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DEPLOYMENT OF DEEP ENHANCED GEOTHERMAL SYSTEMS FOR SUSTAINABLE ENERGY BUSINESS





European Geothermal Congress

Palais de la Musique et des Congres
Place de Bordeaux, Strasbourg

20. September 2016

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DEEPEGS Coordinator

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DEEPEGS Project Description

EU SUPPORTED DEMONSTRATION PROJECT

- The goal is to demonstrate the feasibility of Enhanced Geothermal Systems (EGS) for delivering renewable energy for the European citizens
- The project will be testing stimulation technologies for **EGS in deep wells in different geological settings**

DEMONSTRATION LOCATIONS

- The project will demonstrate advanced technologies in three types of geothermal reservoirs,
 - in high enthalpy at Reykjanes with **T** up to 550°C and
 - two deep hydrothermal reservoirs in southern France with **T** up to 220°C.

PROJECT DETAILS

Coordinated by HS Orka, Iceland

4 year project started **December 1, 2015**

Consortium partners from

Iceland, France, Germany, Italy, and Norway

€44.057.254
Total budget

€19.999.740
EC Grant



Source: Herrenknecht Vertical GmbH

DEEPEGS – Project Consortium

Partners

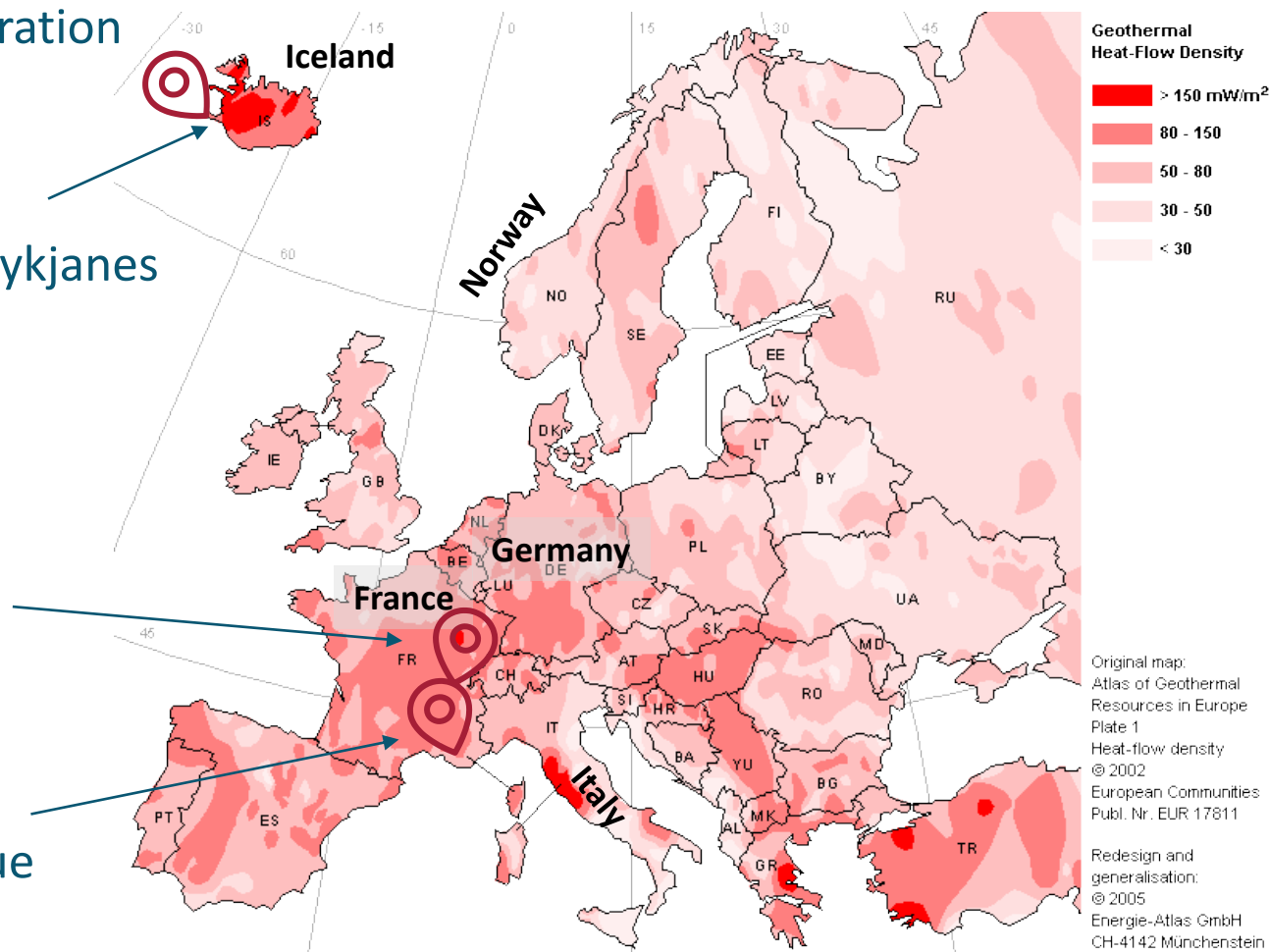
- **Iceland:**
 - HS Orka
 - ISOR
 - GEORG
 - Landsvirkjun
- **France:**
 - BRGM
 - Fonroche Geothermie
- **Germany**
 - Herrenknecht Vertical
 - Karlsruher Institut fuer Technologie
- **Italy**
 - Enel Green Power
- **Norway**
 - Statoil Petroleum

Demonstration sites

Iceland:
RN-15 Reykjanes

France:
Valence

France:
Vistrenque



DEEPEGS – Industry driven consortium

Energy Companies



Supporting Companies & Research Entities





AMBITION

- Develop a **future approach to geothermal energy** by implementing deep EGS methodologies,
- Laying the **foundation of a novel geothermal engineering** allowing widespread exploitation of deep heat resources for improved energy security.



BUSINESS MODEL TO BE CREATED

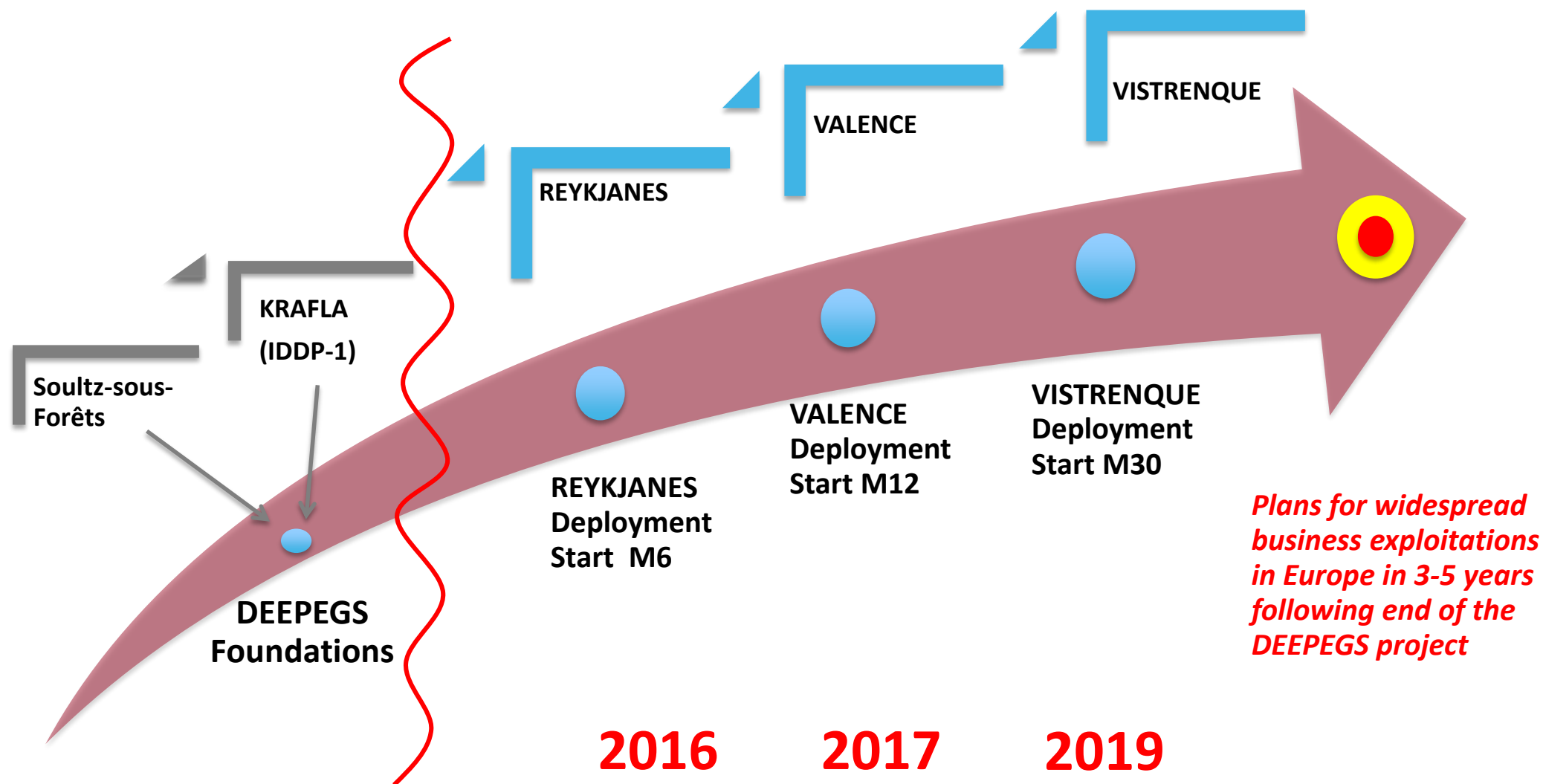
- Robust business models for EGS wide spread deployments will be developed
- Showcasing Business Case demonstrators of EGS for deep geothermal energy
- Feasibility frameworks for exploitation in different geological areas/conditions
- Market analysis and cost-benefit assessments for wider deployments of EGS in Europe and world wide



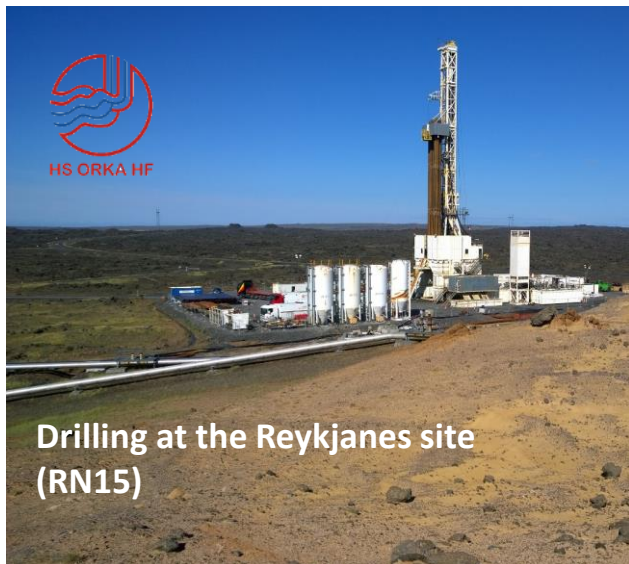
EXPECTED IMPACT

- **Bring down cost** of renewable energy and **increase the attractiveness** of renewable heating and cooling technologies
- Reduce life-cycle environmental impact
- Improve EU **energy security**
- Make renewable electricity generation **more predictable**
- Strengthen the European industrial technology base

DEEPEGS - Timeline



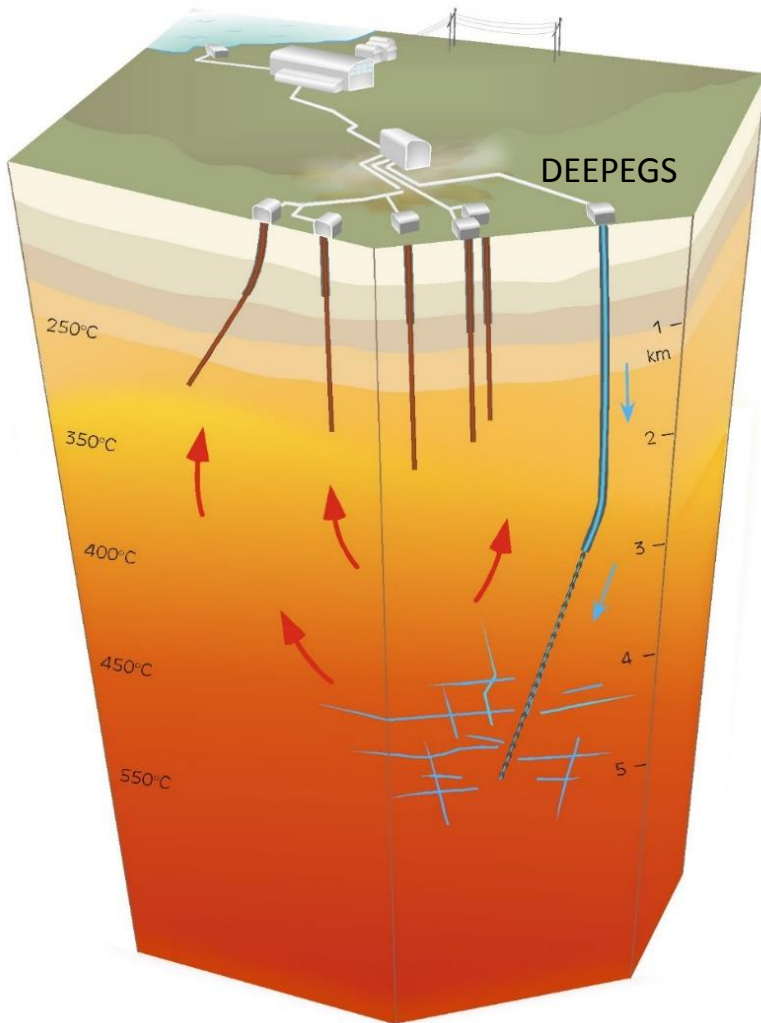
DEEPEGS Scope



MAIN TARGETS

- DEEP DRILLING IN REYKJANES ICELAND → 5 KM
 - Deep **EGS stimulation** in an existing geothermal field with number of production wells,
 - Power plant on site with existing 100 MW capacity,
 - Through EGS **increase** the available energy output,
 - Demonstrate this business case in a high enthalpy geological environment.
- DEEP DRILLING OF DOUBLETS IN **TWO** DIFFERENT GEOLOGICAL ENVIRONMENTS IN FRANCE
 - **Target depth** at both demonstration sites → 5 KM +
 - **Soft EGS** stimulation to enhance energy recovery,
 - Demonstrate that deep EGS will enable access to deep geothermal energy in France → *business case for wider deployments in Europe.*

RN-15: Production well: offered for deepening as IDDP-2 DEEPEGS demonstration well



Reykjanes power plant: 100 MW_e

RN-15 production well: 2.5 km deep

RN-15 defined as Well of opportunity for IDDP-2 / DEEPEGS

It will be directionally drilled to 5 km depth in 2016

Flow tested in both directions – down and up

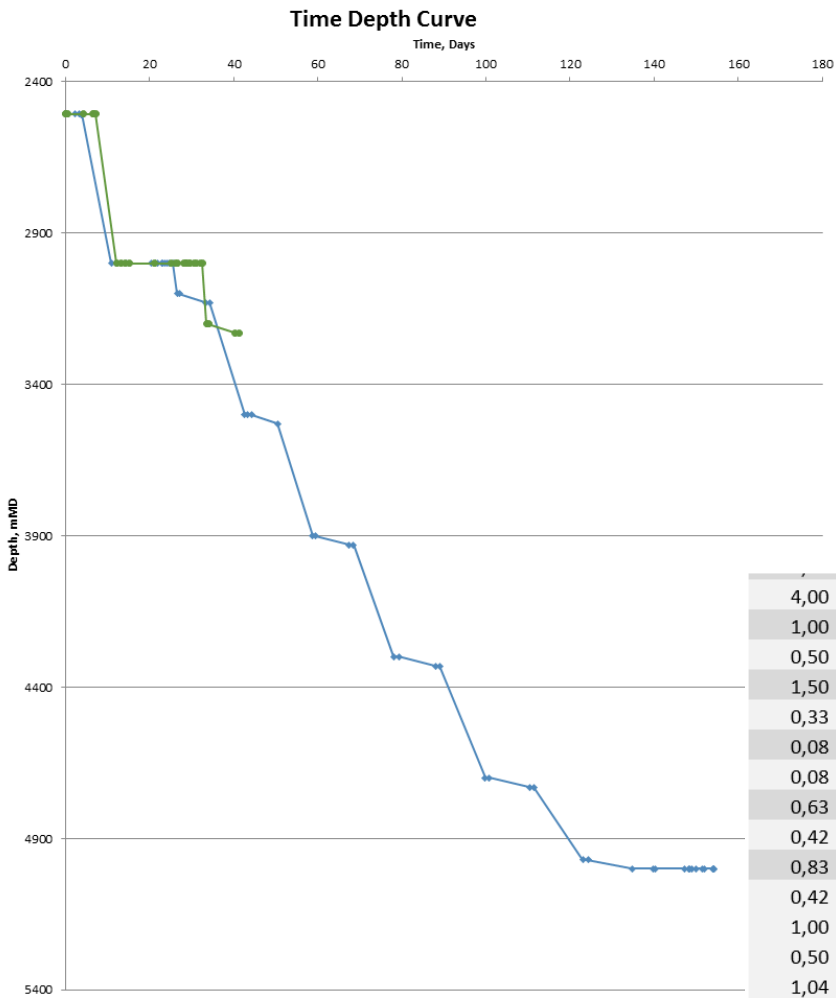
Pilot tested for power production

Scientifically studied as a black smoker analog

Reservoir fluid is of seawater origin

19 September 2016

PROGRESS TO DATE



4,00	25,2	96	RIH 9 7/8" - 9 5/8" casing and cables	3000	3000	0	1.9.2016	5.9.2016
1,00	26,2	24,0	Circulation and cooling well before cementing	3000	3000	0	5.9.2016	6.9.2016
0,50	26,7	12	Cementing casing reverse to surface	3000	3000	0	6.9.2016	6.9.2016
1,50	28,2	36,0	WOC, logging temp and CBL	3000	3000	0	6.9.2016	8.9.2016
0,33	28,5	8	"Cut" Casing and nipple down BOP's	3000	3000	0	8.9.2016	8.9.2016
0,08	28,6	2	Remove 13 5/8" flange	3000	3000	0	8.9.2016	8.9.2016
0,08	28,7	2	Install 9 7/8" flange	3000	3000	0	8.9.2016	8.9.2016
0,63	29,3	15	Nipple up 13 5/8" 5000 psi BOP's, including centralizer flange and test BOP	3000	3000	0	8.9.2016	9.9.2016
0,42	29,7	10	Make up 8 1/2" rotary BHA for drill out cement	3000	3000	0	9.9.2016	9.9.2016
0,83	30,5	20	Drill out cement and POOH	3000	3000	0	9.9.2016	10.9.2016
0,42	31,0	10	RIH cement string for cementing below casing	3000	3000	0	10.9.2016	10.9.2016
1,00	32,0	24	Cement below casing and POOH + brake out DP	3000	3000	0	10.9.2016	11.9.2016
0,50	32,5	12	Make up 8 1/2" DD BHA, RIH	3000	3000	0,00	13.9.2016	14.9.2016
1,04	33,5	25	Drill out cement, DD AB 1,5°/30m, MAB 16°, Azi 210°, @ 16° hold to TD	3000	3200	200	14.9.2016	15.9.2016
0,50	34,0	12	POOH	3200	3200	0	15.9.2016	16.9.2016
6,25	40,3	150	Makeup coring assembly, coring & tripping x 3 runs, about 30 m, POOH	3200	3230	30	16.9.2016	22.9.2016

Reykjanes

- Preparation for drilling
 - ✓ Final design → selection of materials/methods → purchasing materials → receive on site
 - ✓ Cabled thermocouples added on the outside of the casing – Temperature tolerance up to 600°C
 - ✓ Decision made to use IMAGE funded fibre optic cable to 900 m outside casing – GFZ personnel funded by GEOWELL
- Drill rig on site in late July
 - ✓ Drilling operation formally began 11.08.2016
 - ✓ 3 km casing depth reached 23.08.2016
 - ✓ Cementing of casing completed 06.09.2016
 - ✓ Cement being drilled out today - 09.09.2016
 - ✓ Public meeting before drilling held at Reykjanesbaer on 4th August, 2016



- Monitoring
 - ✓ Accelerometer set up in the nearest village (Grindavik) some 12 km from drill site.
 - ✓ Seismic network expanded by ISOR close to the drill site, and network expanded by 3 seismometers and MT monitoring station from KIT
 - ✓ Gas monitoring equipment during drilling supplied by ICDP and set up – we fund transporting of the tools
 - ✓ Conductivity and pH monitoring during drilling added

Valence

- Seismic acquisition in Valence, first geophysical investment in this area since the 80's

- ✓ Done in July 2016
- ✓ 9 - 2D seismic lines for ~95km total length
- ✓ Interpretation ready for T1 2017
- ✓ → good quality acquisition



Thank you!

For more information please contact us via



www.deepeggs.eu



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twitter.com/DEEPEGS_demo



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