How to really terraform (part 1)

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OK, the only solar system body that can be terraformed realistically is Mars. Venus is too hot, and has too much CO2. Titan is too cold, and too reduced − we'd never get n oxygen atmosphere.

The #1 problem on Mars is the lack of surface water. A lot of it is frozen in the soil, but there's also a substantial amount in the polar caps. In fact, all of Mars's surface water has ended up at the poles. Why is this? Well, ask why it doesn't happen on Earth. After all, evaporation << precipation at our polar caps also.

The answer is that the polar caps are recycled by means of the oceans, icebergs calve and melt. Mars doesn't have any oceans, so this can't happen there. So the first thing that has to be done on Mars is to get the ice off the poles and into the equatorial regions where it will evaporate. If we get enough H2O into the atmosphere, there will be clouds, then snow (it's too cold for rain as of yet).

Mars has a diameter of about 22 1/2 million feet (Earth = 42 millions). This gives a surface area of 1,600 trillion sq ft. Gravity as 0.39 g, but because of the colder temperature the scale height is only 2.0 times Earth's or 50,000 ft.
The total atmospheric volume is thus 80 million trillion cu ft.

The average temperature is around −70 F where the vapor pressure of ice is about
16 microbar, equaling 1.0e−6 lb/ft^3. This gives a saturated atmosphere of 80 trillion lb H2O. If the mean humidity were 50% (as on Earth), and about 20% of this was precipitated per day, this would give 8 trillion lb/d.

We need to evaluate how much of this H2O is 'locked up', or will not re−enter the atmosphere. It is likely that any falling above the latitude of 60 degrees − about 1/6 the area of the planet − will not. If the precipitation rate here is 1/4 the average for the whole area, about 5% of the snow will be 'locked up'. This is 400 billion lb/d.

Now it is true that H2O vapor is a greenhouse gas and would warm the planet. The equilibrium perhaps (assuming constant RH) would be up to

30 F warmer than the present. This would raise the precipitation severalfold but also lower the lock up ratio, and I therefore will use the above figure as a gross estimate.

We must transport that amount of ice from the poles to the equator, forever.
If we build solar−powered trucks that can carry 200 Klb ice, and these can make one round trip every 40 days (this is a speed of 10−12 mph average), then they deliver 5 Klb/d. We would then need 80 million such trucks. This seems to be a tall order. Note, though, that any conceivable terraforming scheme must address this issue as ice will always accumulate at the pole