

**RETURN ON INVESTMENT (ROI)
FROM “NEW WORLDS”
&
LUNAR SOLAR POWER**

DR. DAVID R. CRISWELL

University of Houston

dcriswell@houston.rr.com

281-486-5019 ph. & fax

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1492 NEW WORLDS ROI

- Christopher Columbus voyage to “India” (1, 2)
 - Queen Isabella invested ~ 200,000 \$(U.S.)
 - Columbus invested ~ 100,000 \$(U.S.) loan
- New World gold transported to Spain (3)
 - ~ 40 M\$ (1500 to 1515, Columbus’ death) ROI ~ 130 to 1
 - ~ 30 B\$ (to 1600) ROI ~100,000 to 1
- Gross *New World Product* (T\$/y) much greater (4)
 - \sum GNWP (1500 to 1820) ~ 7.5 T\$ (4% of \sum GWP)
 - \sum GNWP (1820 to 2005) ~ 1,100 T\$ (30% of \sum GWP)
- Sustainable “New World” exploration required sustainably increasing GNWP and “useful energy”

USEFUL ENERGY & GWP (5)

- “Useful Energy” is the final energy incorporated into new goods & services (GWP)
- Electricity is most useful form of useful energy
 - The world now delivers ~ 1.6 TWe ($1.6 \cdot 10^{12}$ We) of electric power to users & yields GWP ~ 40 T\$/y
 - 1 TWe-y of useful electric energy (=power•time) enables
 - ~ 12 T\$ GN(national)P in developing nations
 - ~ 25 T\$ of GWP ($1.6\text{TWe-y} \cdot 25\text{T\$/y} = 40\text{T\$}$) and U.S. GNP
 - ~ 42 T\$ of GNP in Western Europe & Japan
- 20 TWe can enable GWP ~ 840 T\$/y by 2050
- Solar power stations on the Moon are the only reasonable option to provide 20 TWe by 2050

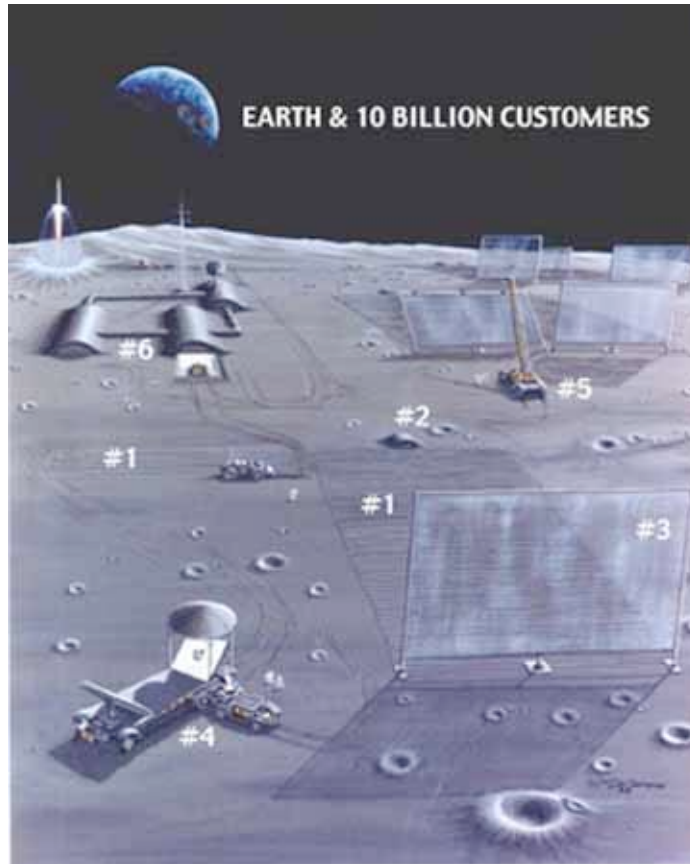
SOLUTION: LUNAR SOLAR POWER SYSTEM

- Invented by D. R. Criswell & R. D. Waldron ⁽⁶⁾
- Sun sends 13,000 TWs of reliable solar power to the lunar surface
- Bases on Moon convert solar power to microwave beams
 - Beams deliver power to rectennas on Earth



- Safe (<20% of sunlight)
- Reliable (through clouds, rain, smoke, etc.)
- Rectennas on Earth
 - Convert beams to electricity
 - Deliver 20 TWe to power grids
 - Sustainable, clean, affordable

DEMONSTRATION LSP BASE (7, 8)



- Earth is fixed in sky
- Base is composed of power plots
- Power plot - basic unit
 - #1 Solar arrays, buried wiring
 - #2 Microwave transmitters
 - #3 Reflectors that overlap, as seen from Earth, to form a large segmented lens
- #1, 2, & 3 are made from lunar materials by #4, 5, & 6 production equipment

Harvesting the Moon

LSP ROI (2015 TO 2100)^(5, 7)

- Today GWP ~ 40 T\$/y (~ 4 T\$/y to energy industries)
- LSP investment to breakeven ~ 0.4 T\$ (@ 0.1 \$/kWe-h)
- \sum GWP (2015 - 2100) $\sim 68,000$ T\$ (@ 42 T\$/TWe-y)
- \sum GL_(lunar)P (2015 - 2100) $\sim 2,500$ T\$ (2050 GLP ~ 10 T\$/y)
- ROI \sim 180,000 to 1
- Isabella and Columbus would be envious
- Each year LSP is delayed loses ~ 800 T\$ (GWP + GLP)
- LSP enables exponential ROI growth and sustainable exploration of our Solar System

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