

How Feedstock Supply Uncertainty Equates to Project Success

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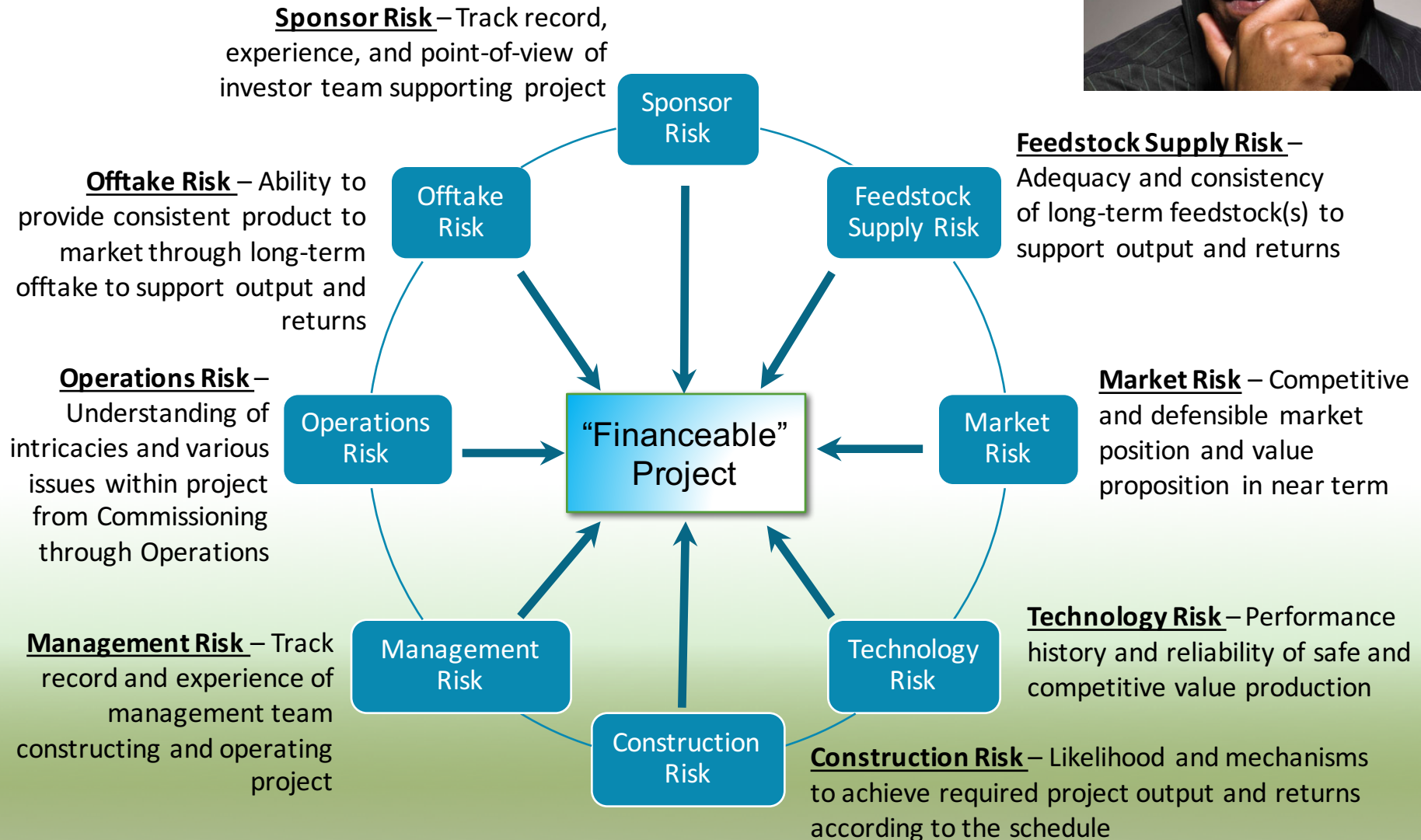


Topic Areas We Will Discuss



1. Project Risk Categories that Influence Project Delivery
2. Feedstock Variability Impacts On Operational Risk
3. Feedstock Variability Impacts On Construction Risk
4. Feedstock Variability Impacts On Technology Risk
5. People To Ask For Help

Financier Concerns: “The Risk Wheel”



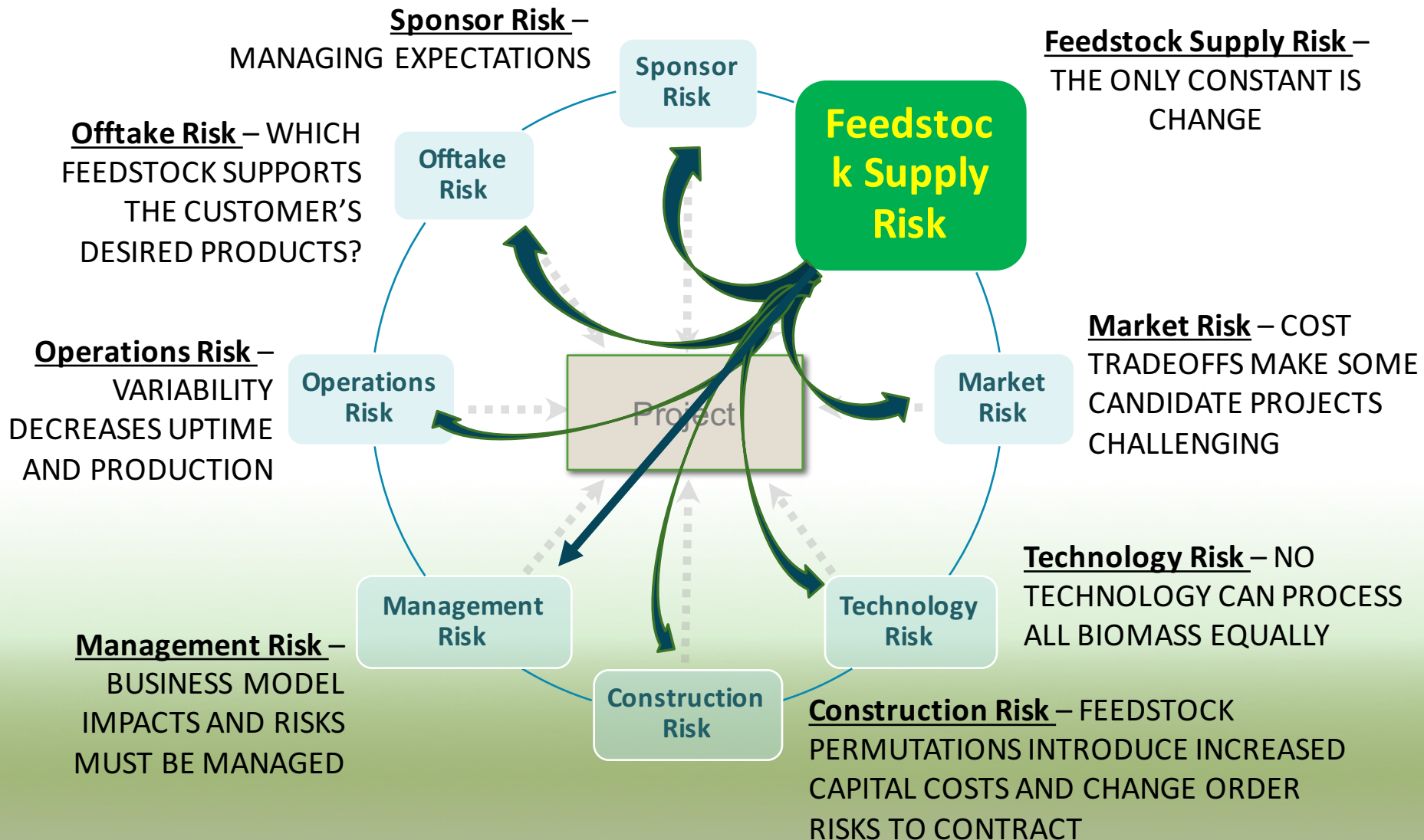
Assuming the Risk Away...



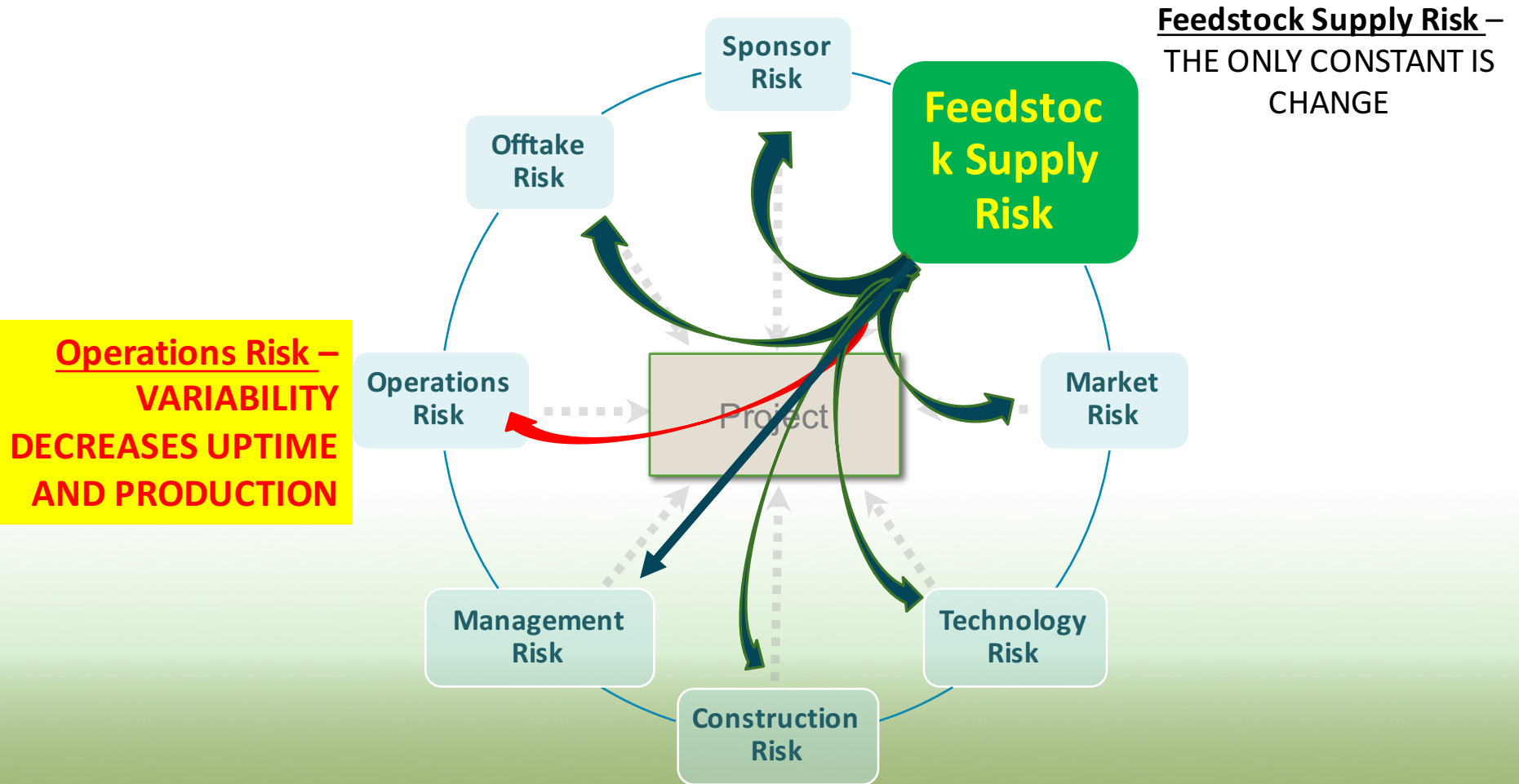
Lots of spreadsheets say that the business plan makes money...

- When technologies are considered in detail, there is no such thing as a feedstock-agnostic technology, i.e. certain feedstocks present inherent benefits to any business model.
- One of the top two costs in almost all biomass-to-bioprocess projects is the cost of goods for consumed feedstock.

Feedstock Impacts the entire “The Risk Wheel”



Feedstock Impacts the entire “The Risk Wheel”



Weather (Operations & Management)

Weather introduces a number of problems to biomass production, harvest, and storage.

- Does the weather have an impact on your business plan?
- What assumptions has your business made about the weather, year in and year out?
- If the operating harvest season is shorter due to weather, what does that do to your costs?



Weather (Operations & Management)

- How many days have you assumed for your harvest?
- Does your business assume average weather (rainfall and wind) conditions? Conservative (worst-case)? Optimistic?
- What happens to your process if the feedstock quality is off-specification or the delivered price jumps in a shortened year?
- Can your process handle the variability?

	Total Operat ing Days	Normal Harvest Days	Late Harvest Days	Total Harvest Days	Rainfall - Total
1985	141	74	9	83	52.8
1986	115	51	29	80	58.7
1987	106	62	6	68	62.5
1988	90	51	8	59	59.1
1989	113	82	19	101	60.6
1990	121	74	6	80	53.7
1991	97	72	14	86	70.3
1992	109	65	16	81	62.7
1993	117	91	5	96	59.3
1994	119	56	22	78	44.2
1995	103	50	18	68	65.4
1996	141	52	28	80	53.8
1997	99	52	14	66	65.7
1998	145	71	7	78	56.6
1999	168	97	25	122	37.4
2000	150	72	43	115	48.4
2001	125	66	16	82	62.9
2002	78	22	17	39	85.2
2003	132	67	10	77	43.9
2004	102	73	13	86	68.5
2005	146	69	10	79	45.8
2006	132	50	33	83	57.0
2007	74	49	14	63	68.5
2008	122	68	11	79	44.4
2009	70	9	21	30	73.6
2010	136	64	10	74	35.9
2011	146	64	24	88	38.6
2012	105	50	8	58	72.0
2013	131	86	14	100	57.5

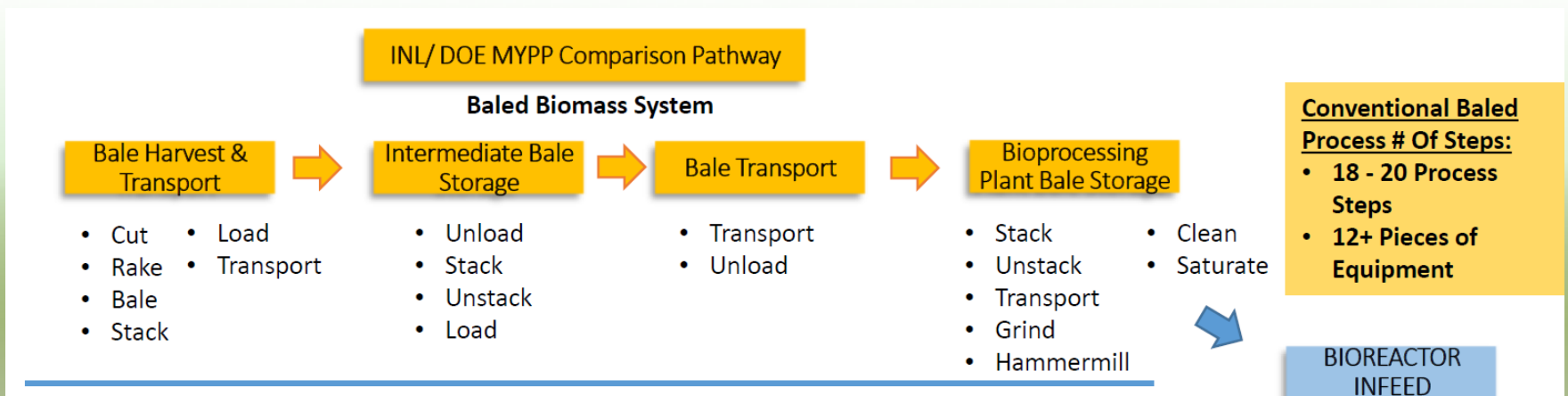
Satellite Storage (Operations)



This wheat straw pile (from Denmark) has an estimated 1,100 metric tonnes, ~ 1.5 days of biorefinery throughput



- The operating space requirements of aggregated biomass storage, particularly bales, is immense and often underappreciated. This storage must be accessible year round, requiring 20+ acres of offsite operations that should be considered in the pro forma.
- Moving inventory into and out of satellite storage is costly.



Fire-Risk and Inventory Loss (Operations)

Fires are a constant risk to baled biomass and biorefineries must be vigilant at all of their storage locations to protect the public and their inventory costs and risk.



Courtesy of the Victoria Advocate; 10/30/2015



Courtesy of the Adelaide Advertiser; 11/12/2009

Dirt and Rocks (Operations)



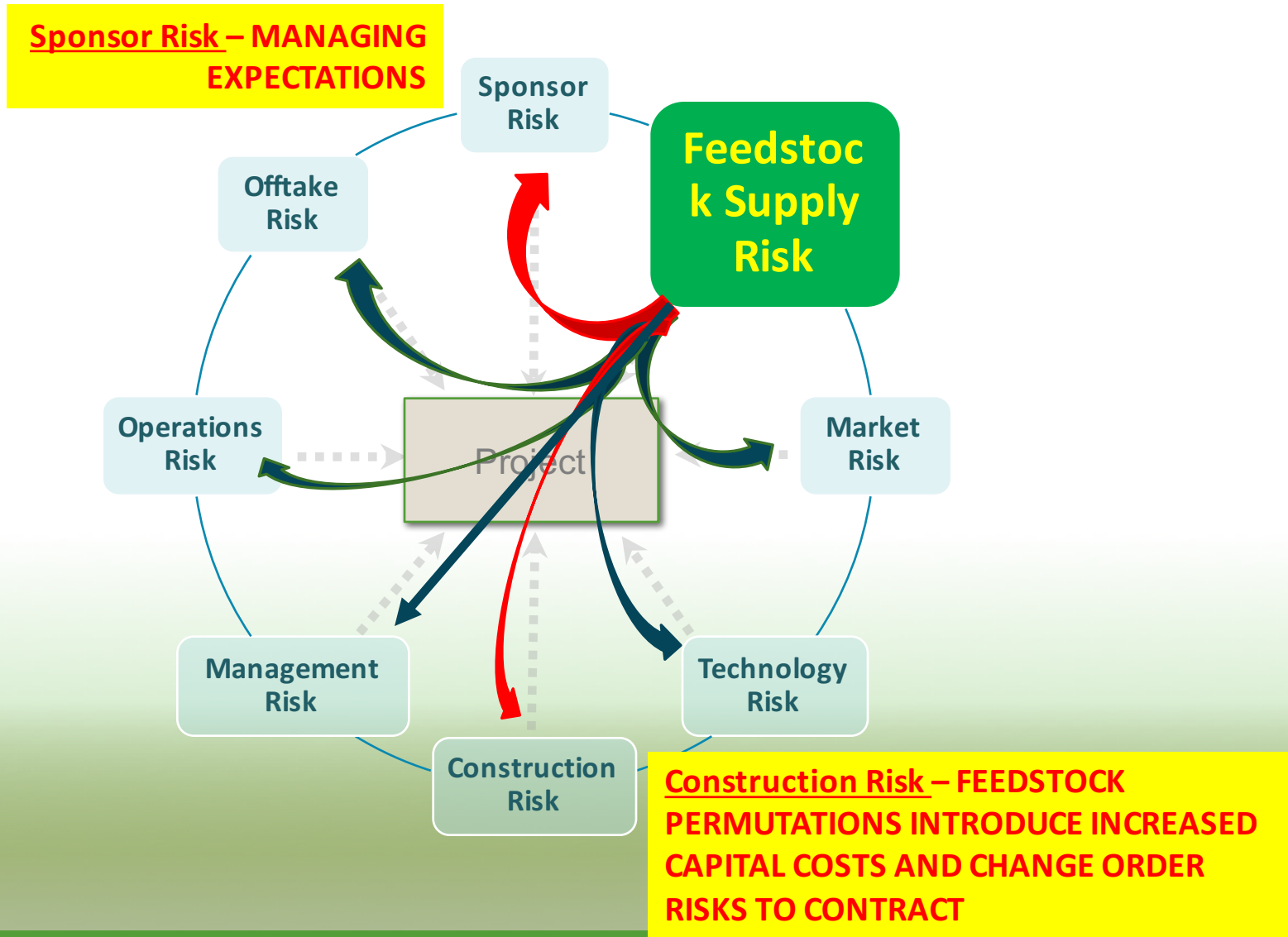
Courtesy of the The Wood Nerd blog; 7/7/2010



Courtesy of Industrial Fire Prevention blog; 4/5/2013

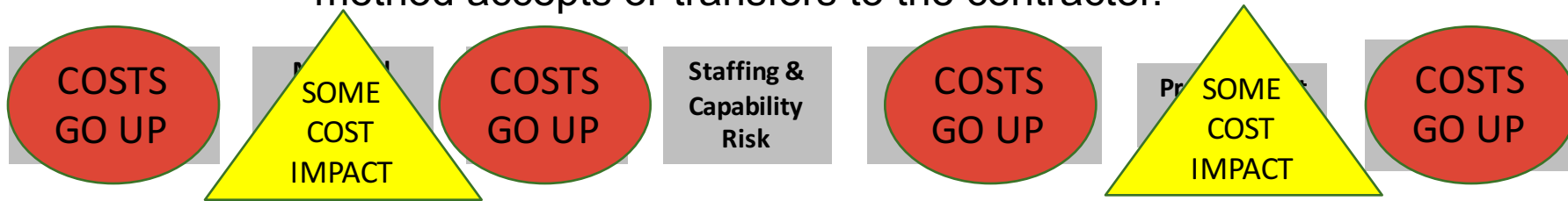
- Dirt collected with feedstock has a negative impact on the performance of biomass processing plants.
- Cleaning and screening of the unbaled biomass requires expensive process equipment to automate and complete reliably.
- Just ask the wood pellet industry, spark detection and suppression systems are expensive to install during construction! (But even more expensive when you have to rebuild a portion of your facility...)

Feedstock Impacts the entire “The Risk Wheel”



Risk Categories in Construction Contracts

There are multiple sources of risk in construction contracts that each contracting method accepts or transfers to the contractor.



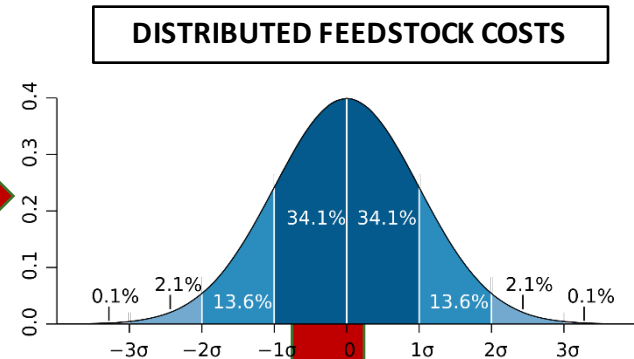
- Design (Performance) – Risk that technology selected does not work.
- Material Quantity – Risk that bids and designs accommodate all needs (e.g. concrete, steel, staff)
- Timing (Schedule) – Risk that project will be completed by agreed upon schedule
- Staffing & Capability – Risk that project team is adequate and has appropriate experience.
- Startup & Commissioning – Risk that project will be started up efficiently and transition to operations effectively
- Procurement – Risk that the prices for selected equipment will vary depending upon schedule needs
- Unforeseen Circumstances – The “unknown-unknown” risk for circumstances that introduce cost or schedule delays (i.e. weather, work stoppage, accidents, etc.).
- **Operations Risk (Not Shown) – Owner takes in all construction contracting models**

Compounding Risk Lowers Returns in Pro Forma



FEEDSTOCK VARIANCE

PRICE POINT FOR
MINIMUM QUALITY
CHANGES



DESIGN CASES
INCREASE

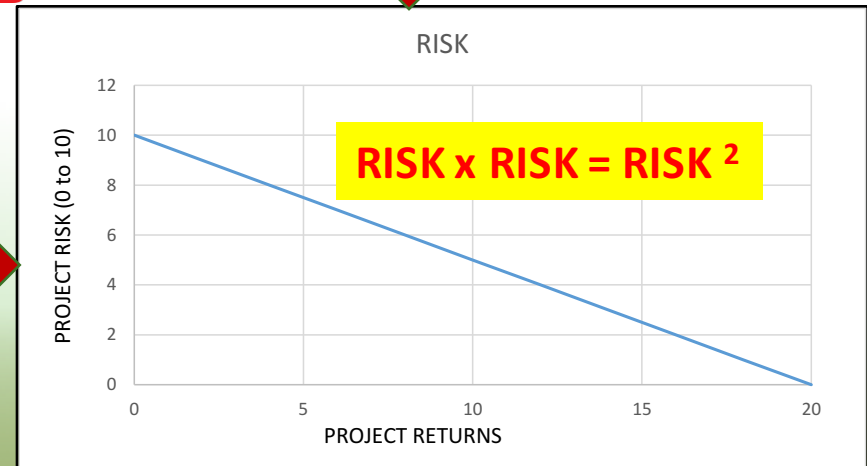


PERFORMANCE
RISK INCREASES

CONTRACT PRICE CONTRIBUTORS		% INSTALLED COSTS
ENGINEERING	\$ x,xxx,xxx	4% TO 8%
EQUIPMENT COST	\$xx,xxx,xxx	35% TO 45%
INSTALL COST	\$xx,xxx,xxx	35% TO 40%
CM/OVERHEAD	\$xx,xxx,xxx	8% to 12%
+ CONTRACTOR PROFIT	\$xx,xxx,xxx	10% to 20%
BASE CONTRACT PRICE	\$xx,xxx,xxx	100%
CONTINGENCY	\$xx,xxx,xxx	10% to 20%
+ CONSTRUCTION RISK	\$xx,xxx,xxx	10% TO 30%
EPC CONTRACT PRICE	\$xx,xxx,xxx	120% TO 150%

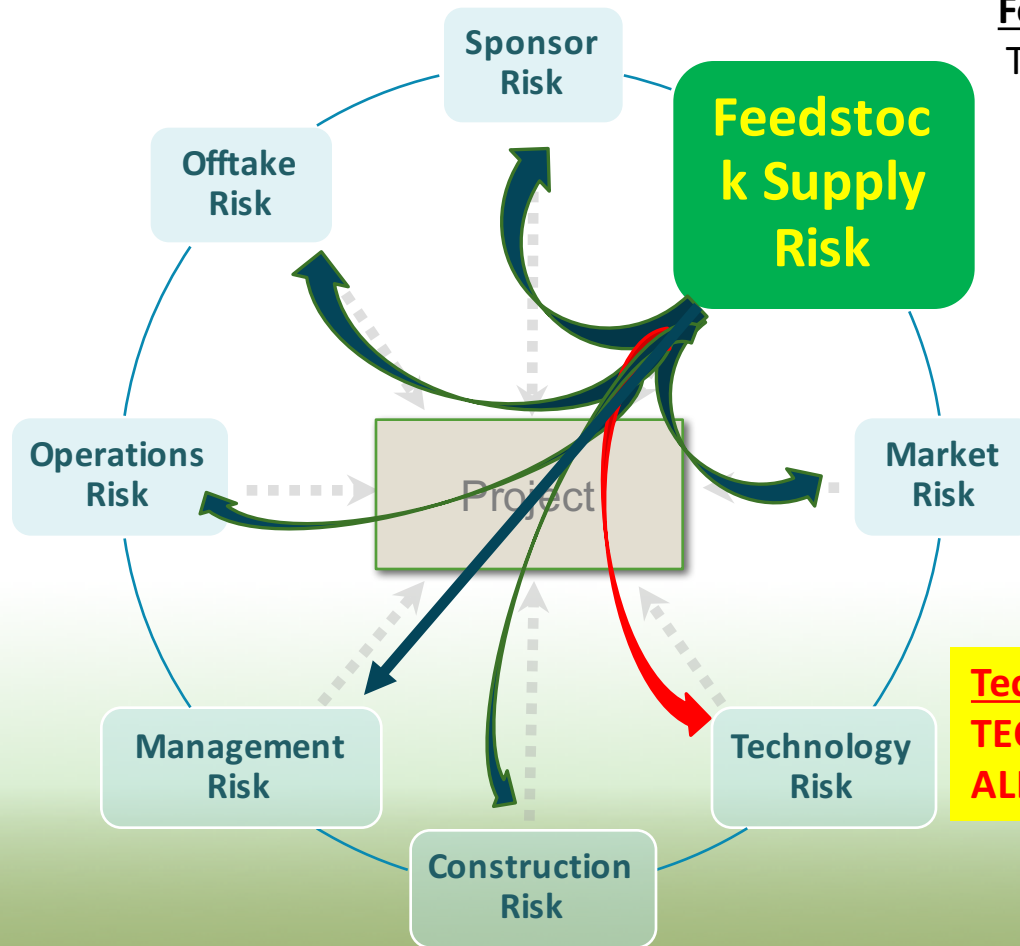
VARIABLE PROJECT CAPITAL COSTS

CAPITAL
INCREASES



VARIABLE PROJECT CAPITAL COSTS

Feedstock Impacts the entire “The Risk Wheel”



Feedstock-Centric Strategy: Attributes Mapped to the Market

Beginning (THE LAND)

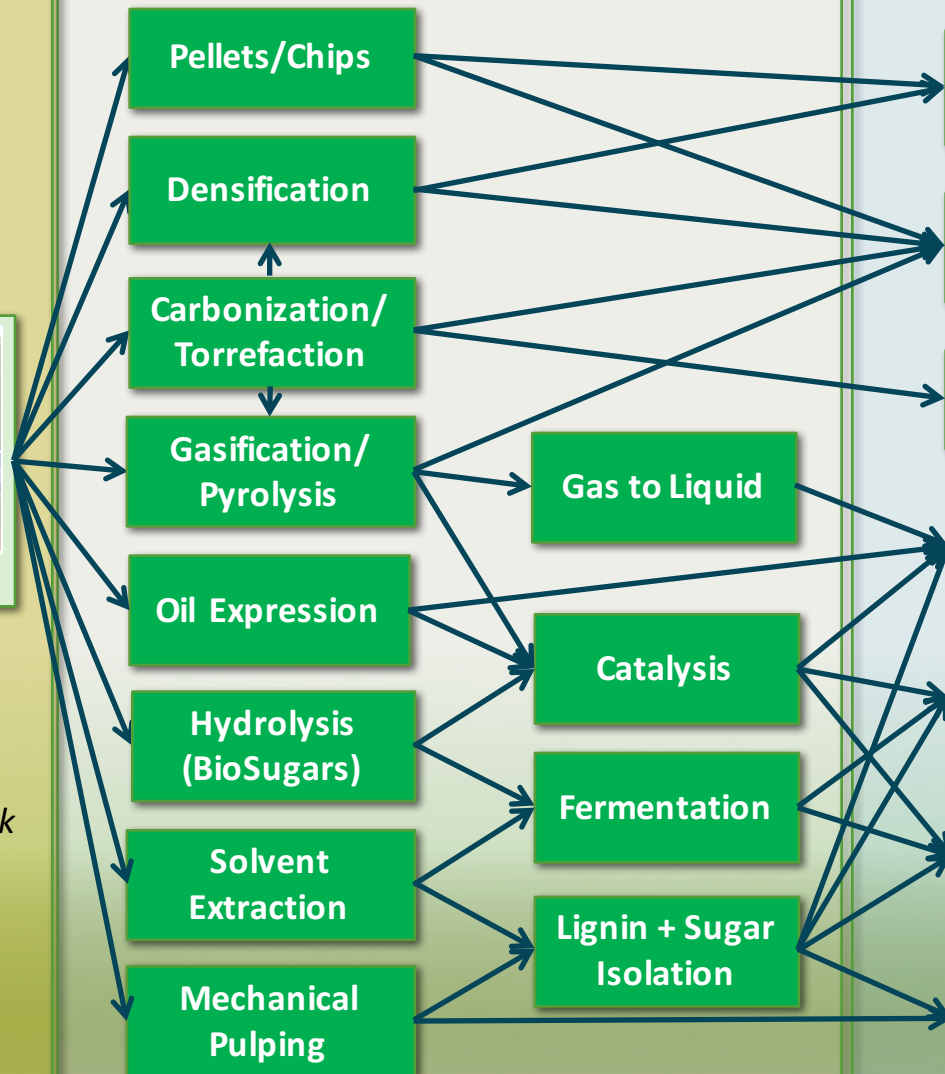
- For a feedstock company, the biomass presents unique attributes that are dependent upon ecology and soil nutrient profile, weather, and other impactful growth conditions.



SUITABLE BIOMASS

- With cursory laboratory testing and work with locally-trained scientists (e.g. university researchers, others), a feedstock company can determine if the attributes are unique or can be replicated in other growth environments.

The Route (TECHNOLOGY)



The End (MARKETS)

Conclusion

- Management Teams should undertake a humble assessment of themselves, their staff, and their investors to assess whether feedstock risk is being captured and understood.
- Feedstock variability may add substantial operational costs to the business through weather, storage, etc.
- Feedstock variability increases project capital costs through compounding influence on design and performance requirements.
- **Feedstocks are too complex to assume away in a pro forma!**

Where to Find Help

- At this conference and others, a number of talented consultants and organizations can help feedstock companies, technology companies, and project companies learn about the key constraints presented today.
- Folks to have an adult beverage with for further information:

Genera Energy, Inc.

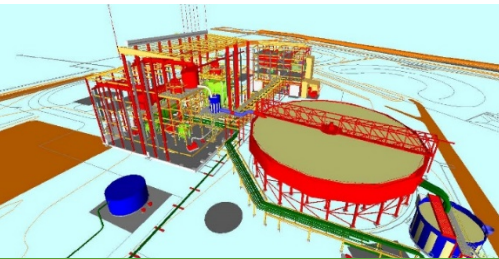
Equinox

Rock Creek Consultants

PacificAg

FDC Enterprises

Matera



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