



Gioin – Energia e Tecnologia Tra futuro e sostenibilità

Ing. Carlo Corallo

WHITEQUBE



A NEW VIRTUAL UTILITY

OLIMPIA

Holding di Gruppo

ELETTROGREEN POWER

*Servizi e consulenza per la
gestione energetica*

GREEN VENTURE

*Investimenti strategici
nell'innovazione
tecnologica*

GREEN TRADE

*Trading di
energie rinnovabili*

KERBEROS

*Tecnologie wireless per
l'efficienza energetica*

INTECNO

Ingegneria per l'acqua

RULEX, Inc

*Piattaforma di cognitive
machine learning*

WHITEQUBE

*Piattaforma per la gestione
dei dati energetici*

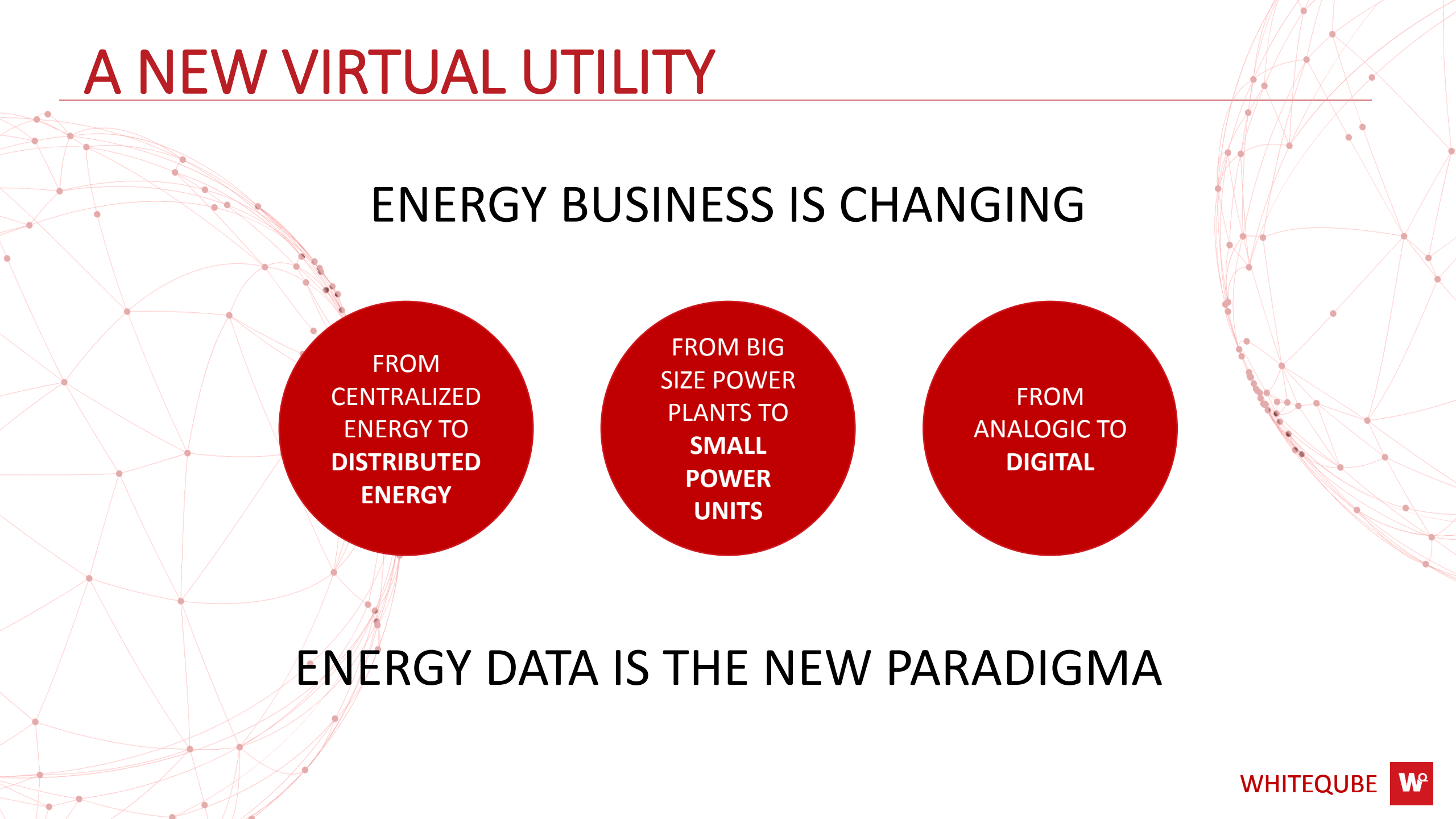
MAVEL

*Motori e azionamenti elettrici
ultra-performanti*

TPM

*Tecnologie hardware e
software per l'energia distribuita*

A NEW VIRTUAL UTILITY



ENERGY BUSINESS IS CHANGING

FROM
CENTRALIZED
ENERGY TO
DISTRIBUTED
ENERGY

FROM BIG
SIZE POWER
PLANTS TO
SMALL
POWER
UNITS

FROM
ANALOGIC TO
DIGITAL

ENERGY DATA IS THE NEW PARADIGMA

DATA TECHNOLOGIES



INTEGRATED DIGITAL SYSTEM



COGNITIVE MACHINE LEARNING

WHITEQUBE - INTEGRATED DIGITAL SYSTEM

E-M2M

IoE

Embedded Smart Control

Pluggable Smart Control

Delivery to market

Modular Pluggable Smart Control

HW



2012

2014

2016

2017

WEB
PLATFORM

PRIVATE CLOUD
PLATFORM

IOT ANALYTICS
PLATFORM

FOG COMPUTING
PLATFORM

SW



2012

2014

2016

2017

SMART HW PRODUCTION
Distributed Generation

DIGITAL SYSTEM AS A SERVICE
Integrated Platforms

SMART INTEGRATOR
Pay per Rule

BIZ
MODEL



2012

2015

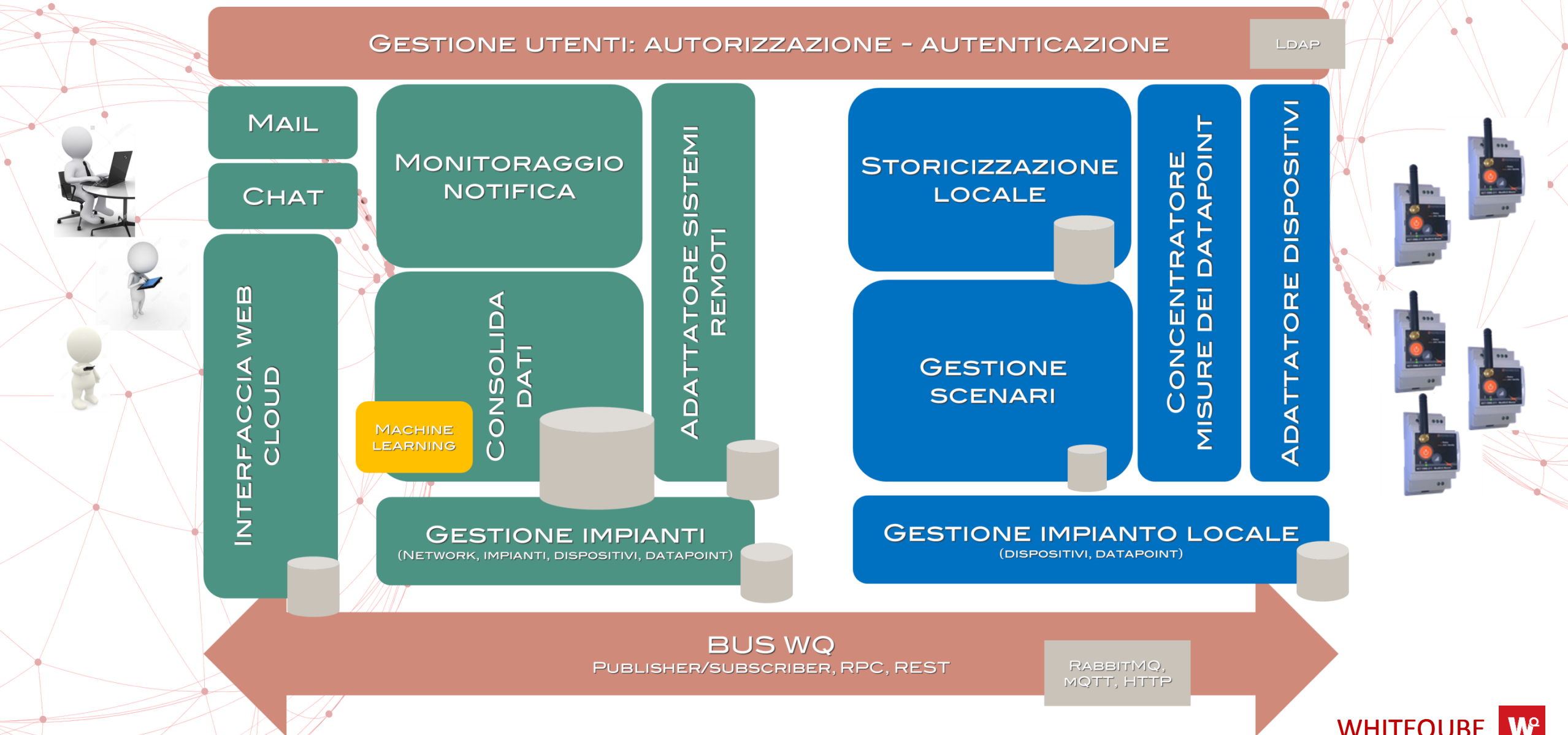
2017



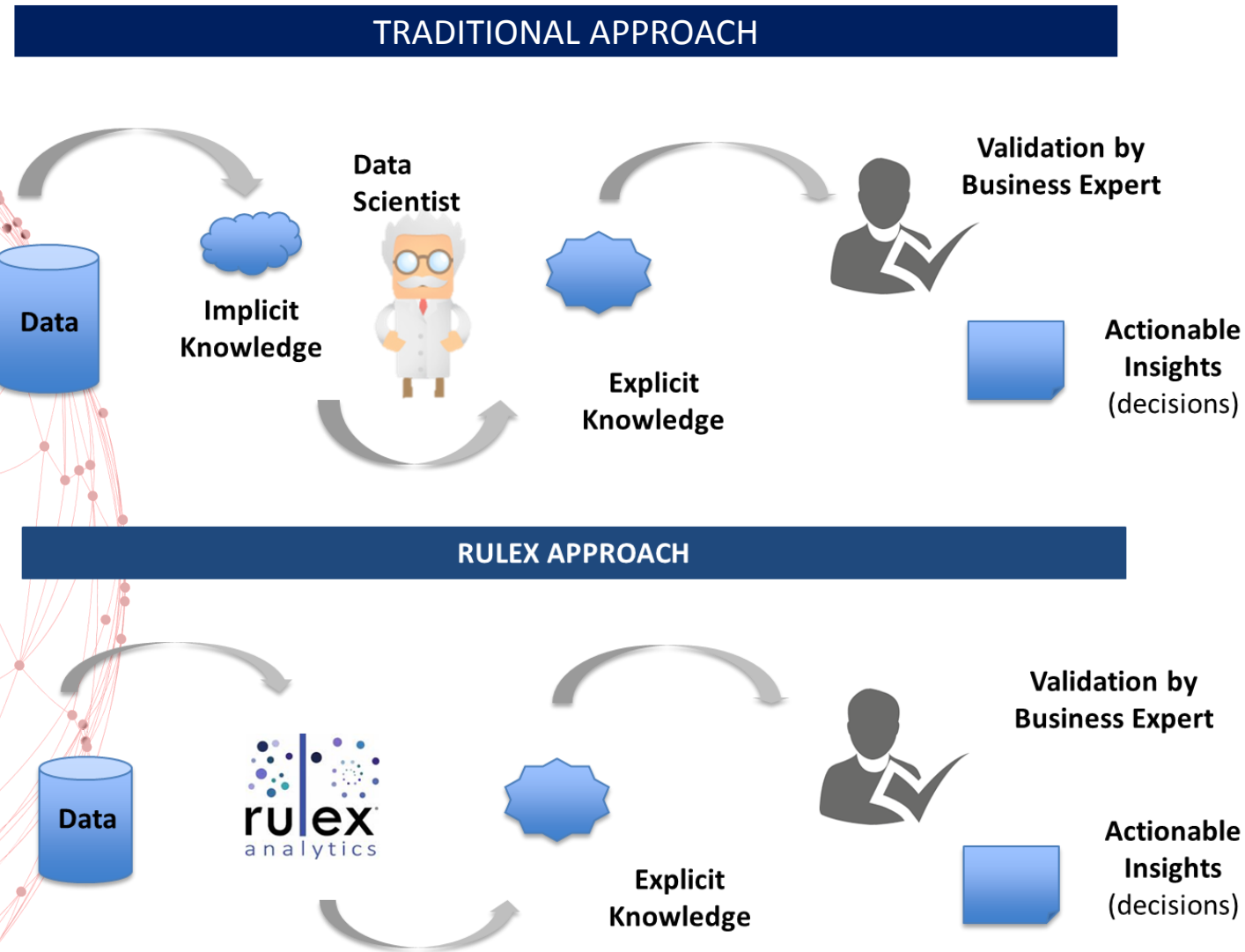
WHITEQUBE



WHITEQUBE – INTEGRATED DIGITAL SYSTEM



RULEX - COGNITIVE MACHINE LEARNING



«WHITE BOX» MODEL IS THE GAME CHANGER

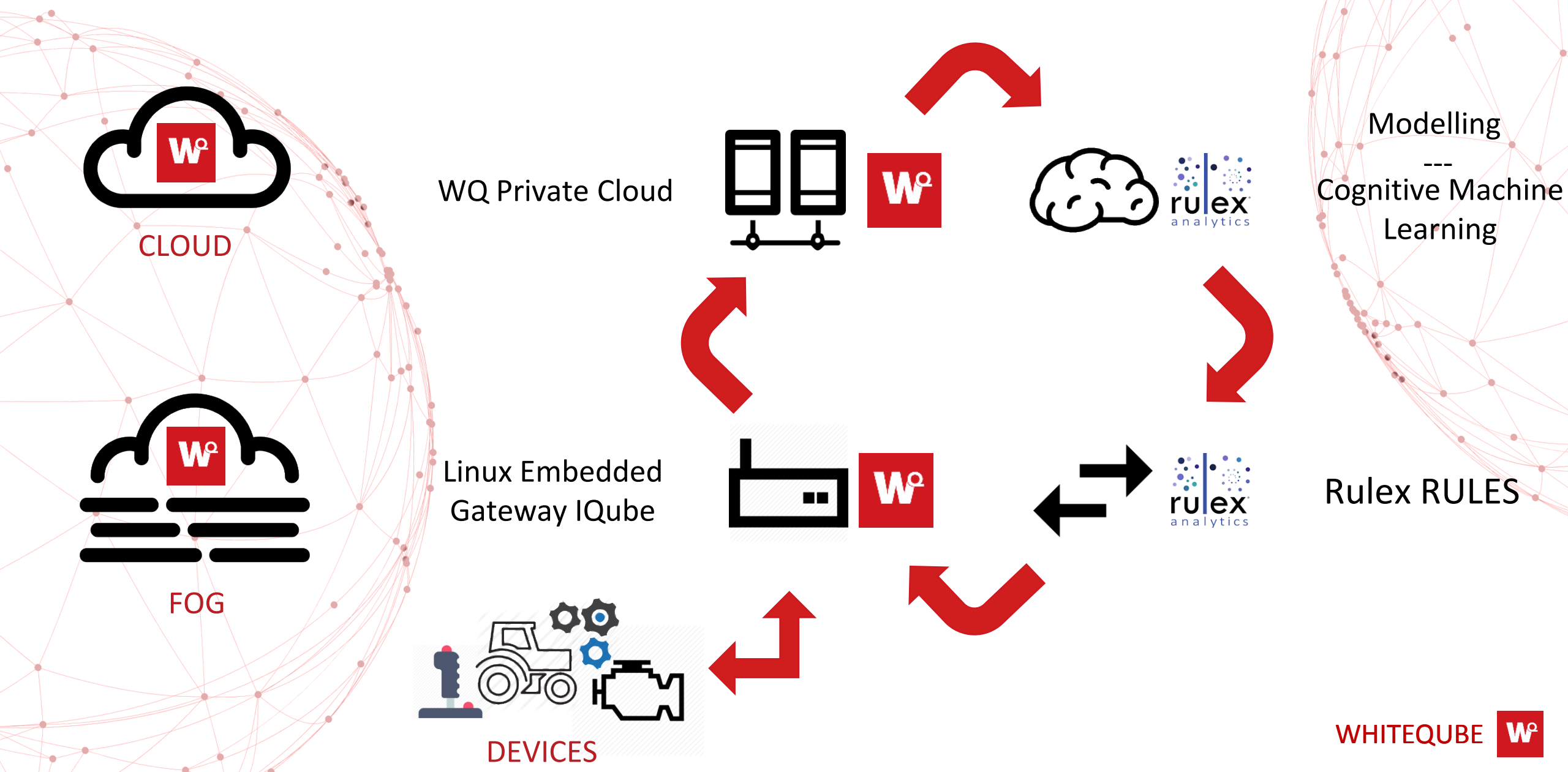
NEURAL NETWORK MODEL

$$\begin{aligned} f(\mathbf{x}) = & 0.293 \tanh(0.113 x_0 + 0.337 x_1 - 0.329 x_2 + 0.251 x_3 - 0.288 x_4 - 0.297 x_5 + 0.436 x_6 + \\ & + 0.166 x_7 - 0.184 x_8 + 0.219 x_9 + 0.483 x_{10} - 0.222 x_{11} + 0.173 x_{12} + 0.012 x_{13} + \\ & + 0.352 x_{14} + 0.259 x_{15} + 0.176 x_{16} + 0.345 x_{17} + 0.314 x_{18} + 0.177 x_{19} - 0.329 x_{20} + \\ & - 0.363 x_{21} + 0.216 x_{22} - 0.148 x_{23} - 0.043 x_{24} + 0.316 x_{25} - 0.068 x_{26} - 0.421 x_{27(0)} + \\ & + 0.15 x_{27(1)} - 0.289 x_{27(2)} - 0.241 x_{28} + 0.16 x_{29} + 0.199 x_{30} - 0.111 x_{31} - 0.164 x_{32} + \\ & + 0.117 x_{33} + 0.466 x_{34} + 0.457 x_{35} + 0.133 x_{36} + 0.331 x_{37} - 0.362 x_{38} - 0.43 x_{39} + \\ & - 0.491 x_{40} - 0.155 x_{41} + 0.371 x_{42} - 0.05 x_{43} - 0.177 x_{44} - 0.044 x_{45} + 0.225 x_{46} + \\ & + 0.328 x_{47} - 0.118 x_{48} - 0.3) + \\ & - 1.934 \tanh(-0.233 x_0 + 0.174 x_1 - 0.252 x_2 - 0.501 x_3 - 0.125 x_4 + 0.311 x_5 - 0.573 x_6 + \\ & - 0.299 x_7 + 1.123 x_8 + 0.318 x_9 - 1.169 x_{10} + 0.105 x_{11} - 0.429 x_{12} - 0.075 x_{13} + \\ & - 0.143 x_{14} + 0.146 x_{15} - 0.531 x_{16} + 0.077 x_{17} - 0.133 x_{18} - 0.122 x_{19} + 0.162 x_{20} + \\ & - 0.08 x_{21} - 0.496 x_{22} - 0.21 x_{23} - 0.113 x_{24} + 0.485 x_{25} + 0.575 x_{26} - 0.126 x_{27(0)} + \\ & + 0.135 x_{27(1)} + 0.022 x_{27(2)} - 0.352 x_{28} - 0.693 x_{29} + 0.379 x_{30} + 0.409 x_{31} - 0.109 x_{32} + \\ & + 0.228 x_{33} + 0.292 x_{34} + 0.161 x_{35} - 0.086 x_{36} - 0.3 x_{37} - 0.089 x_{38} + 0.163 x_{39} + \\ & - 0.074 x_{40} + 0.31 x_{41} - 0.849 x_{42} + 0.14 x_{43} + 0.754 x_{44} + 0.291 x_{45} - 0.533 x_{46} + 0.273 x_{47} + \\ & - 0.285 x_{48} - 0.286) + 0.252 \end{aligned}$$

RULEX MODEL

1. IF (White alone, percent, 2014 $\leq$ 71.100) **THEN party = Democrat**
2. IF (High school graduate or higher, percent of persons age 25+, 2009-2013 $>$ 90.450) **THEN party = Democrat**
1. IF (High school graduate or higher, percent of persons age 25+, 2009-2013 $\leq$ 88.650 AND White alone, not Hispanic or Latino, percent, 2014 $>$ 73.950) **THEN party = Republican**
2. IF (Persons per household, 2009-2013 $>$ 2.615 AND White alone, percent, 2014 $>$ 62.300 AND White alone, not Hispanic or Latino, percent, 2014 $>$ 32.500) **THEN party = Republican**
3. IF (Persons 65 years and over, percent, 2014 $>$ 19.850 AND High school graduate or higher, percent of persons age 25+, 2009-2013 $\leq$ 90.850 AND White alone, not Hispanic or Latino, percent, 2014 $>$ 57.350) **THEN party = Republican**
4. IF (724908 $<$ Manufacturers shipments, 2007 (\$1,000) $\leq$ 16640803 AND Asian alone, percent, 2014 $\leq$ 6.350 AND White alone, not Hispanic or Latino, percent, 2014 $>$ 63.000) **THEN party = Republican**
5. IF (Private nonfarm establishments, 2013 $\leq$ 289 AND Population per square mile, 2010 $>$ 14.550 AND 56.150 $<$ White alone, percent, 2014 $\leq$ 98.750) **THEN party = Republican**

MONETIZE YOUR ENERGY DATA



MONETIZE YOUR ENERGY DATA – USE CASE

City water network

Constraint:

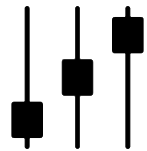


Preserve network pressure

Target:



Optimize pumps energy consumption

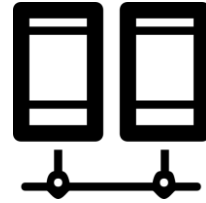
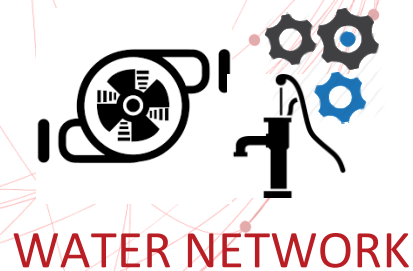


Switching pumps RULES

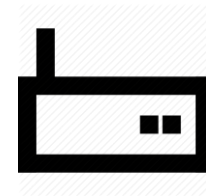


MONETIZE YOUR ENERGY DATA - PROCESS

Realtime data
collection



Generate pumps
RULES



Deliver RULES in the
field

MONETIZE YOUR ENERGY DATA - RULESET

IF (time <= 20:40:30.000 AND Npompe(A01) > 0 AND Npompe(A04) > 2 AND Npompe(C03) > 0 AND Npompe(F01) > 0 AND Npompe(G01) > 0) THEN System_Status (after 15 min) = «Good efficiency»

IF (time <= 06:28:30.000 AND Npompe(I01) <= 0) THEN System_Status (after 15 min) = «Violation of pressure constraints»

IF (time > 21:59:30.000 AND Npompe(C05) > 0) THEN System_Status (after 15 min) = «Bad efficiency»

Covering statistics (%)

49.7513983841, 0.341827221877, 0.963331261653, 7.98632691112, 0.124300807955, 3.0453697949, 0.559353635799

48.951048951, 0.32634032634, 1.02564102564

20.5736894164, 69.9802176063, 0.0494559841741

Error statistics (%)

3.83969282457, 1.05591552676, 0.431965442765, 0.527957763379, 0.239980801536, 1.39188864891, 0.239980801536

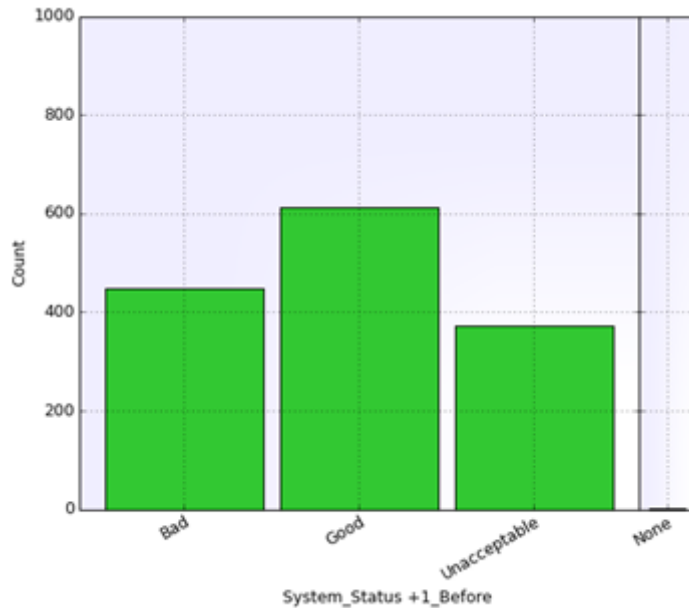
3.7213740458, 0.916030534351, 0.209923664122

3.93436509416, 87.6934551557, 0.111877680403

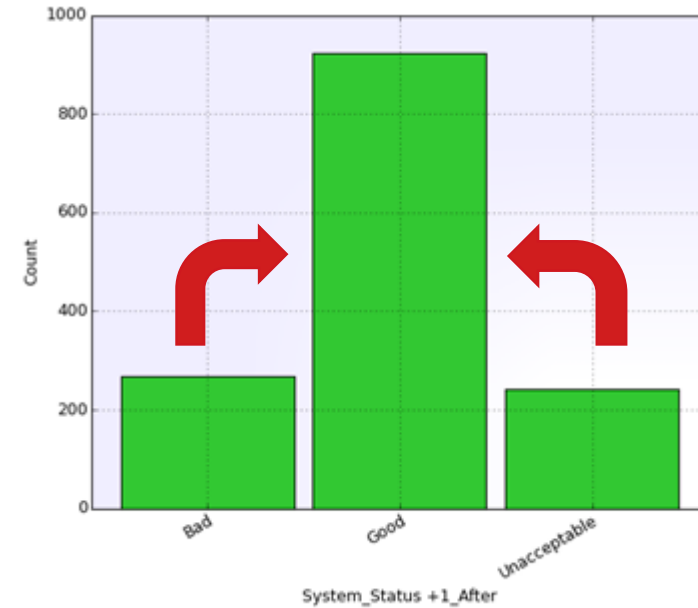
After defining pressure constraints and energy efficiency criteria, Rulex automatically generated 146 rules.

MONETIZE YOUR ENERGY DATA - RESULTS

Before



After



Save **8.500 €/month**
(6% TOTAL COST)



Grazie per l'attenzione

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WHITECUBE 