Smart Energy and Water Meter (SEWM)
An Innovative Approach Towards Groundwater Monitoring and Management
The Case of Khorasan Razavi Province, Iran

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An Innovative Solution For Sustainable Groundwater Resource Management: The Case Of Khorasan-Razavi Province, Iran

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Groundwater Resources (GWR) in the World and the essentiality of Efficient/Sustainable utilization

As the 2nd largest fresh water resources in the world (1st: glaciers)

GWRs: Global Economy and the Environment. One third of World Population depends on GWR. 70% of GWR is utilized by Agriculture Sector (World Bank statistics published in 2014).

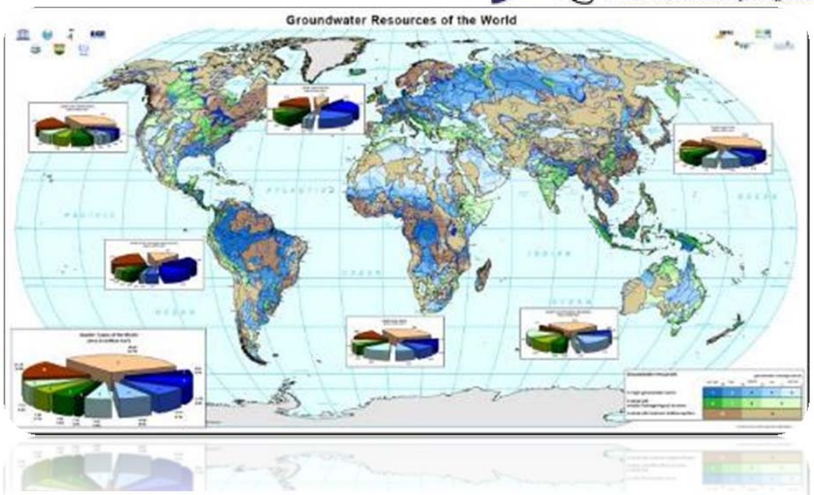
Recent decline in surface Water Resources >> **Excessive Stress** on GWR to meet **demands** of various sectors.

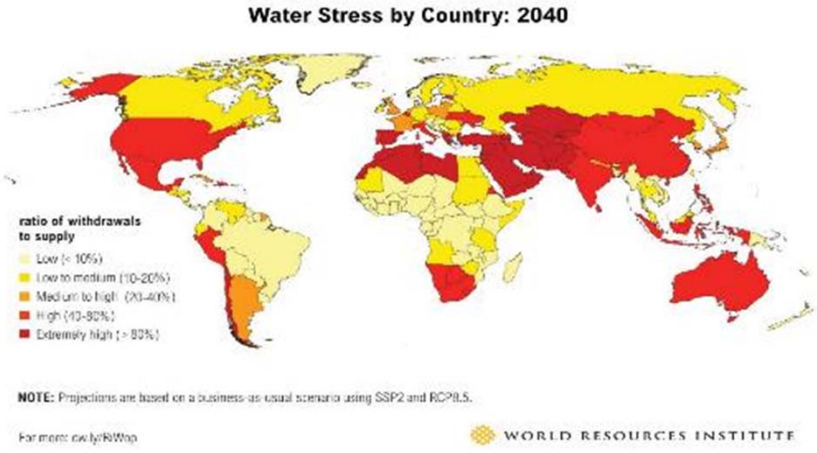
>> GW is mined in different parts of the world to continue irrigated agriculture. Global GWR shortage is estimated at about 750 to 800 BCM (Billion Cubic Meter) / per year.

Consequently, Over pumping, depletion of groundwater resources, and land subsidence are widespread and by groundwater tables decline this resource may not be as readily available.

Towards Sustainability: Time to Recharge Aquifer

Methods & Equipment + Monitoring
>> Avoid Over-pumping <<





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Groundwater Resources in Iran: Demand More Than Supply and Unsustainable Utilization

Dry Country: %10 receives enough rainfall to meet demand side

- Remainder: Heavily reliant on non-surface Water
- 60% Water Demand: From Aquifers

Huge Increase in Demand for Water:

- Population growth + Economic Development + A Boom in Industry and Farming

>>> Very High Groundwater Pumping Rates: Agriculture Sector

UNSUSTAINABLE GWR Utilization >>>> the Slow-filling Aquifers have not been able to keep up

Average Over Pumping : 6 BCM / Yearly

In 79 plains located in the central plateau of Iran, Overall Water Level Depletion more than 2 meters / Year

Source: The Ministry of Energy and Water, Iran

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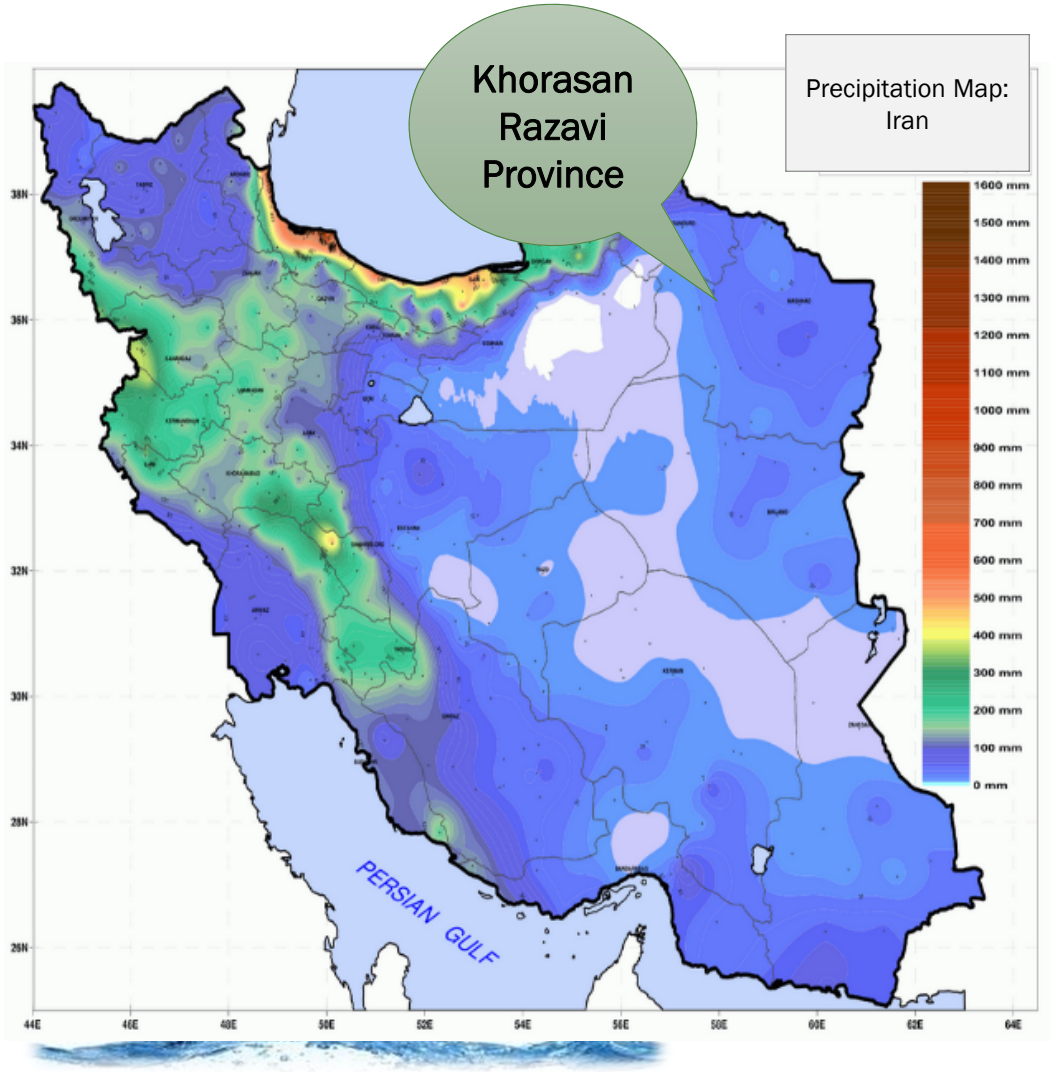

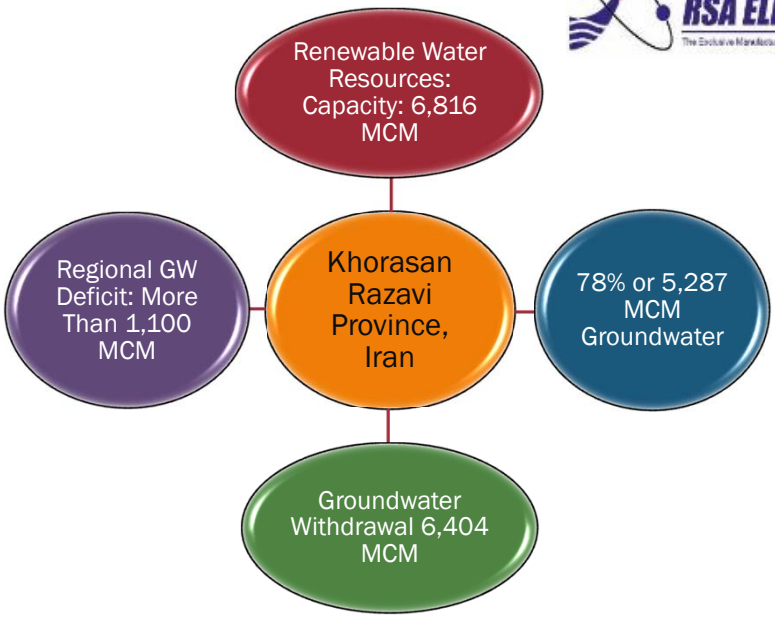

Breakdown of Groundwater Resources and Annual Withdrawal in Khorasan Razai, Iran

Source	Count	Volume (MCM)
Well	24,624	5,475
Spring	6,370	350
Qanat	6,794	579
Total	37,788	6,404

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Groundwater Monitoring and Management in Iran: VERY URGENT

- Need for Appropriate Regulatory Policies, Actions
- Outreach programs to mitigate & Reverse this Unsustainable Trend
- Implementation of reliable monitoring initiatives is key for meeting the data needs for better groundwater resource management.

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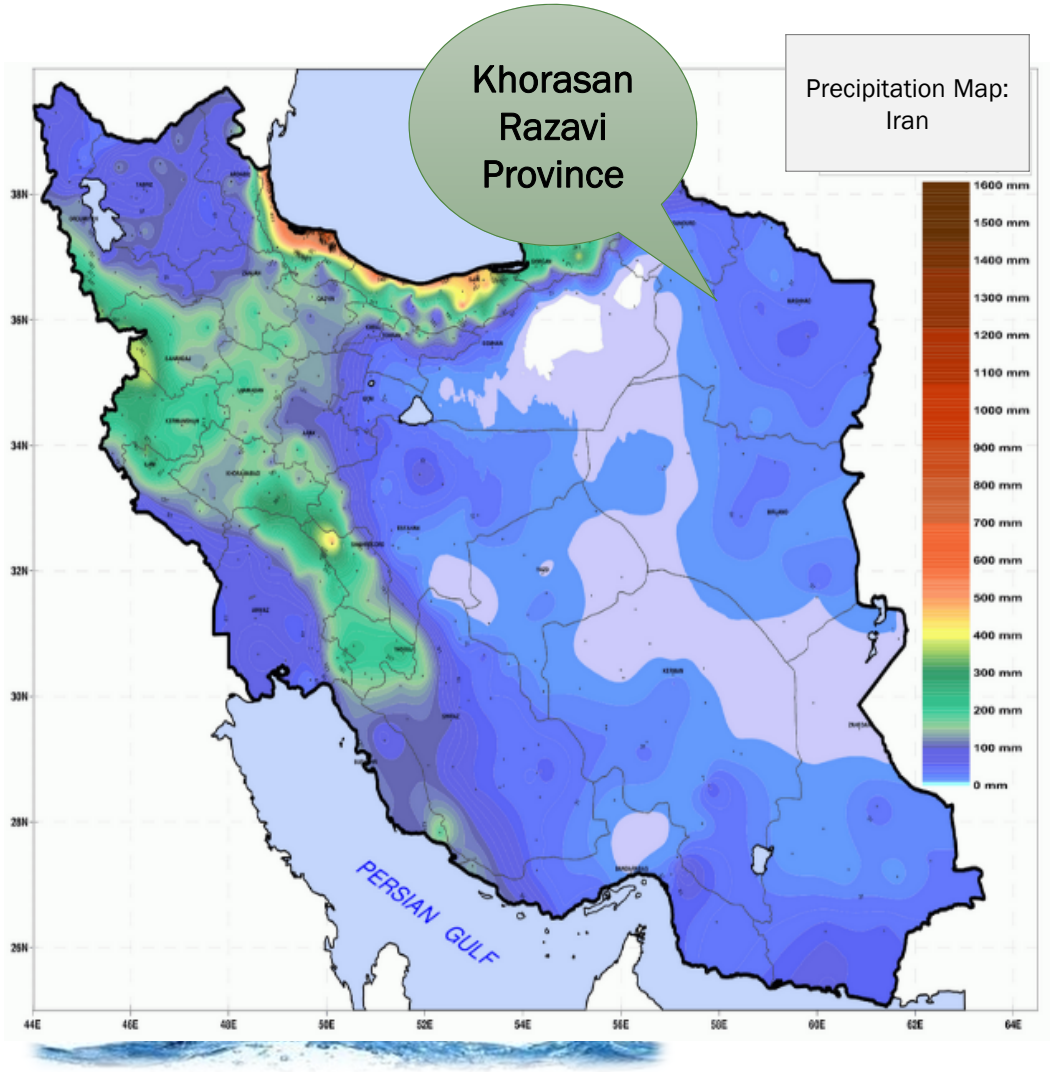

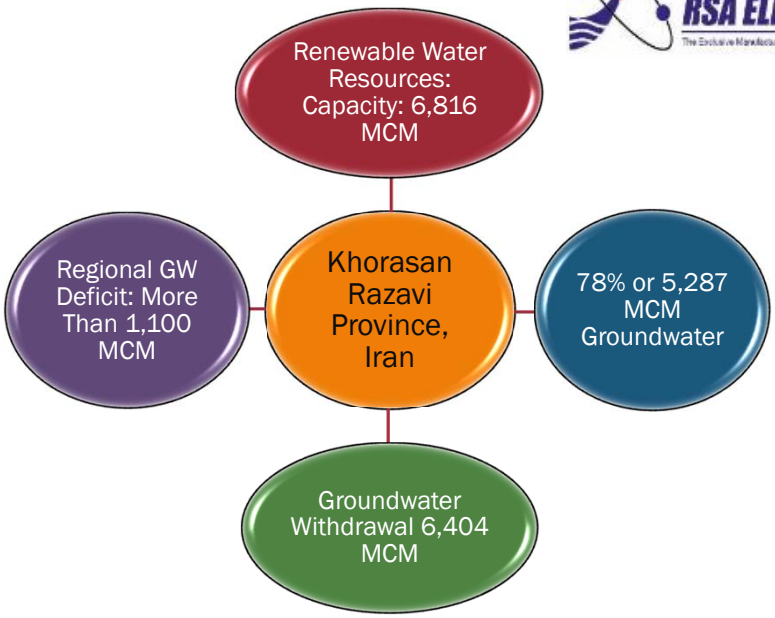

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Rebalancing Groundwater Resources: Government's Plan

- Critical Situation of Plains and Aquifers
- Long-Term Strategic & Development plans: conserve Local Water Resources
- Ministry of Energy and Water: Saving 25% of National Water Resources
- 2005 Onwards: Groundwater Regulation Plan in Khorasan Razavi Province to offset the water resource deficit and improve GW quality
- Artificial Aquifer Recharge
- Shifting Floodwater

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Rebalancing Groundwater Resources: Government's Plan

- Resource Conservation by LAW
- Permit and Restriction By The Ministry of Energy and Water
- Geographical Aspects and Aquifer Condition
- Issued Permit: Maximum Depth, Flow Rate, Total Annual Water Withdrawal (Quota)
- Quota: Planned cultivate pattern (Ministry of Agriculture)
- ILLEGAL: Digging unlicensed wells or over pumping and punished by LAW

Licensed Wells and Withdrawal Quota by Sectors
Khorasan-Razavi, Iran

Use Category	Agriculture	Drinking	Industrial	Livestock	Services	Total
Number of Permitted Wells	10,054	2,591	1,299	1,269	703	15,916
Water Quota (MCM)	3,262	567	74	16	90	4,009
% Volume	81%	14%	2%	%1	2%	-

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>EQUIPMENT/TOOL<

HOW TO ASSIGN, MONITOR AND MANAGE QUOTA UTILIZATION?

Is there any…

Solution!?

Groundwater Monitoring and Management Solution

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dlms device language message specification

DLMS User Association

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Tel. +36 28 514065
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dlms@dlms.com

Certification No. 1557

This is to certify that the metering equipment identified as:

Type: SEWM303
Mgmt. SAP = 1, "525341534557 4D333033303234393333" (RSASEWM303024933)

manufactured by:

Rahrovan Sepehr Andisheh PTE., Iran

has successfully passed the DLMS/COSEM Conformance test under the following conditions:

- CTT version: CTT version 2.7
- Licensed to: Shenzhen_Clou_China (2010-3-25)
- COSEM object definitions file version: Object_defs_v2.9_released_GKVV141201.dat
- Media identifiers used: [ABSTRACT, ELECTRICITY]

Test performed	Communication profile	Operating mode	application context	Date and time	Digital signature of the test report
Test 1	[illegible]	MODE_E	LN	21 Sept 2015	E8058AC82801212858B76490AF758AA

The authenticity of the test report(s) has been verified by the DLMS User Association and the metering equipment identified above is listed on its web site at: http://www.dlms.com.

With this, the manufacturer is entitled to display the DLMS/COSEM Compliant mark – shown below – on its product duly identified and on its product literature.

dlms COSEM Compliant

The test reports are filed by the DLMS UA. Copies are available from the manufacturer.

This Certificate is only valid for the functions successfully tested. The test has been executed on one specimen of the product, as identified by the Management Logical Device Name reported. Results may not be applicable for other test specimens.

Date: Zug, the 21st September 2015

Paul Fuchs

Paul Fuchs
General Secretary

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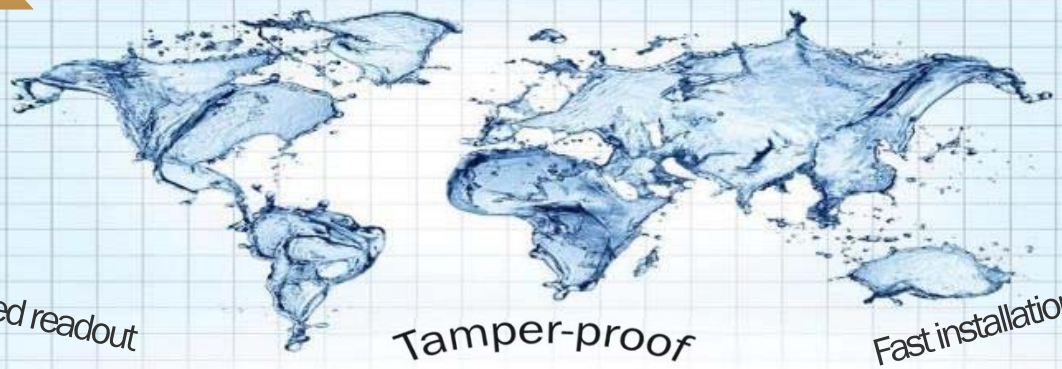
BENEFITS



Distanced readout

Tamper-proof

Fast installation

Online monitoring

Low-cost installation

2-way communication

Low-cost maintenance

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Solution benefits

Comparison with other methods

Method/Solution	Life time	Water Quality Impact on life time	Installation Costs	Maintenance Costs	Tampering Possibility
Mechanical meters	3 Years	Yes	High	High	High
Ultrasonic/Electromagnetic meters	5 Years	Yes	High	High	High
Smart Energy and Water Meter	Up to 10 Years	No	Low	Low	Impossible

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- **SEWM** eliminates common problems of typical/convention meters such as:
- Sensitivity and vulnerability against:
  - Suspended particles,
  - Air bubbles,
  - pipes' slope,
  - existence of tap, bend and connections
- Easy and Quick Installation and Calibration/Recalibration
- Easy to educate and Train especially in the agriculture sector

The previous projects: Local

	Provinces	Sales (Quantity)	Completed Installation (Quantity)	Completed Installation (Percentage)
1	Alborz	319	319	100%
2	Ardabil	1029	1029	100%
3	Booshehr	1554	1554	100%
4	Charmahal	900	900	100%
5	Eastern Azarbayjan	1850	1850	100%
6	Fars	10048	10048	100%
7	Gilan	189	189	100%
8	Golestan	1344	1344	100%
9	Hamedan	2124	2124	100%
10	Hormozgan	1121	621	55%
11	Ilam	1008	1008	100%
12	Isfahan	4993	2993	60%
13	Kerman	3440	3440	100%
14	Kermanshah	1951	1951	100%
15	Khoozestan	603	603	100%
16	Kohkilooyeh	510	510	100%
17	Kurdestan	2516	2516	100%
18	Lorestan	1203	1203	100%
19	Markazi	872	872	100%
20	Mazandaran	288	288	100%
21	Northern Khorasan	1617	1617	100%
22	Qazvin	1557	1557	100%
23	Qom	1059	1059	100%
24	Razavi Khorasan	9396	9396	100%
25	Semnan	1116	1116	100%
26	Sistan & Baloochestan	1213	1213	100%
27	Southern Khorasan	1698	1698	100%
28	Tehran	394	394	100%
29	Western Azarbayjan	4828	4328	90%
30	Yazd	1580	1580	100%
31	Zanjan	1235	1235	100%

After obtaining approval from the ministry of energy and water, the product and Solution has being installed across all provinces in Iran as a key element to manage groundwater resources.

- Until end of 2015: out of 65K, 95% Installed and being used by water authorities
- Q1 2016 : Won tenders and signed contract to install additional 45K across all provinces, while in some tenders was the only qualified participant

An Innovative Solution For Sustainable Groundwater Resource Management: The Case Of Khorasan-Razavi Province, Iran

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A central proposal for Khorasan-Razavi's groundwater withdrawal regulation plan was to **install Smart Energy and Water Meters (SEWM) projects in Khorasan-Razavi Province**

Installation of 9,600 (so far 5,498) SEWM at the expense of Applicants

Stop Over Pumping in Permitted Wells

Reduce Overall Consumption

Water & Electricity Utilities - Ministry of Agriculture - Local Governors

Integration of Water & Electricity A/C of well owners & website for Subscribers

15 Groups to Measure, Calibrate & Control Water Equipment & Remote Monitoring and Reading of SEWMs

Organizing Regional Operational Teams for the management of meters

Smart Cards to assign Quota

Sending 3,086 Notices and Penalizing Over-Pumped Subscribers

Conferences, Workshops & Training for Regional Water and Energy Personnel

Knowledge Sharing and Events for farmers, owners

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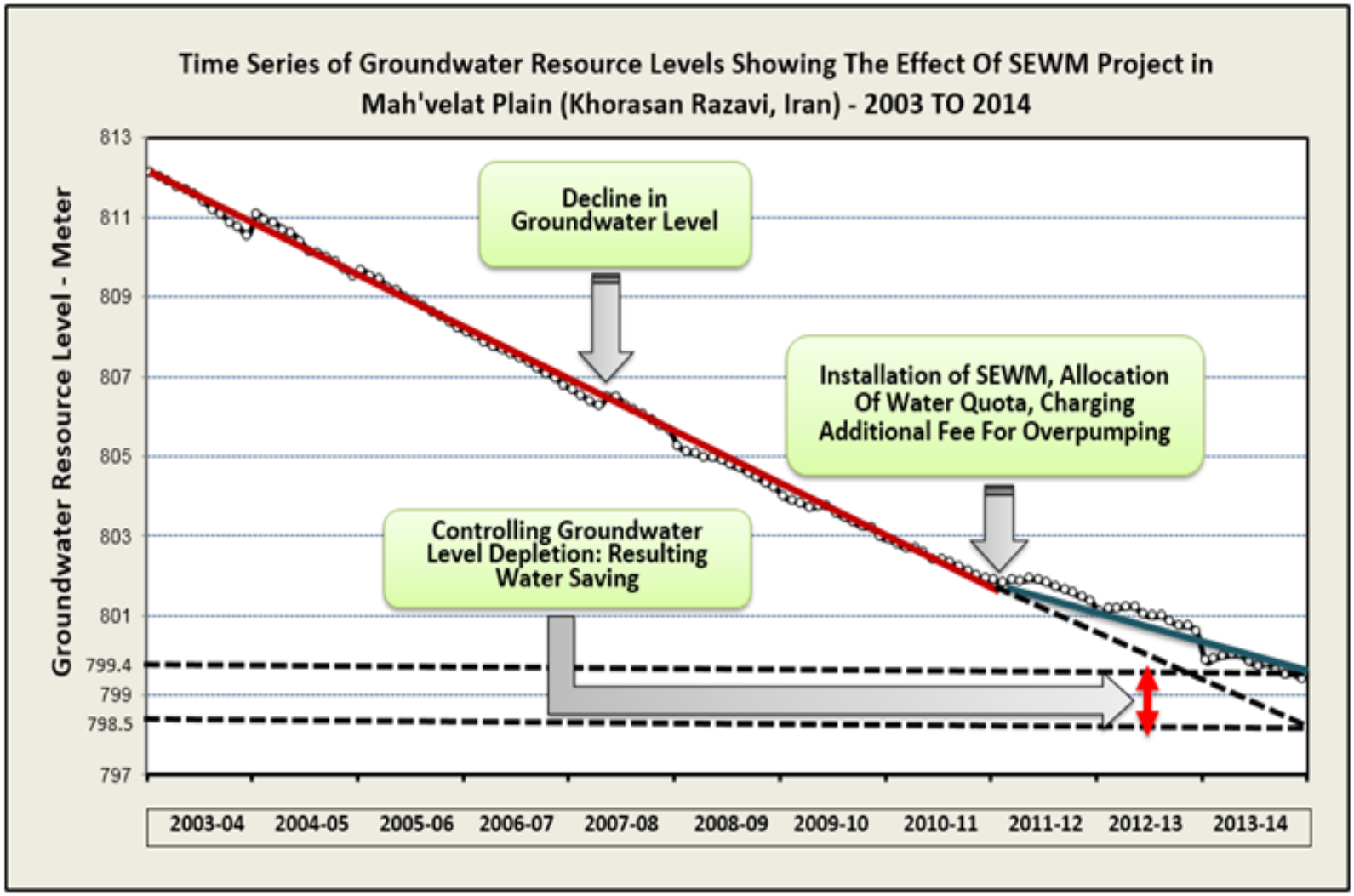

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Average annual Groundwater Depletion : **1.35M** = 71.95 MCM. Overall Depletion of 27.07 M in 20 Years.

Installation of **SEWM**s Groundwater Table is **0.9M** higher than it would have been under business as usual, which is equivalent to Groundwater saving of **47.97 MCM**

WATER SAVING

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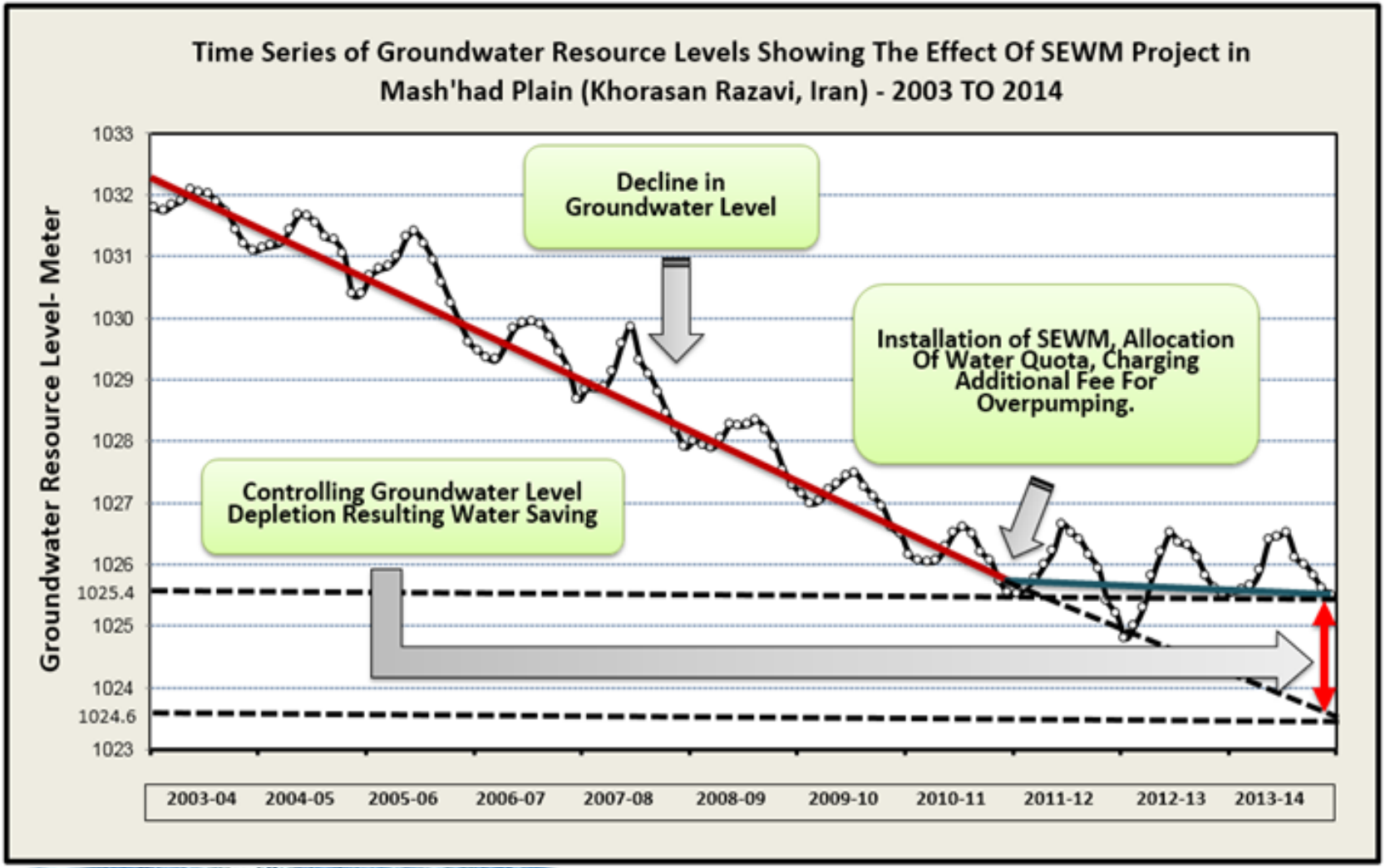

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As nearly all permitted wells in this plain are equiped with SEWMs, the result shows significant effectiveness of SEWMs.

Past 30 years Mashad plain: facing an average annual deplition 0.69M = **92.48 MCM**, overall **20.8 M**.

After implementation of the SEWM project, the groundwatertable drawdown was mitigated by almost 1 meter = **134.03 MCM**

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The total amount of collected fines: 542,000$, collected from a total of 422 cases pumping quota violation via the Smard Card utilization by farmers. No additional Operational Cost for water utilities.

Plain: Mah'velat	YEAR		
	2012	2013	2014
Average Pumping Hour in authorized wells (Hours)	5,207	5,496	5,508
the Amount of Over Pumping in licensed wells (Cubic Meter)	10,408,777	12,750,328	12,638,433
Change in Pumping Hours	-	+5.6%	+0.2%
Change in Over Pumping Volume	-	+22.5%	-0.9%
Plain: Mash'had	YEAR		
	2012	2013	2014
Average Pumping Hour in authorized wells (Hours)	4,341	4,516	4,375
the Amount of Over Pumping in licensed wells (Cubic Meter)	64,148,954	42,739,134	29,263,749
Change in Pumping Hours	-	+4.0%	-3.1%
Change in Over Pumping Volume	-	-33.4%	-31.5%

Plain	Violation Cases	Fine Collected (USD)
Mashad	96	133,918
Sabzevar	1	1,618
Torbat Heidarieh	40	51,469
Torbat Jam	96	176,462
Neishaboor	3	7,818
Ghoochan	0	0
Kashmar	42	55,052
Sarakh's	58	87,627
Gonabad	86	28,137
Dargaz	0	0

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Conclusion:

This paper provided an overview of the installation of SEWMs as a key component in the implementation of groundwater rebalancing plan in Khorasan-Razavi Province, Iran. Based on previous promising results in other provinces, along with several features included, installation of SEWMs is considered as an effective means to mitigate groundwater table decline. As a result of this plan, which involved multiple institutions (e.g., Ministry of Energy, Ministry of Agriculture, and local governors) the regional water authority managed to install 5,948 SEWMs in the region. The groundwater level depletion rate in Mashad and Mahvelat (which are almost completely equiped with SEWMs), along with the pumping hour and over pumping have been effectively reduced, leading to saving 182 MCM of groundwater. Additionally, the SEWM technology provided an opportunity to mitigate the over-pumping rate by charging farmers for surplus water withdrawal, and as a result, a sum of 542,000 USD was collected by electricity and water authority. Improving groundwater regulation aided by SEWMs is a promising water management strategy for arid and semi-arid regions.

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Thanks For Attention!