Phase 1 Version 1 – English Translation

Here comes a detailed explanation of the 3-coil electric motor at a high-school graduation (Abitur) level, with stepwise structure and the corresponding formulas:

Construction of a 3-Coil Electric Motor
A 3-coil electric motor consists of:

1. **Stator**
   The stationary part of the motor, where three coils (windings) are evenly arranged in a circle. Each coil is offset by 120° relative to the others.
2. **Rotor**
   The rotating part of the motor, usually a magnetic iron core with a permanent magnet or electromagnet.
3. **Power Supply**
   The three coils are powered with three-phase alternating current (AC), each phase shifted by 120°.

How It Works

1. **Three-Phase Alternating Current**
   The three coils are powered with a three-phase current I(t)I(t)I(t) that varies sinusoidally over time and is phase-shifted by 120°:

I1(t)=Imaxsin⁡(ωt)(I:current, ω:angular frequency, t:time)I_1(t) = I_\text{max} \sin(\omega t) \quad (I: \text{current}, \, \omega: \text{angular frequency}, \, t: \text{time})I1(t)=Imaxsin(ωt) (I:current,ω:angular frequency,t:time) I2(t)=Imaxsin⁡(ωt−120∘)I_2(t) = I_\text{max} \sin(\omega t - 120^\circ)I2(t)=Imaxsin(ωt−120∘) I3(t)=Imaxsin⁡(ωt−240∘)I_3(t) = I_\text{max} \sin(\omega t - 240^\circ)I3(t)=Imaxsin(ωt−240∘)

2. **Generation of a Rotating Magnetic Field**
   Each coil generates a magnetic field proportional to the current:

Bi(t)∼Ii(t)B_i(t) \sim I_i(t)Bi(t)∼Ii(t)

Due to the 120° phase shift of the currents and the spatial arrangement of the coils, the magnetic fields add up to a rotating magnetic field with constant rotational speed.

3. **Torque and Rotor Rotation**
   The rotor tries to follow the rotating magnetic field, as the interaction of the magnetic fields produces a torque MMM. The torque is proportional to the product of the magnetic field BBB, the current III in the rotor (or permanent magnet), and the angle θ\thetaθ between the stator and rotor field:

M=k⋅B⋅I⋅sin⁡(θ)(M:torque, θ:angle)M = k \cdot B \cdot I \cdot \sin(\theta) \quad (M: \text{torque}, \, \theta: \text{angle})M=k⋅B⋅I⋅sin(θ)(M:torque,θ:angle)

Thus, the rotor rotates synchronously with the magnetic field.

4. **Synchronization**
   The rotational speed of the rotating magnetic field is determined by the AC frequency fff:

n=f⋅60p(n:speed in RPM, p:number of pole pairs)n = \frac{f \cdot 60}{p} \quad (n: \text{speed in RPM}, \, p: \text{number of pole pairs})n=pf⋅60(n:speed in RPM,p:number of pole pairs)

For a 3-coil motor, p=1p = 1p=1 usually.

Summary

- Three coils in the stator are offset by 120°.
- They are powered with phase-shifted three-phase AC.
- This produces a rotating magnetic field.
- This field generates a torque on the rotor, which follows the field.
- Motor speed depends on the AC frequency.

3-Coil DC Motor

A 3-coil DC motor (sometimes described as a multi-coil DC motor or a "DC motor with multiple windings") works similarly but uses a commutator.

Construction

1. **Stator**
   Stationary part with three coils arranged in a circle around the rotor, each offset by 120°. The coils are connected via a commutator or other current-switching device.
2. **Rotor (Armature)**
   Rotating part with coils or permanent magnets that generate a magnetic field or rotate within the stator's magnetic field.
3. **Commutator**
   A mechanical device that reverses the current in the rotor windings so that torque always acts in the same direction.

How It Works

1. **DC Power Supply**
   The three stator coils are powered with DC, usually not simultaneously in all coils, but controlled by the commutator to always generate the correct magnetic field.
2. **Magnetic Field in the Coils**

B=μ⋅N⋅Il(B:magnetic field strength, μ:permeability, N:number of turns, l:coil length)B = \mu \cdot \frac{N \cdot I}{l} \quad (B: \text{magnetic field strength}, \, \mu: \text{permeability}, \, N: \text{number of turns}, \, l: \text{coil length})B=μ⋅lN⋅I
(B:magnetic field strength,μ:permeability,N:number of turns,l:coil length)

3. **Rotating Magnetic Field via Commutator**
   Since DC does not naturally rotate, the commutator cyclically switches the current in the coils, generating a varying magnetic field that drags the rotor along.
4. **Torque on the Rotor**

M=k⋅Φ⋅I(M:torque, Φ:magnetic flux, I:current)M = k \cdot \Phi \cdot I \quad (M: \text{torque}, \, \Phi: \text{magnetic flux}, \, I: \text{current})M=k⋅Φ⋅I(M:torque,Φ:magnetic flux,I:current)

5. **Continuous Rotation**
   The commutator ensures the rotation direction remains constant, keeping the rotor moving.

Comparison with Three-Phase Motor

- In DC motors, the commutator produces the necessary "rotation" of the magnetic field by

switching the current.

- There is no truly rotating magnetic field; rather, a time-controlled field enables rotation.

Key Formulas

- Magnetic field of a DC coil: $B = \mu \cdot \frac{N \cdot I}{l}$
- Torque on the rotor: $M = k \cdot \Phi \cdot I$
- Speed-to-voltage relationship (simplified): $n \sim \frac{U - I \cdot R}{\Phi}$

3-Coil DC Motor with Remote Magnetic Energy Supply ("Jump Supply")

Here, the magnetic energy is not delivered directly via current in the coils, but via "jump supply" or remote irradiation—transmitted without conventional wiring, like wireless energy transfer.

Construction

1. **Stator with 3 Coils**
   Coils are offset by 120° as usual, but they do not receive direct electrical current.
   Instead, they receive magnetic energy via coupling (jump supply).
2. **Energy Source (Transmitter)**
   An external source generates a high-frequency magnetic field or electromagnetic waves, which are "beamed" to the stator coils via near-field coupling.
3. **Rotor**
   Rotating as usual, generating or reacting to the stator's magnetic field.

How It Works

1. **Remote Magnetic Energy Transfer**
   Energy is transmitted not through physical wiring but by magnetic coupling (e.g., inductive resonance), producing a strong alternating magnetic field that energizes the coils.
2. **Magnetic Field in Coils**

$B_i(t) \sim H_{\text{extern}}(t) \quad (B_i: \text{magnetic field in coil } i, \, H_{\text{extern}}: \text{external magnetic field})$

3. **Rotating Magnetic Field via Temporal Control**
   The external source phases the energy to the three coils to create a rotating magnetic field, which applies torque to the rotor and causes it to turn.
4. **Drehmoment am Rotor**
    1. Das Drehmoment entsteht aus der Wechselwirkung zwischen dem rotierenden Magnetfeld der Stator-Spulen und dem Magnetfeld des Rotors:

    $M = k \cdot B \cdot I_{\text{Rotor}} \cdot \sin(\theta)$

    Hier steht BBB für das magnetische Feld, das durch die Fern-Energieversorgung in den Spulen erzeugt wurde.
5. **Keine direkte elektrische Verbindung**
    1. Da die Energieübertragung magnetisch (induktiv) und berührungslos erfolgt, gibt es

keine physische Leitung, die den Strom zu den Spulen führt.

2. Die „Sprungzufuhr“ bezeichnet also das punktuelle „Abspringen“ der magnetischen Energie aus dem externen Feld auf die Spulen.

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1. Wichtige Formeln in diesem Kontext

6. Induzierte Spannung in einer Spule durch magnetisches Wechselfeld:

   Uind=N⋅A⋅dBdt(N:Windungszahl, A:Querschnittsfla¨che, B:magnetisches Flussdichte)U_{\text{ind}} = N \cdot A \cdot \frac{dB}{dt} \quad (N: \text{Windungszahl}, \, A: \text{Querschnittsfläche}, \, B: \text{magnetisches Flussdichte})Uind=N⋅A⋅dtdB (N:Windungszahl,A:Querschnittsfla¨che,B:magnetisches Flussdichte)

7. Magnetfeld in Spule aufgrund externer Energie:

   Bi(t)∼Hextern(t)B_i(t) \sim H_{\text{extern}}(t)Bi(t)∼Hextern(t)

8. Drehmoment am Rotor:

   M=k⋅B⋅IRotor⋅sin⁡(θ)M = k \cdot B \cdot I_{\text{Rotor}} \cdot \sin(\theta)M=k⋅B⋅IRotor ⋅sin(θ)

9. Drehzahl des Motors abhängig von Frequenz der magnetischen Energiezufuhr:

   n=f⋅60pn = \frac{f \cdot 60}{p}n=pf⋅60

10.

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1. Zusammenfassung

11. Die Energieversorgung der Spulen erfolgt **nicht direkt per Stromleitung**, sondern als **magnetische Fernenergieübertragung** (Sprungzufuhr).

12. Eine externe Quelle erzeugt ein magnetisches Wechselfeld, das die Spulen „fernbestrahlt“.

13. Dadurch wird ein rotierendes Magnetfeld erzeugt, das den Rotor in Drehung versetzt.

14. Die gesamte Energieübertragung geschieht berührungslos und ohne direkte elektrische Verbindung.

15. Übertragung des 3-Spulen-Motor-Prinzips auf Erde, Berge und Sonne

1.1. Aufbau (Analogie zum Motor)

16. **Stator = Erdkern**
    Der feste innere Kern und der flüssige äußere Kern wirken wie das „tragende Zentrum“ (Stator). Er dient als Bezugssystem, um das rotierende Magnetfeld der Erde zu verankern.

17. **Spulen = Erzgehalt der Bergketten (Amerika, Afrika, Asien)**
    Die metallhaltigen Gebirgsketten (z. B. Eisen-, Nickel-, Kupferlager) übernehmen die Rolle der Spulen: Sie sind leitfähig und reagieren auf äußere Magnetfelder. Da sie global versetzt angeordnet sind (ähnlich wie 120°-Versatz im Motor), können sie zusammen ein „Magnetfeldmuster“ bilden.

18. **Energiequelle (Fernzufuhr) = Sonne**

Die Sonne liefert Strahlung, Teilchenströme (Sonnenwind, Plasma) und elektromagnetische Wellen. Diese Energie erreicht die Erde nicht leitungsgebunden, sondern **drahtlos** („Fernwellen“), wie bei der **Sprungzufuhr**.

1.2. Funktionsweise

19. **Fernübertragung durch Sonne**
    Sonnenstrahlung und Sonnenwind wirken wie eine wechselnde magnetische Bestrahlung. Die Ströme von Plasma-Teilchen erzeugen in der Magnetosphäre starke Schwankungen – vergleichbar mit einem **dreiphasigen Wechselstrom**, nur dass die Phasen durch Sonnenzyklen und Eruptionen (Sonnenstürme) moduliert sind.

20. **Induktion in den „Spulen“ (Bergketten mit Erzgehalt)**
    Die metallhaltigen Strukturen der Gebirge nehmen die Energie auf und können lokale Magnetfelder erzeugen oder verstärken:

    Uind=N⋅A⋅dBdtU_{\text{ind}} = N \cdot A \cdot \frac{dB}{dt}Uind=N⋅A⋅dtdB

    (induzierte Spannung durch zeitliche Änderung des solaren Magnetfeldes).

21. **Rotierendes Magnetfeld der Erde**
    Durch die Drehung der Erde und das Zusammenwirken der leitfähigen Strukturen (Kern + Erzketten) entsteht ein **globales rotierendes Magnetfeld** – unser Erdmagnetfeld.
    → Das entspricht dem Motor-Statorfeld.

22. **Eruptionen = Wechselstrom**
    Sonneneruptionen (Flares, Massenauswürfe) wirken wie Strompulse. Sie verstärken oder modulieren das Erdmagnetfeld, ähnlich wie ein kräftiger Sinusimpuls, der eine Motorwicklung zusätzlich anregt.

23. **Drehmoment / Wirkung auf den „Rotor“**
    Der „Rotor“ in diesem Bild ist die **Atmosphäre & Ionosphäre**: Sie reagiert auf das Magnetfeld, bewegt sich (Strömungen, Polarlichter, elektrische Ströme in der Atmosphäre). Analogie zur Drehmomentformel:

    M∼BErde⋅ISonnenwind⋅sin⁡(θ)M \sim B_{\text{Erde}} \cdot I_{\text{Sonnenwind}} \cdot \sin(\theta)M∼BErde⋅ISonnenwind⋅sin(θ)

    → je stärker das solare Feld (Sonnensturm) und je leitfähiger die Erdzonen, desto größer die Wirkung (geomagnetische Stürme).

1.3. Zusammenfassung (Metapher)

24. **Erdkern = Stator** → das Zentrum, das die Magnetfeldrotation trägt.
25. **Gebirge/Erzgehalt = Spulen** → nehmen die Energie auf und formen sie um.
26. **Sonne = Energiequelle** → liefert über Fernstrahlung & Plasma die „Sprungzufuhr“.
27. **Sonneneruptionen = Wechselstrompulse** → modulieren das Feld und treiben Dynamik an.
28. **Ergebnis**: ein global rotierendes Magnetfeld, das die Erde schützt und gleichzeitig dynamische Effekte (Aurora, Störungen, Strömungen) hervorruft – wie der Rotor eines Motors, der durch das Feld in Bewegung bleibt.

1.1. Metaphorisch vs. physikalisch real

29. **Metaphorisch** war meine erste Formulierung, weil ich dein Bild (Motor = Erde–Sonne–Gebirge) wie ein Lehrbeispiel verstanden habe.

30. **Elektrophysikalisch** ist es aber nicht völlig unrealistisch:
Tatsächlich laufen in der Erde und im Sonnensystem viele **induktive und elektromagnetische Prozesse**, die sich mit den Motor-Prinzipien vergleichen lassen.

1.2. Welche Teile sind real?

31. ✓ **Sonne als Energiequelle**

32. Sonnenwind + elektromagnetische Strahlung wirken wie eine „Fernzufuhr“ (keine Kabel, sondern Teilchen- und Feldübertragung).

33. Eruptionen (CMEs, Flares) sind wie starke Strompulse – sie modulieren direkt das Erdmagnetfeld.

✓ **Induktion durch leitfähige Strukturen der Erde**

34. In den **leitfähigen Gesteinsschichten** (vor allem Eisen/Nickel im Erdkern, aber auch Erzgebirge in der Kruste) entstehen durch zeitliche Feldänderungen tatsächlich **induzierte Ströme**: die sogenannten *Tellurischen Ströme*.

35. Formel, die wirklich angewendet wird:

Uind=N⋅A⋅dBdtU_{\text{ind}} = N \cdot A \cdot \frac{dB}{dt}Uind=N⋅A⋅dtdB

→ genauso wie bei der Motorwicklung.

✓ **Rotierendes Magnetfeld der Erde**

36. Der **Geodynamo** (im flüssigen äußeren Kern aus Eisen/Nickel) funktioniert physikalisch fast wie eine gigantische „Spule mit bewegtem Leiter“.

37. Durch die Erdrotation und Konvektionsströmungen im leitfähigen Metall entsteht ein globales, rotierendes Magnetfeld.

38. Das ist tatsächlich sehr ähnlich zum Motorprinzip.

1.3. Wo wird es metaphorisch / problematisch?

39. **Spulen = Erzgehalt der Gebirge**

40. Gebirgserze sind leitfähig, ja – aber sie sind zu klein und unregelmäßig verteilt, um wie saubere „3 Spulen im 120°-Versatz“ zu wirken.

41. Der eigentliche „Spulen-Effekt“ sitzt viel tiefer: im flüssigen äußeren Kern der Erde.

Drei Phasen

42. Im Motor klar: 3 Leitungen, 120° phasenverschoben.

43. In der Erde: Wir haben keine saubere Dreiphasen-Symmetrie, sondern **chaotische Strömungen** im flüssigen Kern. Die Analogie „Amerika, Afrika, Asien als 3 Spulen“ ist also eher ein anschauliches Bild, kein exaktes Modell.

1.4. Fazit

44. **Elektrophysikalisch real**:
   – Drahtlose Energiezufuhr durch Sonne (Sonnenwind, Strahlung).
   – Induktion in leitfähigen Erdmassen (Tellurische Ströme, Geodynamo).
   – Rotierendes Magnetfeld durch Erdrotation.

45. **Metaphorisch/vereinfachend**:
   – Erzgehalte der Gebirge wie Spulen im 120°-Versatz.
   – Exakte Motor-Formeln direkt auf Erde anwendbar.

46. Kurzantwort: Man kann das als Rechenbeispiel aufziehen – physikalisch sauber über **Drehimpuls** und **Rotationsenergie** – aber die nötigen Energiemengen sind astronomisch groß. Die „Erz-Spulen"-Kopplung zur Radiomagnetik wäre extrem ineffizient.

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1) Spin-Up from Rest to Current Martian Rotation

Rotational Energy

Erot=12I ω2,I≈kIMR2, kI≃0.3307E_{\rm rot} = \frac12 I \, \omega^2, \qquad I \approx k_I M R^2, \; k_I \simeq 0.3307Erot=21Iω2,I≈kIMR2,kI≃0.3307

with Mars mass M=5.97×1024 kgM = 5.97\times10^{24}\,\mathrm{kg}M=5.97×1024kg, radius R=6.371×106 mR = 6.371\times10^6\,\mathrm{m}R=6.371×106m,
and angular velocity ω=2π86164 s=7.292×10−5 s−1\omega = \frac{2\pi}{86164\,\mathrm{s}} = 7.292\times10^{-5}\,\mathrm{s^{-1}}ω=86164s2π=7.292×10−5s−1.

Inserted values for Earth:

I≈8.02×1037 kg m2,Erot≈2.13×1029 J.I \approx 8.02\times10^{37}\,\mathrm{kg\,m^2},\quad E_{\rm rot} \approx 2.13\times10^{29}\,\mathrm{J}.I≈8.02×1037kgm2,Erot≈2.13×1029J.

Required power to achieve this in one day τ=86164 s\tau = 86164\,\mathrm{s}τ=86164s:

P=Erotτ≈2.47×1024 W.P = \frac{E_{\rm rot}}{\tau} \approx 2.47\times10^{24}\,\mathrm{W}.P=τErot≈2.47×1024W.

For comparison, the total solar power incident on Earth:

P⊙≈1.74×1017 W.P_\odot \approx 1.74\times10^{17}\,\mathrm{W}.P⊙≈1.74×1017W.

Even with 100 % coupling, one would need:

ErotP⊙≈3.9×104 years\frac{E_{\rm rot}}{P_\odot} \approx 3.9\times10^4\ \text{years} P⊙Erot ≈3.9×104 years

to "accumulate" the rotational energy.

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2) Maintaining Current Spin (Compensating Tidal Losses)
Earth loses rotational energy mainly through tidal friction (Moon/Sun). Approximate magnitude:

PTide∼1012−1013 W(a few terawatts).P_{\rm Tide} \sim 10^{12}-10^{13}\,\mathrm{W} \quad (\text{a few terawatts}).PTide∼1012−1013W(a few terawatts).

This corresponds to only ∼10−5\sim 10^{-5}∼10−5 of the incident solar power. If one could couple a tiny fraction of solar energy directly as torque, one could theoretically compensate the slowdown. Practically, mechanical coupling of the atmosphere/ionosphere/magnetosphere to the rigid Earth layers is very weak.

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3) "Radio-Magnetic" Coupling via the "Ore Coils"
For your model ("coils = ore content of mountain ranges"), one can assume a very rough coupling efficiency η\etaη: fraction of solar/external radiomagnetic power converted into mechanical rotational power in the solid Earth.

- Conductivities in the crust are small; ore veins are irregularly distributed.
- Magnetic coupling to the solid Earth is weak (most energy remains in the ionosphere/oceans as heat/currents).

Optimistically, η=10−8\eta = 10^{-8}η=10−8 (purely illustrative):

Peff=ηP⊙≈1.74×109 W.P_{\rm eff} = \eta P_\odot \approx 1.74\times10^9\,\mathrm{W}.Peff=ηP⊙≈1.74×109W.

Time to reach ErotE_{\rm rot}Erot:

t≈2.13×1029 J1.74×109 W≈3.9×1020 s≈1.2×1013 yearst \approx \frac{2.13\times10^{29}\,\mathrm{J}}{1.74\times10^9\,\mathrm{W}} \approx 3.9\times10^{20}\,\mathrm{s} \approx 1.2\times10^{13}\ \text{years} t≈1.74×109W2.13×1029J≈3.9×1020s≈1.2×1013 years

→ completely unrealistic.

To merely maintain current spin:
η∼PTide/P⊙≈10−5−10−4\eta \sim P_{\rm Tide}/P_\odot \approx 10^{-5}-10^{-4}η∼PTide/P⊙≈10−5−10−4.
Such strong direct coupling of radiomagnetic energy into mechanical rotation of the solid Earth is not achievable today.

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4) Key Takeaways

- Earth's rotational energy:

Erot≈2.1×1029 J\boxed{E_{\rm rot} \approx 2.1\times10^{29}\,\mathrm{J}}Erot≈2.1×1029J

- Spin-up in 1 day:

P≈2.5×1024 W(far beyond any source)\boxed{P \approx 2.5\times10^{24}\,\mathrm{W}} \quad (\text{far beyond any source})P≈2.5×1024W(far beyond any source)

- Solar power incident on Earth:

P⊙≈1.7×1017 W\boxed{P_\odot \approx 1.7\times10^{17}\,\mathrm{W}}P⊙≈1.7×1017W

- Tidal losses: ~a few TW → theoretically small fraction of solar power, but coupling is the problem.

Mini Formula Set (for your notes)

I≈0.3307 MR2,ω=2π86164 s,Erot=12Iω2,Pspin in τ=Erotτ,Peff=η P⊙,t=ErotPeff.\begin{aligned} I &\approx 0.3307\,MR^2,\\ \omega &= \frac{2\pi}{86164\,\mathrm{s}},\\ E_{\rm rot} &= \tfrac12 I\omega^2,\\ P_{\rm spin\,in\,\tau} &= \frac{E_{\rm rot}}{\tau},\\ P_{\rm eff} &= \eta\,P_\odot,\quad t=\frac{E_{\rm rot}}{P_{\rm eff}}. \end{aligned}I≈0.3307MR2,ω=86164s2π,Erot=21Iω2,Pspinin τ=EroτPeff=ηP⊙,t=PeffErot.

Conclusion:
Electrophysically, the principle can be used as an induction analogy, but the required energies (and especially coupling η\etaη) make actual "spinning up" of Earth practically impossible. For teaching or modeling purposes, it remains a nice thought experiment.

Mars Example: Steel Conductor Spin-Up

- **Goal:** Determine how much conductive steel would be required to spin Mars from rest to its current rotational energy via a Lorentz/magnetic torque from a current in a steel ring in an external magnetic field.

Mars Physical Parameters:

Parameter	Value
Mass MMM	6.4171×1023 kg6.4171 \times 10^{23}\ \mathrm{kg}6.4171×1023 kg
Radius RRR	3.3895×106 m3.3895 \times 10^6\ \mathrm{m}3.3895×106 m
Moment of inertia IM=kMR2I_M = kMR^2IM=kMR2	k≈0.3662 ⟹ IM≈2.6998×1036 kg m2k \approx 0.3662 \implies I_M \approx 2.6998\times10^{36}\ \mathrm{kg\,m^2}k≈0.3662⟹IM≈2.6998×1036 kgm2
Rotation period TTT	24 h 37 min 22 s =88642 s= 88642\ \mathrm{s}=88642 s
Angular velocity ω=2π/T\omega = 2\pi/Tω=2π/T	≈7.0883×10−5 s−1\approx 7.0883\times10^{-5}\ \mathrm{s^{-1}}≈7.0883×10−5 s−1
Rotational energy Erot=12IMω2E_{\rm rot} = \tfrac12 I_M \omega^2Erot=21IMω2	≈6.78×1027 J\approx 6.78 \times 10^{27}\ \mathrm{J}≈6.78×1027 J

Required Power for a Given Spin-Up Time

- Assume τacc=1 year=365.25 days=3.15576×107 s\tau_{\rm acc} = 1\ \mathrm{year} = 365.25\ \mathrm{days} = 3.15576\times10^7\,\mathrm{s}τacc =1 year=365.25 days=3.15576×107s

P=Erotτacc≈6.78×1027 J3.15576×107 s≈2.15×1020 WP = \frac{E_{\rm rot}}{\tau_{\rm acc}} \approx \frac{6.78\times10^{27}\ \mathrm{J}}{3.15576\times10^7\,\mathrm{s}} \approx 2.15 \times 10^{20}\ \mathrm{W}P=τaccErot≈3.15576×107s6.78×1027 J≈2.15×1020 W

- Mechanical torque needed (assuming uniform angular acceleration, mean angular speed ωmitt≈ω/2\omega_{\rm mitt} \approx \omega/2ωmitt≈ω/2):

τreq≈Pωmitt=2Pω≈6.06×1024 N m\tau_{\rm req} \approx \frac{P}{\omega_{\rm mitt}} = \frac{2P}{\omega} \approx 6.06 \times 10^{24}\ \mathrm{N\,m}τreq≈ωmittP=ω2P ≈6.06×1024 Nm

3) Relation to a Current-Carrying Equatorial Ring
For a ring-shaped surface (equatorial ring), the magnetic torque (with external BBB perpendicular to the ring plane) is:

τ=I⋅Aloop⋅B,Aloop=πR2.\tau = I \cdot A_{\rm loop} \cdot B, \qquad A_{\rm loop} = \pi R^2.τ=I⋅Aloop⋅B,Aloop=πR2.

The required current is therefore:

Ireq=τreqAloop B.I_{\rm req} = \frac{\tau_{\rm req}}{A_{\rm loop} \, B}.Ireq=AloopBτreq.

Using a typical interplanetary magnetic field value near Mars (local values vary strongly, but as an order of magnitude):

B∼5×10−9 T(a few nanotesla — typical IMF).B \sim 5 \times 10^{-9}\ \mathrm{T} \quad (\text{a few nanotesla — typical IMF}).B∼5×10−9 T(a few nanotesla — typical IMF).

The area:

Aloop=πR2≈π(3.3895×106 m)2≈3.608×1013 m2.A_{\rm loop} = \pi R^2 \approx \pi (3.3895\times

10^6\ \mathrm{m})^2 \approx 3.608\times 10^{13}\ \mathrm{m^2}.Aloop =πR2≈π(3.3895×106 m)2≈3.608×1013 m2.

Thus:

Ireq≈3.36×1019 A.I_{\rm req} \approx 3.36 \times 10^{19}\ \mathrm{A}.Ireq≈3.36×1019 A.

(→ A single ring would thus need currents on the order of 101910^{19}1019 amperes — absolutely astronomical.)

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4) How much steel (mass) is needed to carry this current?
Assume steel with average density ρ≈7.850·103 kg/m3\rho \approx 7.850 \cdot 10^3\ \mathrm{kg/m^3}ρ≈7.850·103 kg/m3. The ring length is L=2πRL = 2 \pi RL=2πR.

To avoid melting for a given current III, the conductor cross-sectional area AcsA_{\rm cs}Acs must satisfy the current density

J=IAcsJ = \frac{I}{A_{\rm cs}}J=AcsI

within a practical range. Steel cannot sustain high continuous current densities like superconductors; for conventional steady current we take conservatively:

J∼105 A/m2.J \sim 10^5\ \mathrm{A/m^2}.J∼105 A/m2.

Then:

Acs=IreqJ≈3.36×1019105≈3.36×1014 m2.A_{\rm cs} = \frac{I_{\rm req}}{J} \approx \frac{3.36\times10^{19}}{10^5} \approx 3.36\times10^{14}\ \mathrm{m^2}.Acs=JIreq ≈1053.36×1019≈3.36×1014 m2.

Volume of the ring:

V=Acs·L,L=2πR≈2.1297×107 m,V≈7.16×1021 m3.V = A_{\rm cs} \cdot L, \quad L = 2\pi R \approx 2.1297 \times 10^7\ \mathrm{m}, \quad V \approx 7.16 \times 10^{21}\ \mathrm{m^3}.V=Acs·L,L=2πR≈2.1297×107 m,V≈7.16×1021 m3.

Mass:

m=ρV≈7.85×103·7.16×1021≈5.62×1025 kg.m = \rho V \approx 7.85\times10^3 \cdot 7.16\times10^{21} \approx 5.62 \times 10^{25}\ \mathrm{kg}.m=ρV≈7.85×103·7.16×1021≈5.62×1025 kg.

Comparison: Mars mass MMars≈6.42×1023 kgM_{\rm Mars} \approx 6.42 \times 10^{23}\ \mathrm{kg}MMars≈6.42×1023 kg.
The required steel mass would thus be roughly ~87× the mass of Mars — completely unrealistic.

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5) What if superconductors / high current densities are used?
If instead a superconducting ring were possible and one assumes a much higher effective current density, e.g. J=1010 A/m2J = 10^{10}\ \mathrm{A/m^2}J=1010 A/m2 (hypothetical, see superconducting applications), then the required cross-section is reduced by a factor of 10510^5105 compared to the above example:

Mass (superconducting ring) would then be

msc≈5.6×1020 kg,m_{\rm sc} \approx 5.6 \times 10^{20}\ \mathrm{kg},msc≈5.6×1020 kg,

still ~0.09% of Mars' mass (still gigantic and practically impossible, also requiring cooling, structure, power source, etc. for a space-scale superconducting ring).

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6) Scaling / general formula collection (for substitution)

Rotational energy of Mars:

Erot=12IMω2,IM=kMR2.E_{\rm rot} = \frac{1}{2} I_M \omega^2, \qquad I_M = k M R^2.Erot =21IMω2,IM=kMR2.

Average power over acceleration time τacc\tau_{\rm acc}τacc:

P=Erotτacc.P = \frac{E_{\rm rot}}{\tau_{\rm acc}}.P=τaccErot.

Required torque (average):

τreq≈2Pω.\tau_{\rm req} \approx \frac{2 P}{\omega}.τreq≈ω2P.

Current in a ring with external field BBB:

Ireq=τreqAloop B,Aloop=πR2.I_{\rm req} = \frac{\tau_{\rm req}}{A_{\rm loop} \, B}, \quad A_{\rm loop} = \pi R^2.Ireq=AloopBτreq,Aloop=πR2.

Conductor cross-section for current density JJJ:

Acs=IreqJ,V=Acs⋅2πR,m=ρV.A_{\rm cs} = \frac{I_{\rm req}}{J}, \quad V = A_{\rm cs} \cdot 2 \pi R, \quad m = \rho V.Acs=JIreq,V=Acs⋅2πR,m=ρV.

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7) Interpretation / Conclusion (short)

The energy requirement to spin Mars from rest to current rotation is

Erot≈6.8×1027 J.E_{\rm rot} \approx 6.8 \times 10^{27}\ \mathrm{J}.Erot≈6.8×1027 J.

Even with very optimistic assumptions for external field (BBB) and current density, the required conductor/material is astronomical — in the standard assumptions above several times the mass of Mars; even with superconductors a significant fraction of the planetary mass is still needed.

Practically, this is not feasible with steel (or realistic materials/technologies) — a nice thought experiment showing the scale of planetary rotational energies.

1) Key Basic Quantities & Formulas

Input values (standard values):

- Solar constant (at Earth's location): S≈1361 W/m2S \approx 1361\ \mathrm{W/m^2}S≈1361 W/m2
- Earth radius: R⊕=6.371×106 mR_\oplus = 6.371 \times 10^6\ \mathrm{m}R⊕=6.371×106 m
- Earth cross-sectional area: Adisk=πR⊕2A_{\rm disk} = \pi R_\oplus^2Adisk=πR⊕2
- Earth albedo (reflected fraction): α≈0.30\alpha \approx 0.30α≈0.30

1. **Incoming power on Earth's disk**

P⊙=S⋅Adisk=S⋅πR⊕2P_\odot = S \cdot A_{\rm disk} = S \cdot \pi R_\oplus^2P⊙=S⋅Adisk=S⋅πR⊕2

Substituting:

Adisk=π(6.371×106)2≈1.275×1014 m2,P⊙≈1361⋅1.275×1014≈1.735×1017 W.A_{\rm disk} = \pi (6.371\times10^6)^2 \approx 1.275\times10^{14}\ \mathrm{m^2}, \quad P_\odot \approx 1361 \cdot 1.275\times10^{14} \approx 1.735\times10^{17}\ \mathrm{W}.Adisk =π(6.371×106)2≈1.275×1014 m2,P⊙≈1361⋅1.275×1014≈1.735×1017 W.

2. **Actually absorbed solar power**

Pabsorb=(1−α) P⊙≈0.70⋅1.735×1017≈1.21×1017 W.P_{\rm absorb} = (1-\alpha) \, P_\odot \approx 0.70 \cdot 1.735 \times 10^{17} \approx 1.21 \times 10^{17}\ \mathrm{W}.Pabsorb=(1−α)P⊙ ≈0.70⋅1.735×1017≈1.21×1017 W.

This is the order of magnitude of energy the Earth actually absorbs from sunlight (heating, etc.).

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2) Important terrestrial energy flows (orders of magnitude)

These are commonly used rough estimates; some values vary in the literature.

- **Geodynamic / geodynamo-relevant power** (convective heat, part driving the geodynamo):

Pgeodynamo∼1011−1013 W (∼0.1−10 TW)P_{\rm geodynamo} \sim 10^{11} - 10^{13}\ \mathrm{W} \ (\sim 0.1 - 10 \text{ TW})Pgeodynamo∼1011−1013 W (∼0.1−10 TW)

(Background: total heat flux from core/mantle is in the tens of TW range; only a fraction effectively drives the magnetic field generator.)

- **Tidal dissipation** (loss through friction in oceans & solid Earth):

Ptide∼1012−1013 W (several terawatts)P_{\rm tide} \sim 10^{12} - 10^{13}\ \mathrm{W} \ (\text{several terawatts})Ptide∼1012−1013 W (several terawatts)

(This is the power converted to heat via tidal friction, corresponding to the rate at which Earth transfers angular momentum to the Moon.)

- **Induced telluric currents / magnetic effects in crust & ore veins:**
  These are much smaller than the above flows (typically local MW–GW during strong geomagnetic storms); globally: ≪1012 W\ll 10^{12}\ \mathrm{W}≪1012 W on average.

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3) Sun → Earth (core + ore) ratio — rough estimate

We want the ratio of solar energy reaching Earth versus energy consumed in the core/dynamo and by tides.

Using the above values:

Pabsorb≈1.21×1017 W,Pgeodynamo∼1011−1013 W,Ptide∼1012−1013 W.P_{\rm absorb} \approx 1.21 \times 10^{17}\ \mathrm{W}, \quad P_{\rm geodynamo} \sim 10^{11}-10^{13}\ \mathrm{W}, \quad P_{\rm tide} \sim 10^{12}-10^{13}\ \mathrm{W}.Pabsorb ≈1.21×1017 W,Pgeodynamo∼1011−1013 W,Ptide∼1012−1013 W.

Ratios (Sun divided by terrestrial flows):

1. **Sun : Geodynamo**

PabsorbPgeodynamo∼1.2×10171011−1013∼104−106\frac{P_{\rm absorb}}{P_{\rm geodynamo}} \sim \frac{1.2\times10^{17}}{10^{11}-10^{13}} \sim 10^4 - 10^6Pgeodynamo Pabsorb∼1011−10131.2×1017∼104−106

→ The Sun provides 10,000–1,000,000 times more power than needed for the geodynamo.

2. **Sun : Tidal losses**

PabsorbPtide∼1.2×10171012−1013∼104−105\frac{P_{\rm absorb}}{P_{\rm tide}} \sim \frac{1.2\times10^{17}}{10^{12}-10^{13}} \sim 10^4 - 10^5PtidePabsorb∼1012−10131.2×1017 ∼104−105

→ The Sun also supplies 10,000–100,000 times more energy than the annual tidal dissipation rate.

3. **Telluric / ore-induced power (very rough)**

PErz−Induktion≪1012 WP_{\rm Erz-Induktion} \ll 10^{12}\ \mathrm{W}PErz−Induktion ≪1012 W

→ The ratio is even larger; Sun >> induced ore energy.

Summary: The Sun dominates energetically; humans or geological processes utilize only tiny fractions for geophysical effects.

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4) Role of the Moon as "Amplifier / Relay / Commutator" — physically accurate description

Physically, the Moon affects Earth mainly mechanically/gravitationally:

A) Gravitational coupling (main effect)

- The Moon generates tides (in oceans and crust).
- Gravitational forces cause periodic bulges. Friction (ocean drag, mantle friction) produces dissipation → heat.
- Angular momentum transfer: the Moon extracts angular momentum from Earth's rotation; the energy per time is PtideP_{\rm tide}Ptide. The associated torque is related to power by:

Ptide=τtide ω⊕⇒τtide=Ptideω⊕.P_{\rm tide} = \tau_{\rm tide} \, \omega_\oplus \quad \Rightarrow \quad \tau_{\rm tide} = \frac{P_{\rm tide}}{\omega_\oplus}.Ptide=τtideω⊕⇒τtide=ω⊕ Ptide.

- This torque transfer is mechanical/gravitational, not electromagnetic.

B) Moon as "regulator"

- By varying monthly (e.g., shifts in tidal maxima), the Moon periodically modulates mechanical stress distribution and thus local flows and frictional heating.
- In this sense, it regulates local dissipation (temporal modulation of PtideP_{\rm tide}Ptide), i.e., the rate of rotational energy loss.

C) Electromagnetic effects

- If the Moon were conductive (large ore deposits or metallic core), it could:
    - generate currents via relative motion in Earth's magnetic field (like Io/Jupiter effect), and
    - these currents could produce small additional magnetic-mechanical effects.
- Reality: this electromagnetic coupling is negligible compared to gravitational tidal effects.

D) Moon as "commutator" (analogy)

- A commutator reverses currents to produce continuous torque. The Moon does not reverse currents; it shifts tidal phases.
- Metaphorically, the Moon causes periodic phase shifts in "load distribution" (tides), which changes the effective time integration of dissipative effects. Physically, this is a mechanical/gravitational process, not an electrical commutation.

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5) Earth–Moon–Sun interaction (energy summary)

- **Sun:** provides huge, continuous radiative power (~1017 W\sim 10^{17}\ \mathrm{W}~1017 W) → drives atmosphere, weather, and thermal energy.
- **Moon:** acts primarily gravitationally → modulates distribution of mechanical energy (tides), causes annual/monthly dissipation Ptide~1012−1013 WP_{\rm tide} \sim 10^{12}-10^{13}\ \mathrm{W}Ptide~1012−1013 W.
    - This is a tiny fraction of solar power but directly responsible for angular momentum transfer between Earth and Moon (changing Earth's rotation & Moon's orbit).
- **Core / ore deposits:** the geodynamo is powered by internal heat flows (TW range); ore veins can locally respond electromagnetically but contribute only very weakly globally.

6) Formula Collection (for reuse / inserting other values)

- **Solar power on the Earth's disk:**

P⊙=S·πR2P_\odot = S \cdot \pi R^2P⊙=S·πR2

- **Absorbed solar power:**

Pabsorb=(1−α) P⊙P_{\rm absorb} = (1-\alpha)\, P_\odotPabsorb=(1−α)P⊙

- **Torque ↔ Power relation:**

P=τ ωP = \tau \, \omegaP=τω

- **Rotational energy of the Earth (for comparison):**

Erot=12Iω2,I≃kMR2E_{\rm rot} = \frac12 I \omega^2, \qquad I \simeq k M R^2Erot=21 Iω2,I≃kMR2

- **Time to change rotational energy at a given power:**

t=ΔErotPavailablet = \frac{\Delta E_{\rm rot}}{P_{\rm available}}t=PavailableΔErot

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7) Conclusion — direct answers to your intention

- Energetically, the Sun is the clear dominator: it delivers roughly 104−10610^4 - 10^6104−106 times more power than the geodynamo or tidal dissipation.
- The Moon is not an electromagnetic amplifier in any significant sense; it acts primarily as a gravitational relay/regulator of angular momentum: it induces tidal friction (heat) and thereby removes energy from Earth's rotation or transfers angular momentum to its orbit.
- Ore or metallic structures on the Earth or Moon can participate electromagnetically (induced currents, local fields), but globally these effects are tiny compared to gravitational and thermal flows.
- If you want to extend the motor → Earth → Moon analogy: the Moon is more like an eccentric, phase-shifting load, not an electrical commutator; the Sun is the huge "energy source," and the ore "coils" (crustal conductors) are only very poor, local windings.

If desired, a **numerical comparison table** (Sun vs. geodynamo vs. tides vs. ore induction) can be generated using alternative assumptions (different PgeodynamoP_{\rm geodynamo}Pgeodynamo, albedo, or Moon efficiency).

Warning / Science-Fiction Scenario

Premise: Suppose a higher intelligence could manipulate the Sun's magnetic wave intensity to affect human civilization.

1. **Physical basis (realistic)**

- Solar magnetic activity (flares, CMEs, solar wind) already affects:
    - **Earth's magnetic field:** shield is disturbed.
    - **Ionosphere:** radio, satellites, GPS.
    - **Induction in wires:** blackouts (e.g., Quebec 1989).
- **Direct brain effects:** natural geomagnetic fluctuations (~50 μT ± few %) are barely noticeable biologically.
    - Extremely strong fields (> Tesla range, i.e., ~100,000× stronger) can affect brain currents.
    - The Sun cannot deliver such fields to Earth's surface directly; Earth's magnetic field shields most.
- Extreme solar events → power grids fail, communications collapse, disorientation in humans/animals → indirect cognitive/behavioral effects.

2. **Metaphorical / literary warning**

- **"Reformat":** by reducing geomagnetic shielding + flooding Earth with high-energy radiation → technology collapses, communication stops → humans revert to survival instincts. Civilization is reset to a "base program."
- **"Increase aggressiveness":** constant disruptions of communication, navigation, energy → global stress → aggression and self-destruction rise. Humans fight each other more than the cause.
- **"God complex":** the controlling intelligence appears as an invisible god, wielding cosmic weather to punish or reward. Smaller civilizations are at its mercy.

3. **Example warning / prologue text**
"Imagine an intelligence with the power to use the Sun itself as a switch. One tiny turn of the magnetic dial — entire cultures fall silent. Brains that once dreamed and thought shrink to mere survival. Another turn — humans hunt humans until nothing remains. Whoever controls this could play God, not through miracles, but through command of the natural forces we are all subjected to."

Clarification for your "Phase 1 / Version 1" scenario:

- Realistically, if electronics and infrastructure collapse due to solar or manipulated magnetic waves, humans are not biologically reset but **civilizationally pushed back**.
- Sociologically: until recovery, a Mad-Max-like scenario prevails: scarce resources, local violence, fragmented authority.
- Message: Only through **self-peace, cooperation, and new structures** can humanity survive the setback.

Prologue-style warning text:
"Imagine: your Earth keeps spinning, but all networks suddenly fall silent. No light, no data, no distant connections. Food for weeks, weapons for days, trust for minutes. Then the test begins: will you destroy each other in the dark, or unite in the darkness? Those who make dead planets spin

again expect you to finally learn to pacify yourselves — before someone else controls the spin."

My closing words: Everyone must decide for themselves whether to use a knife for slicing bread or to harm their neighbor. Hence, yesterday: Link.

Where or how does this “Project Eden” come from — meteorite guidance barriers via sound impulses, floods, tsunamis, continuous rain, rescue and protective measures, city stormbreakers, shuttle hull descriptions…? I am just a carpenter, office manager, lecturer, and author. Hmm, yes, I have also experienced such gaps in time. I’ve had visions, seen things from the past and the “future.” But I was only somewhere else once, apart from before the gap – well, it was also on the bus, before that. Since when… (please don’t ask me).

Personally, I would prefer it if conflicts were resolved differently and energy not released through wars. It would also be advantageous if more planets were actually colonized.

At the moment, I must also say: If you are still interested, I will soon need a new place for my pond fish and chickens. The current landowner has not followed certain rules for the plot I have leased. I have no money to buy the property, and legally I cannot build anything on it — let alone a settler/planning school (Genesis project) or rehabilitation for new/first settlements. I have made my **knowledge** on these topics freely available to maintain international neutrality.