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New Water Operation Technique

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KAHRAMAA المؤسسة العامة القطرية للكهرباء والماء
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NEW WATER OPERATION TECHNIQUE

"SMART PUMP CONTROL"

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Head-Water Operation Section
Water- Transmission & Distribution Dept
Water Network Affairs

Contents:

Water Supply System

Water Desalination Plant

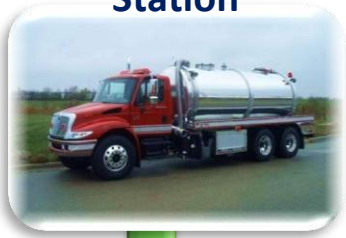
Water Transmission Line

Water Reservoirs

Pumping Station

Water Towers

Tankers Filling Station

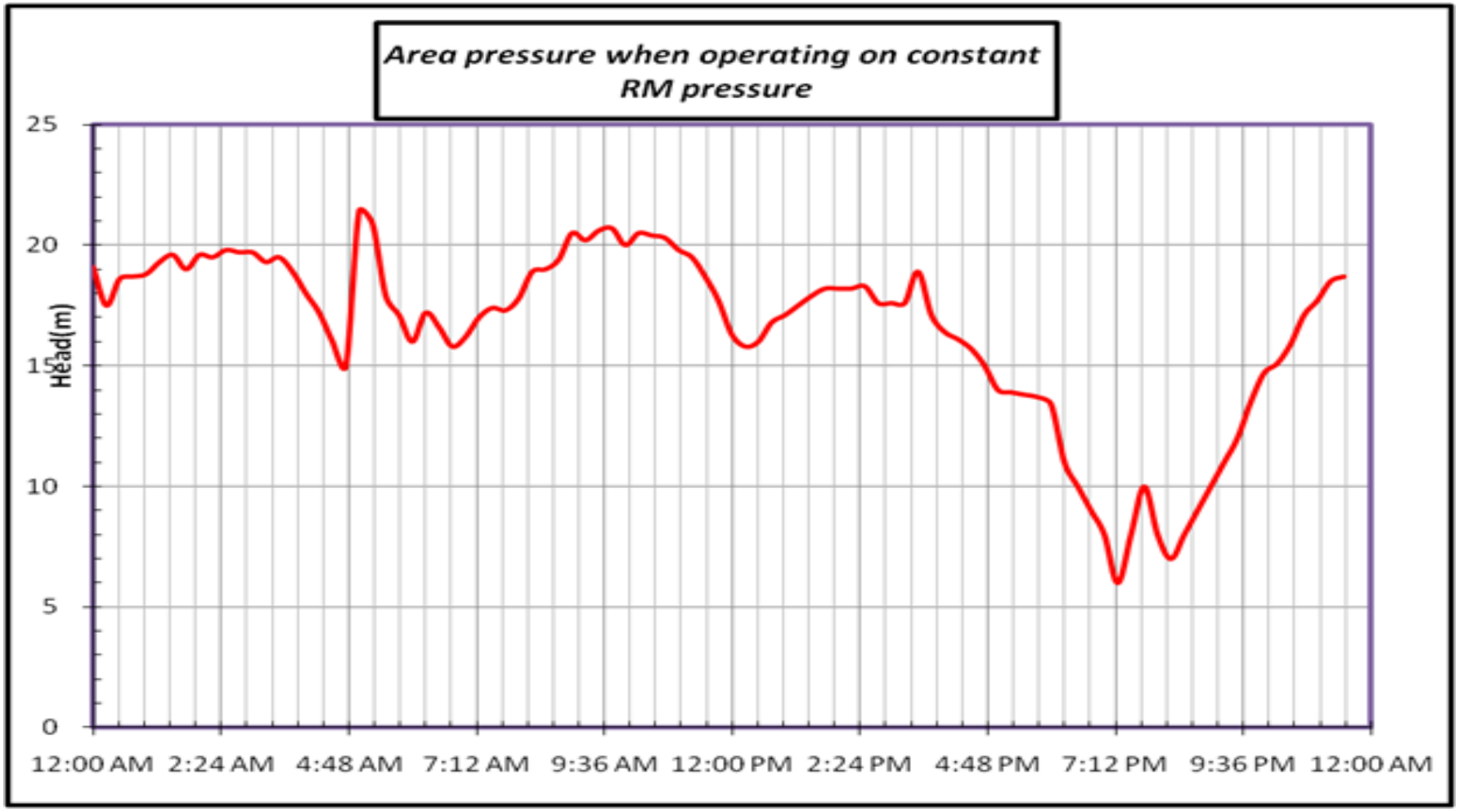


Customers

Water Distribution Network

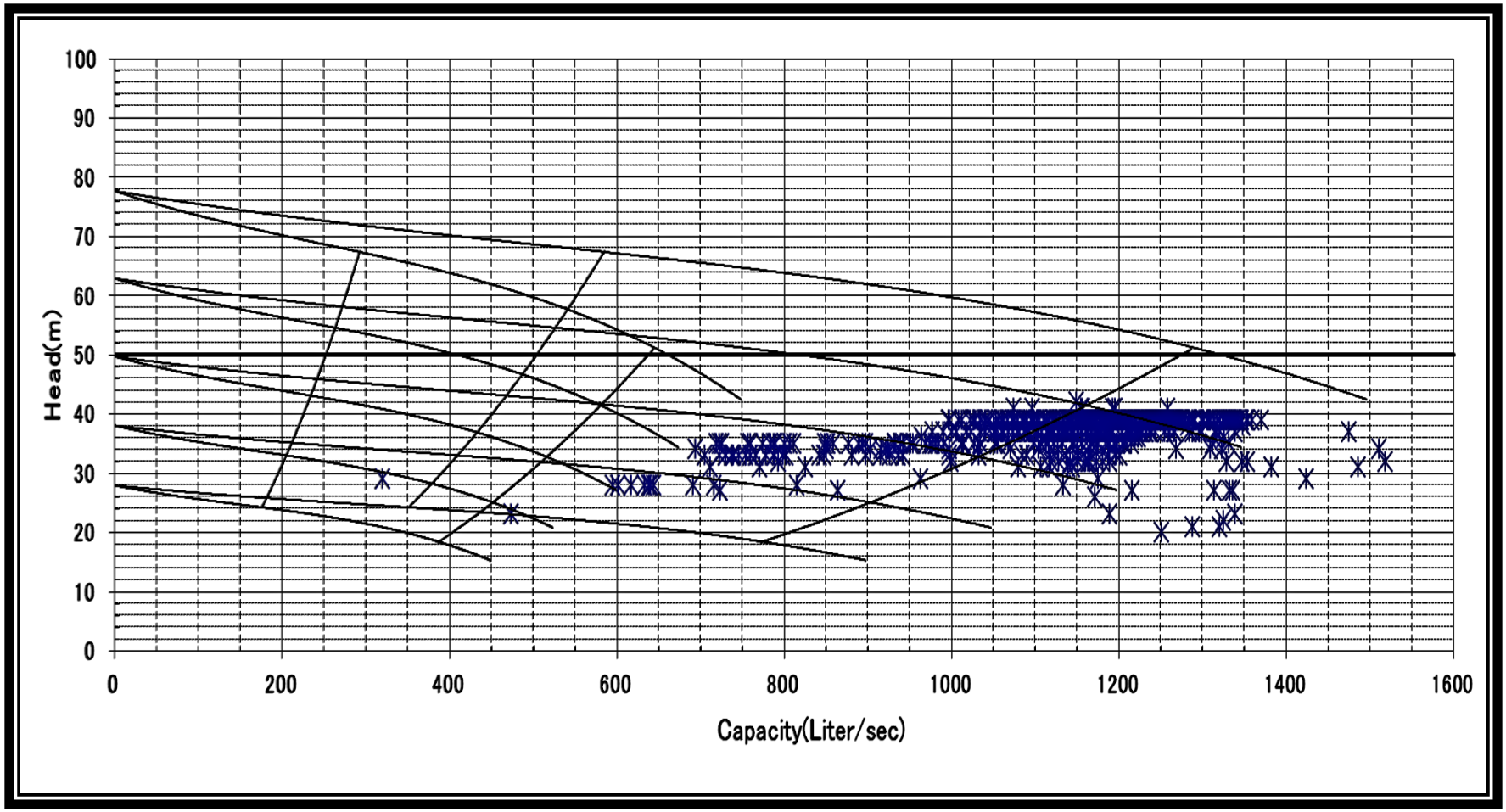
Fixed Pressure Operation

Problems faced: 1) High Fluctuations in Residual Pressure in the Network



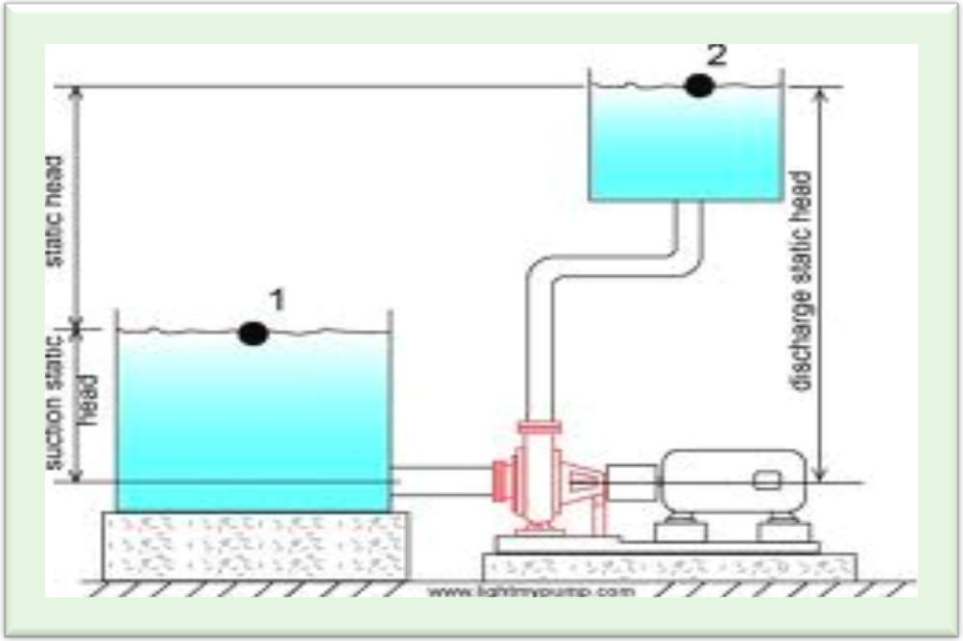
Fixed Pressure Operation

Problems faced: 2) Pump Operations Beyond Recommended Ranges

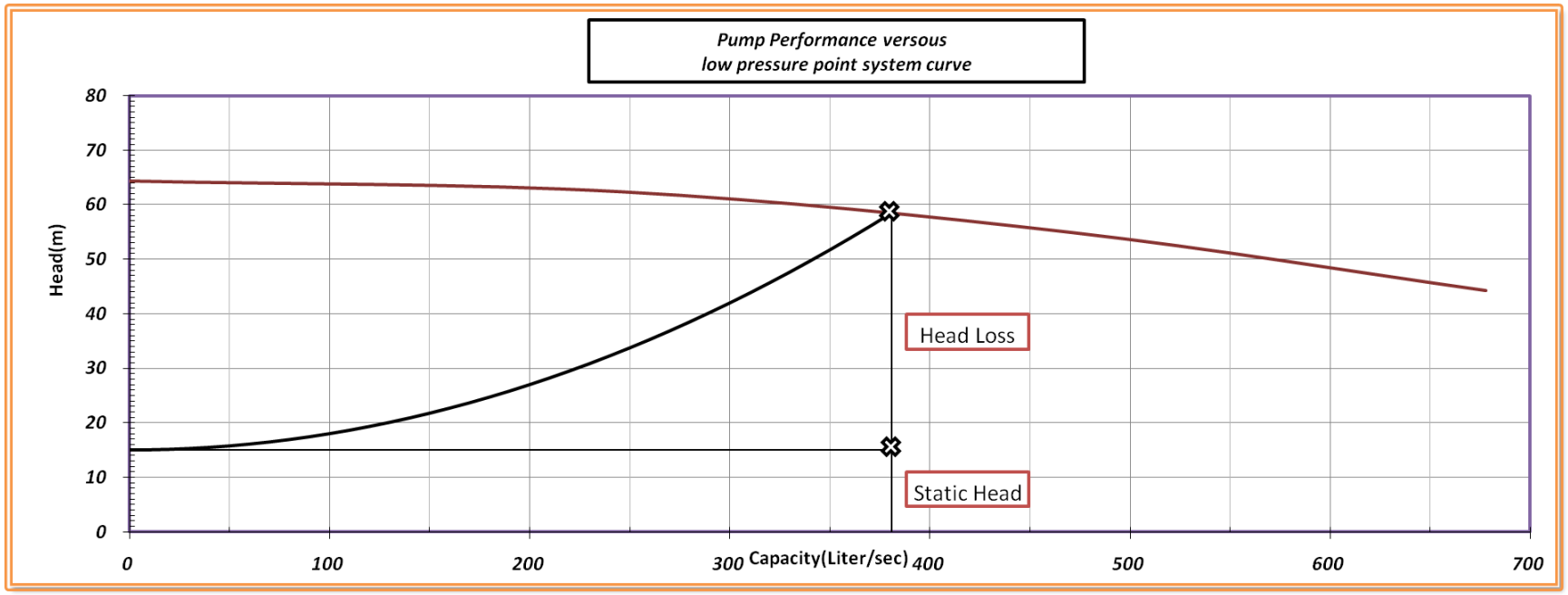


Challenges to Maintain Stable Residual Pressure @ Critical Point in the Network

- It's well known that to pump flow from Point –1 to Point-2 you need to overcome the static head in addition to losses in the line
- H=Static Head +Head Loss
- $Hlf= Kf * V^2/2g = Kf * Q^2/2g*A^2$, $Hlp= f*L*V^2/2g*D= f*L*Q^2/2g*D*A^2$
- Head Loss is function of Q^2
- $H=Constant1+Constant2\ xQ^2$



System Curve



H=Static Head +Frictional Head Loss

$H=Constant1+Constant2\ xQ^2$

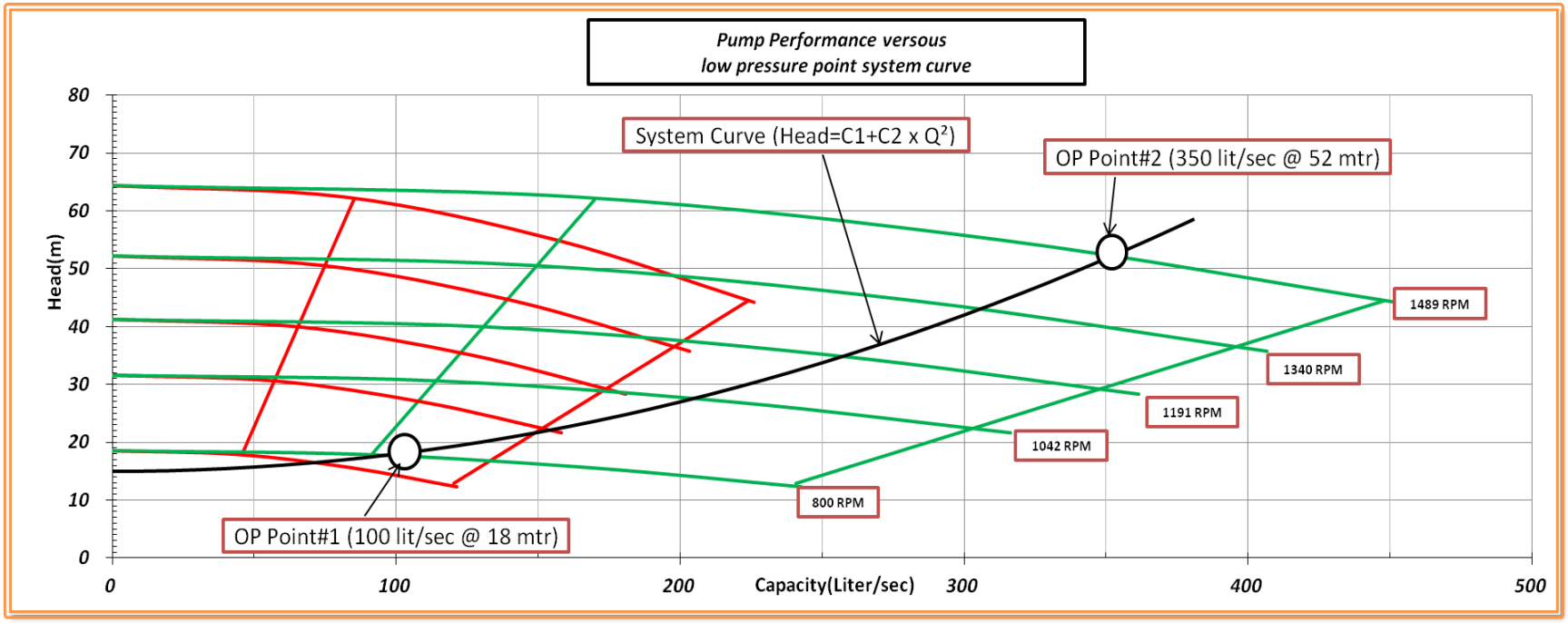
Pumping To Complex network

For complex network we have infinite number of system curve and infinite number of pump performance curves.

To define the operation point we need to maintain the pressure in the network highest point

In Old Method before SCADA we were following the system curve by measuring the area pressure to increase / decrease the pump pressure <u>but only in the time we measure not all day</u>.

Simple Calculation for system Head constants C1 & C2



$H=C1+C2xQ^2$

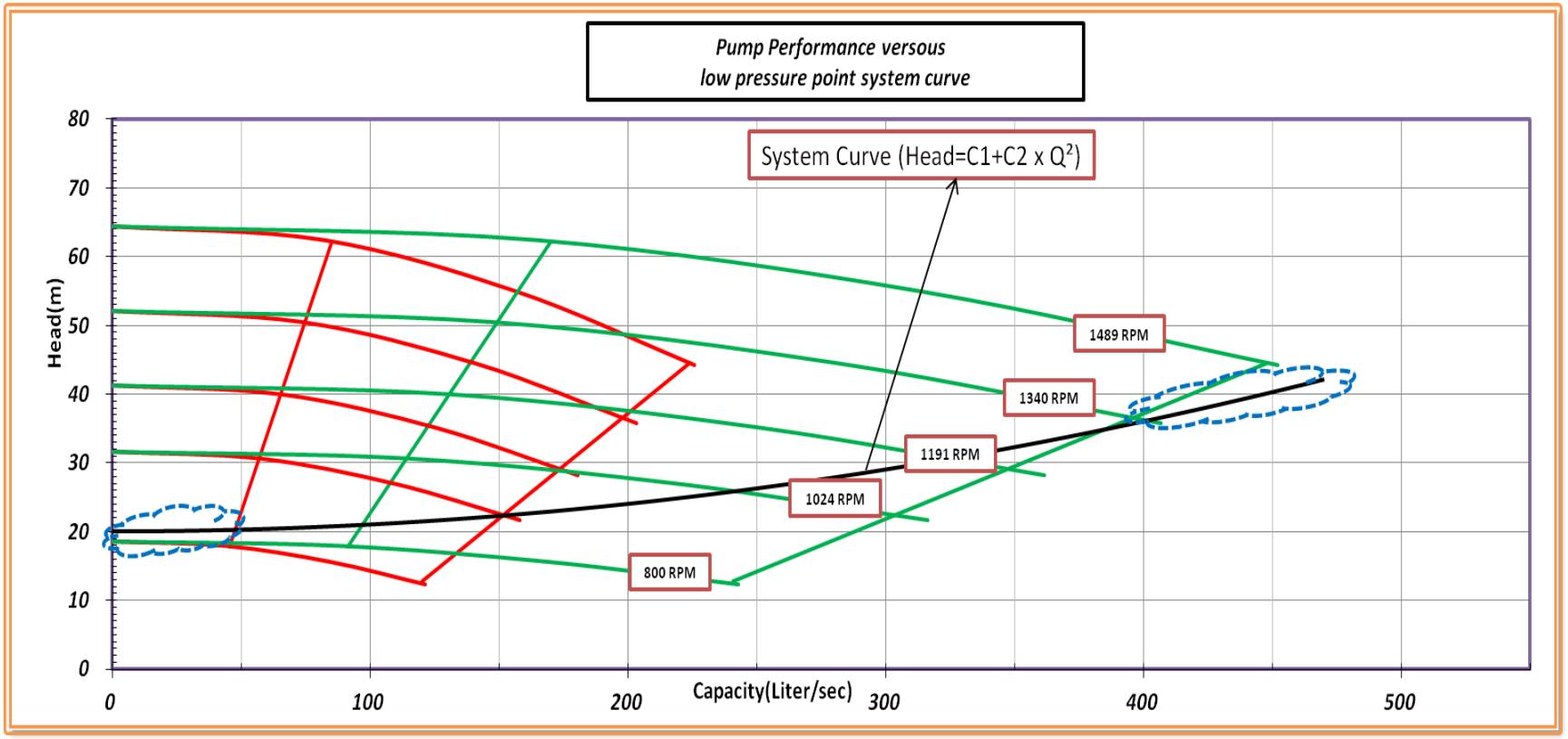
$18=C1+C2x(0.1)^2$

$52=C1+C2x(0.35)^2$

C1=15 & C2=302.2

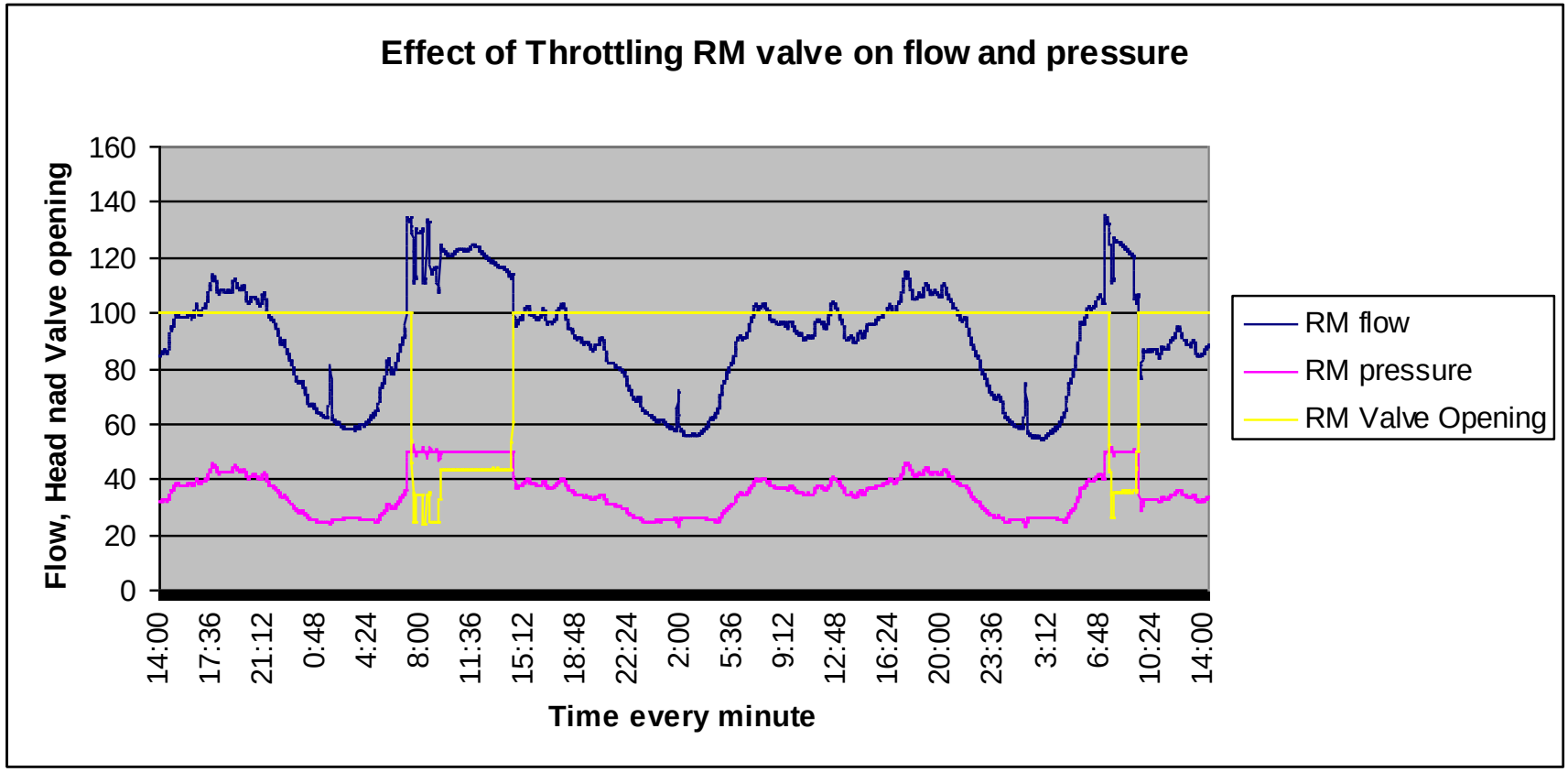
$H=15+302.2xQ^2$

How To Operate Pump within Recommended Operation Range?

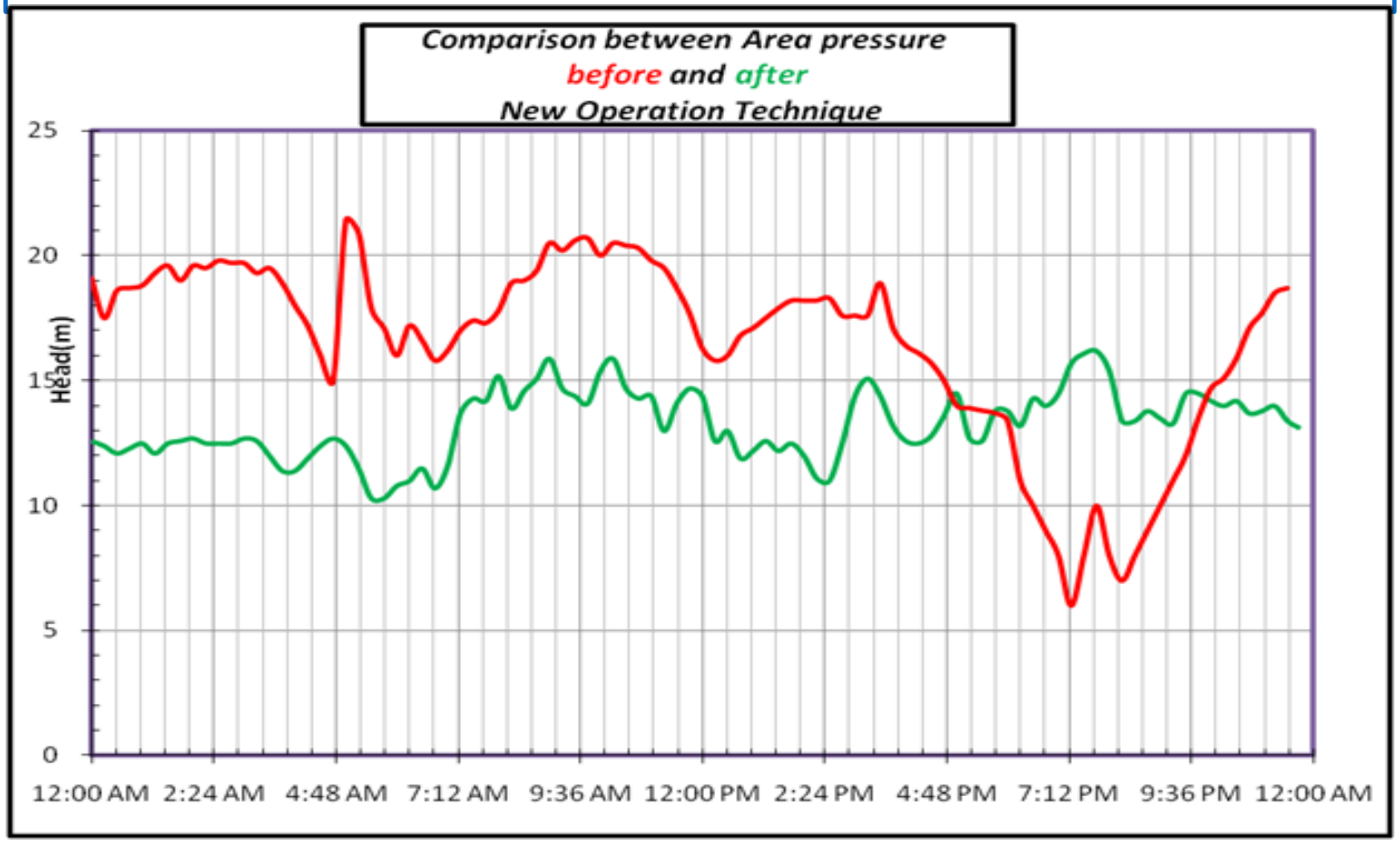


Pump Performance curve for two Duty pumps operation

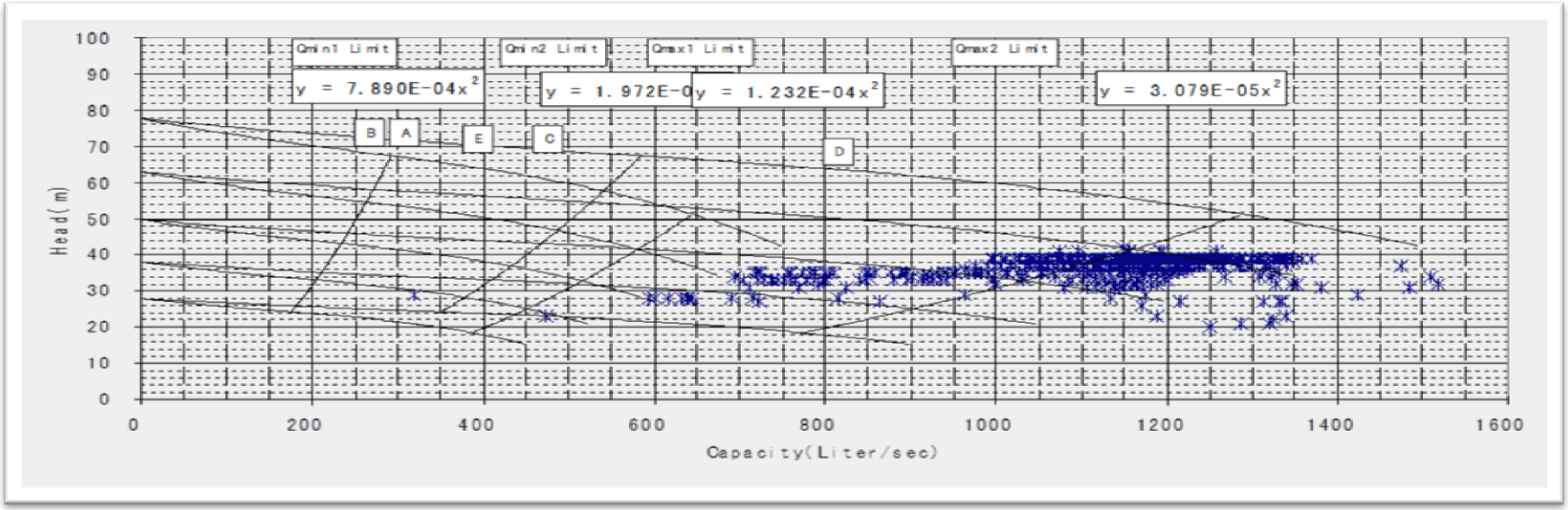
Actual Flow pressure trend Shows Throttling valve operation

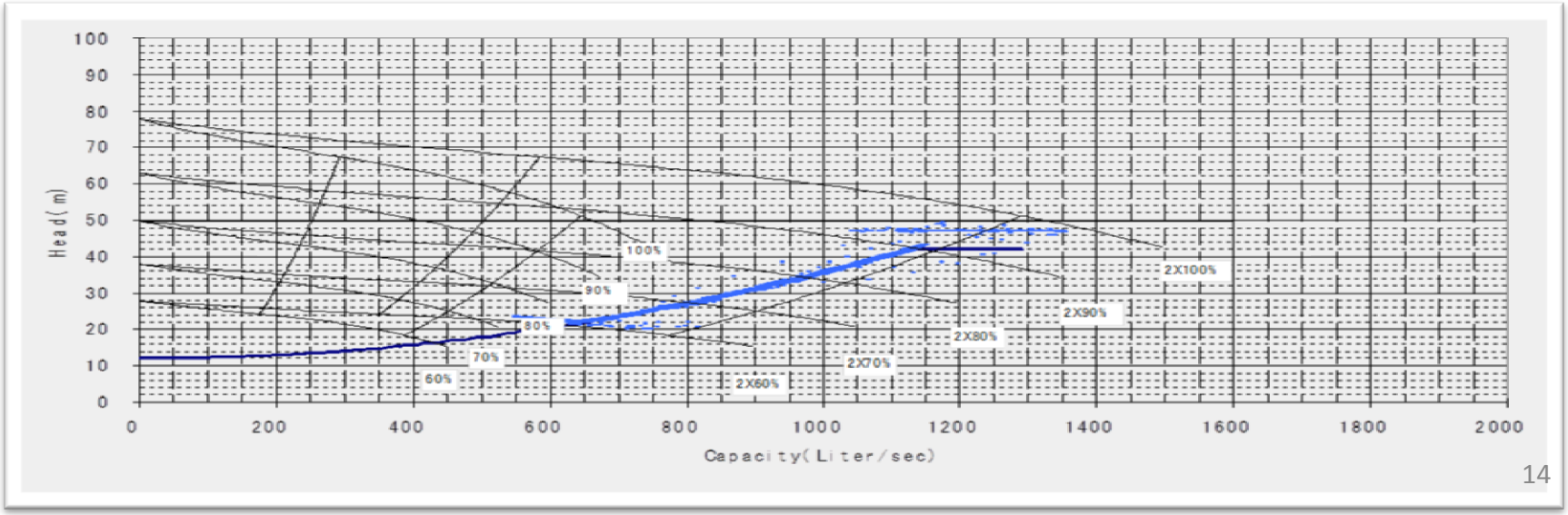


Comparison of Residual Pressure before and after Applying Smart Pump Control



Two Graphs showing Operating points before and after applying New Technique





Benefits Achieved by Applying Smart Pump Control

1. Stable residual pressure within close range
2. Minimize human interference and shorten response time
3. Improvement in system response while handling shutdown works
4. Energy conservation by:
    a) Operating the pump always at high efficiency zone
    b) Optimizing RM pressure as per actual requirement
5. Increase in useful life for:
    a) pumps – by operating within recommended operation range
    b) pipelines – by controlling pressure fluctuation and unnecessary stresses in the network
6. Reduce breakdowns in the network
7. Eliminate additional requirement for pressure control equipments in the network

Thanks & Regards