm energy performance

ICID2015
26th ERC & 66th IEC

Irrigation part

Methods development to build a diagnosis on:

- Water efficiency and consumption
- Energy performances

Technical partners

ARVALIS Institut du végétal

irstea

AGRICULTURES & TERRITOIRES
CHAMBRE D'AGRICULTURE HAUTE-GARONNE

CHAMBRE D'AGRICULTURE
DE LOT-ET-GARONNE

CACG
Valorisons votre territoire

Financial partners

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

MINISTERE
DE L'AGRICULTURE
DE L'AGROALIMENTAIRE
ET DE LA FORET

avec la contribution financière du compte d'affectation spéciale «Développement agricole et rural»

AGENCE DE L'EAU
ADOUR-GARONNE
ETABLISSEMENT PUBLIC DU MINISTERE DU DEVELOPPEMENT DURABLE

RÉGION
MIDI-PYRÉNÉES

Presentation outlines

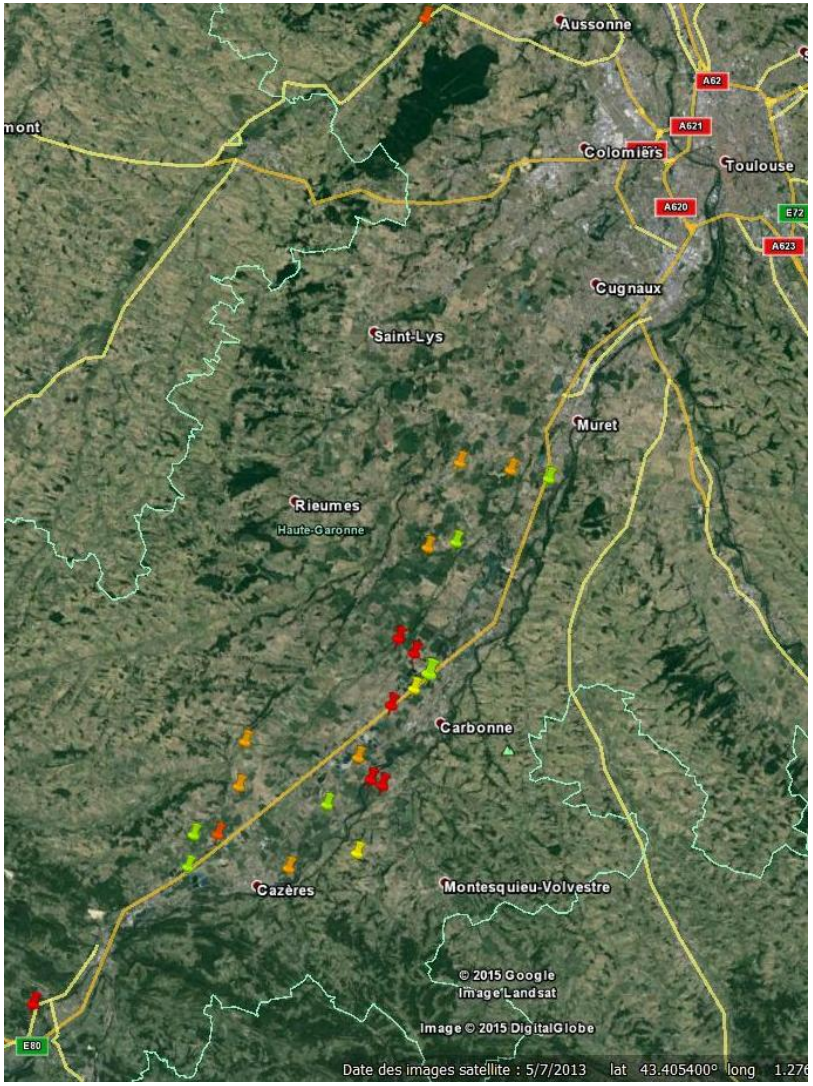
1. Study context

2. Methodology

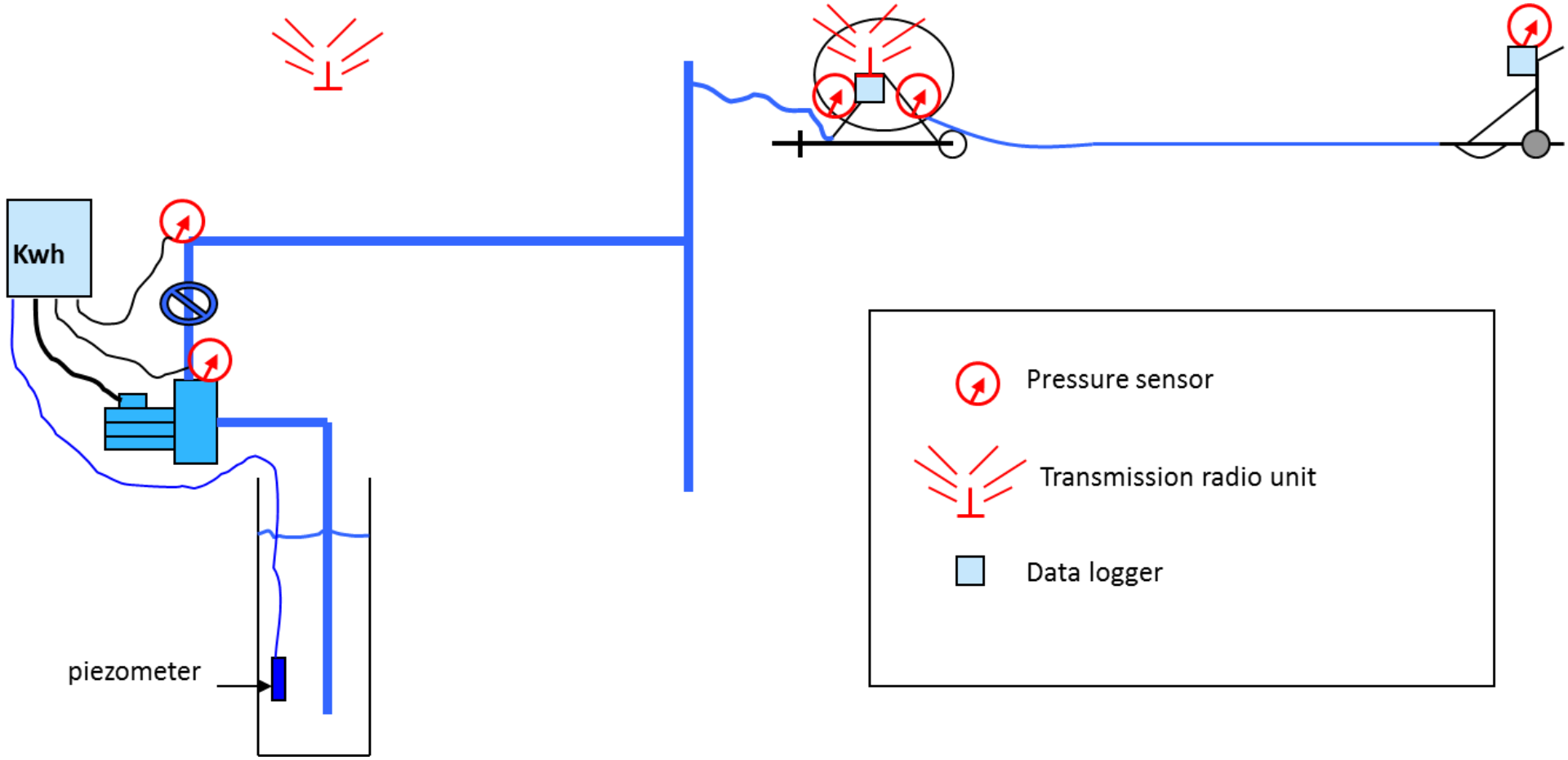
3. Results

Monitoring from 2012 to 2014

- **26 Farm irrigation systems monitored (some monitored during 3 years)**
  - **3 systems with measurement chain**
  - **23 systems monitored with manual measurements**



Mobile gun measurement chain

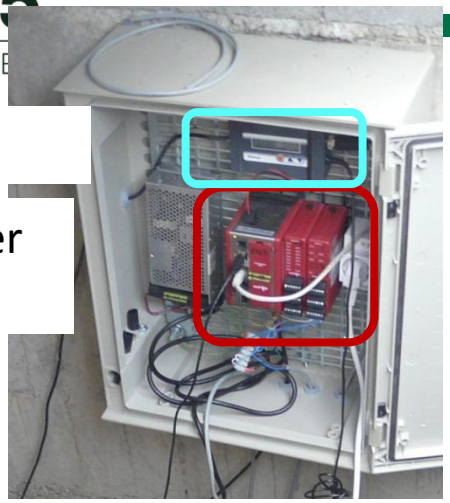


Mobile gun measurement chain

ICID2015
26th ERC & 66th IE

Organizer

Data logger
Redlion



Pressure
sensor

Data logger
transmitter on
battery, Diaxys

Datalogger unit on
battery ,Paratronic

Presentation outlines

1. Study context

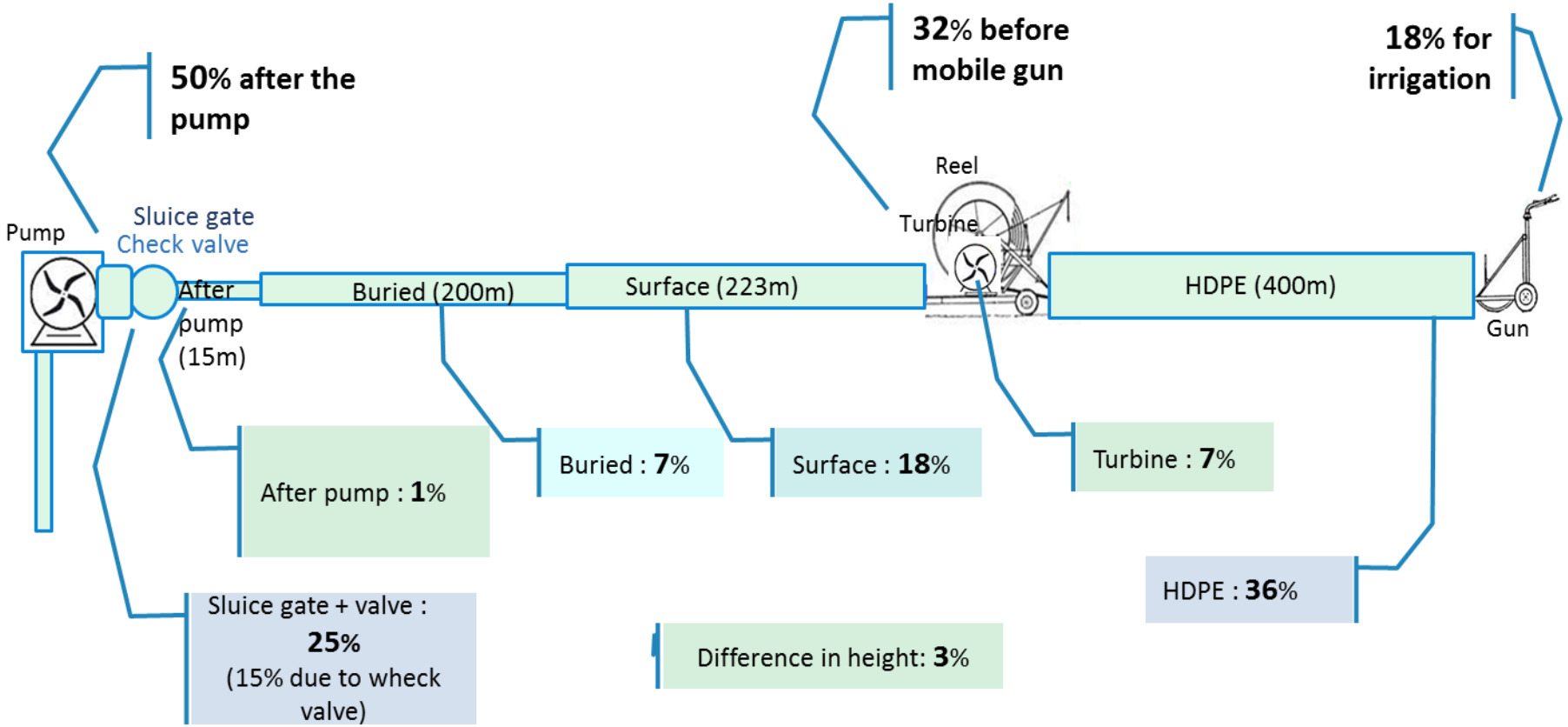
2. Methodology

3. Results

Measurement chain knowledge

For medial position

Reminder: Hydraulic power = Flow x pressure

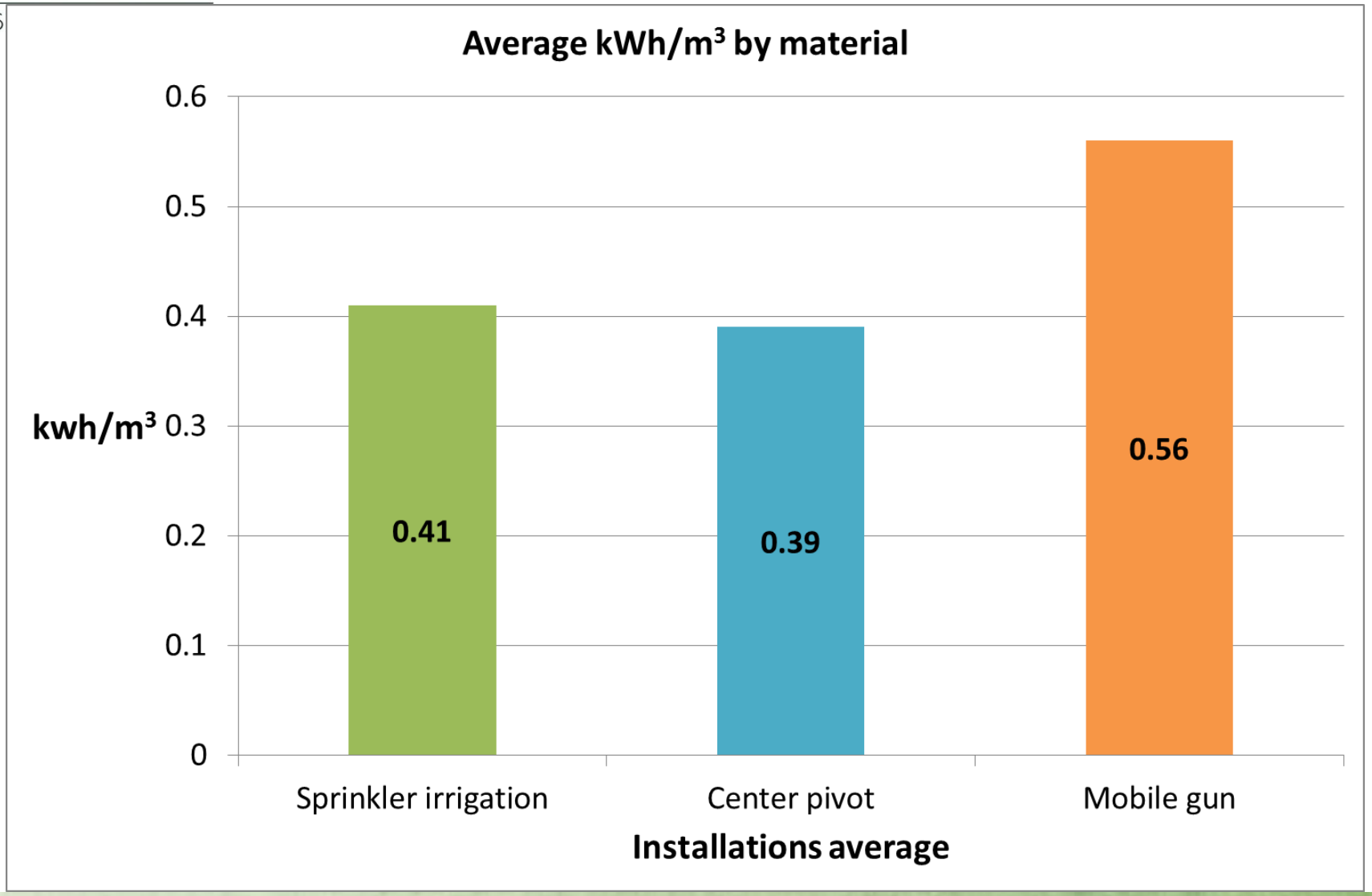


82% of electrical power are used to carry water to the gun, 18% for water field spreading

Definition of simple indicators

Installation	kWh/m^3 "water meter"	kWh/m3 "flow measure"	Difference between "water meter" and flow measure"	%	kWh/m3 "optimized"	Difference between "water meter" and "optimized"	%
1	0.40	0.38	0.02	5.9%	0.28	0.12	***30.5%***
2	0.61	0.63	-0.01	-2.2%	0.64	-0.03	NA
3	0.49	0.39	0.10	***21.3%***	0.35	0.14	***28.6%***
4	0.62	0.43	0.19	***30.9%***	0.36	0.26	***41.6%***
5	0.62	0.59	0.03	4.2%	0.54	0.08	12.7%
6	0.49	0.47	0.02	4.2%	0.41	0.08	***15.9%***

Kwh/m³ per material



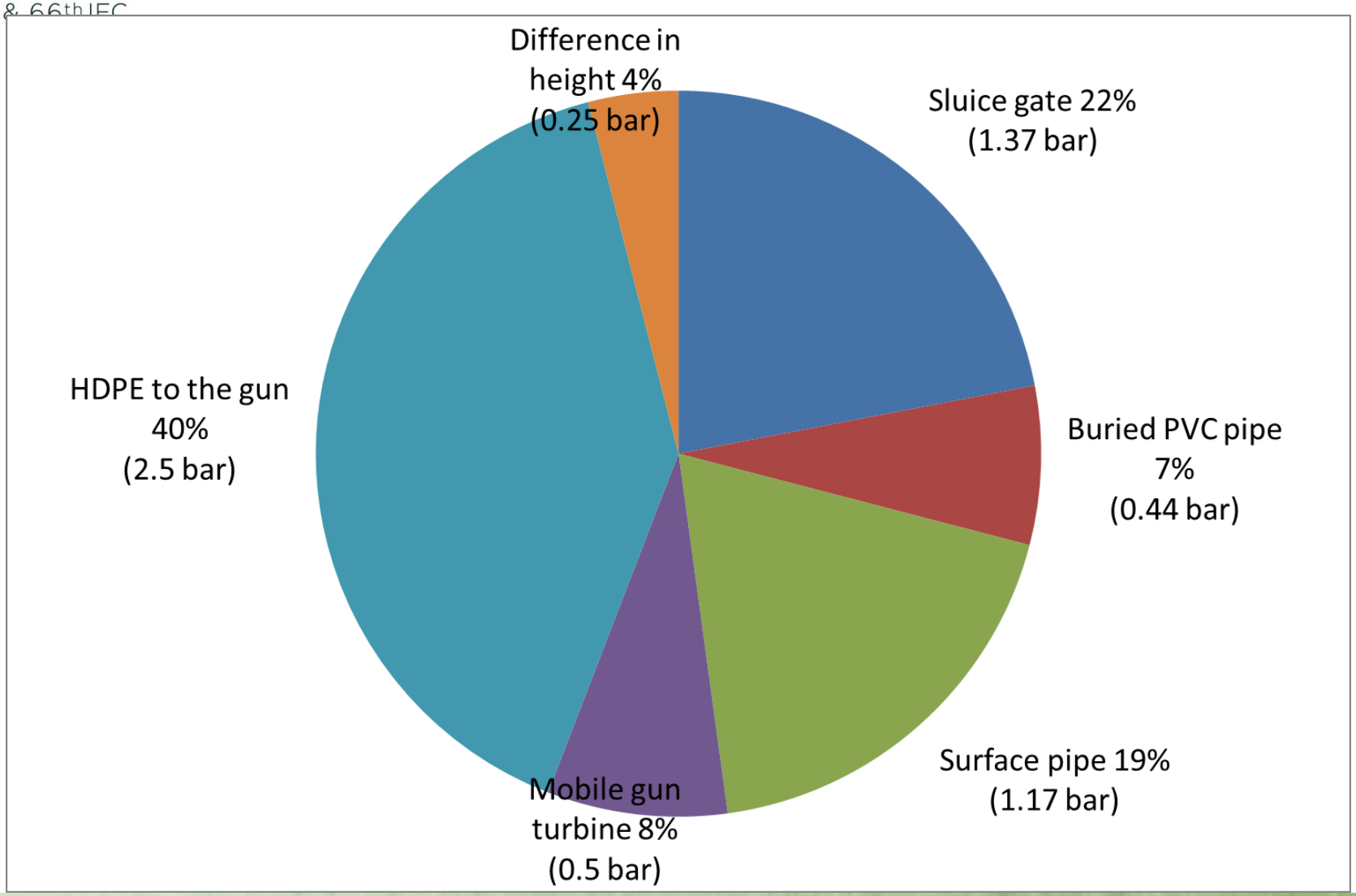
Pressure loss calculation

Hazen Williams formula

$$j = 10{,}68 * (QCwh)1{,}852 * D - 4{,}871$$

With j = pressure loss in water column meter/meter, Q = flow in m3/sec., Cwh = Hazen-Williams coefficient, D = diameter in meter.

Example of pressure loss in a studied installation

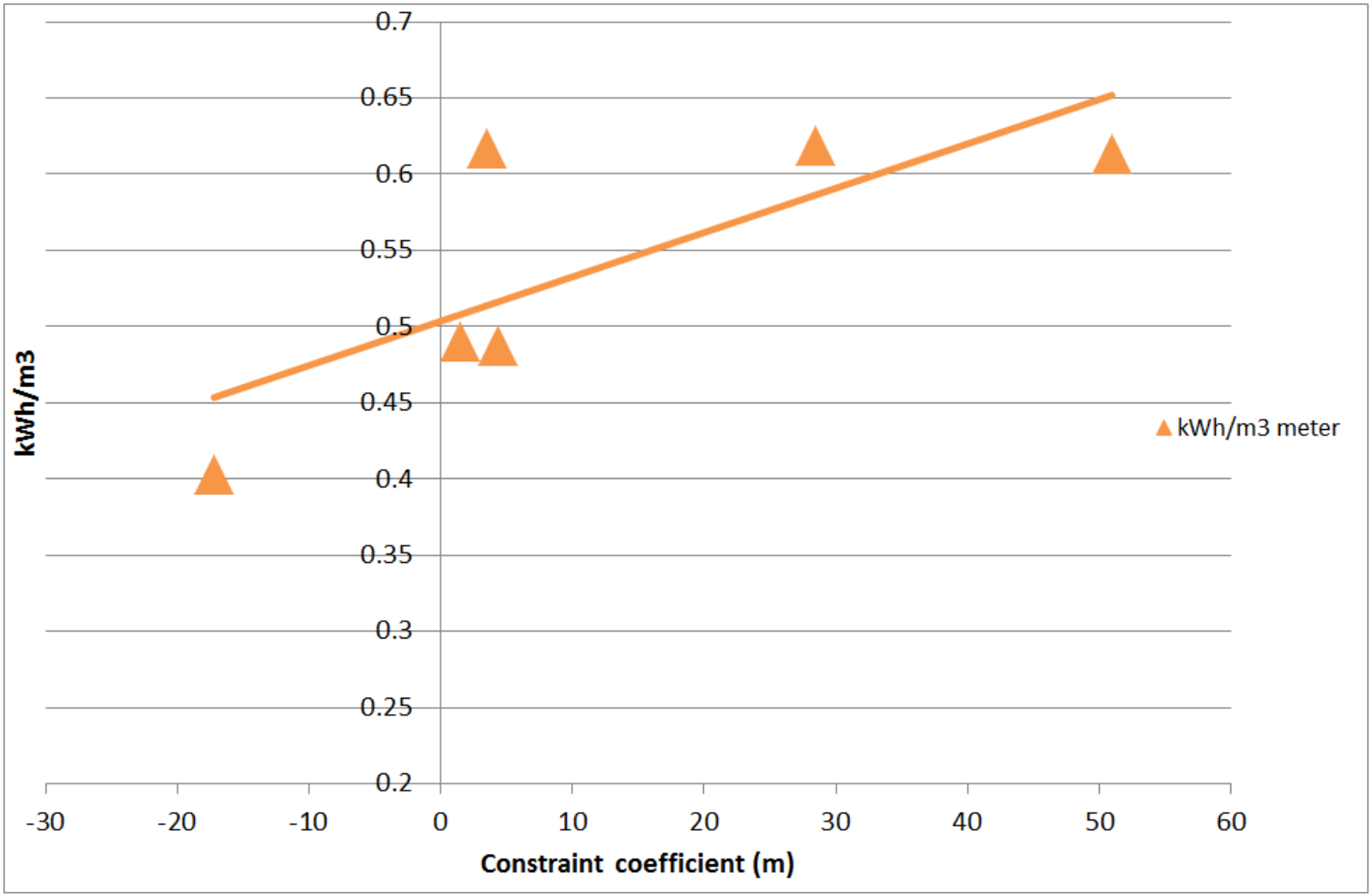


Comparison between installations

Definition of a constraint coefficient to consider topographic difference and distance to the water between farm

Constraint coeff. = length pump/ position in meter* pressure loss + water level difference

Relation between kWh/m³ "water meter" and constraint coefficient for mobile gun



Conclusion and prospect

- **Testing working diagnosis in 2015 on 15 new installations**
- **Building a database on energy in irrigation**
- **Improving our global knowledge about energy consumption in irrigation installations**

ICID2015
26th ERC & 66th IEC

Thanks for your attention

If you have any questions, feel free to ask